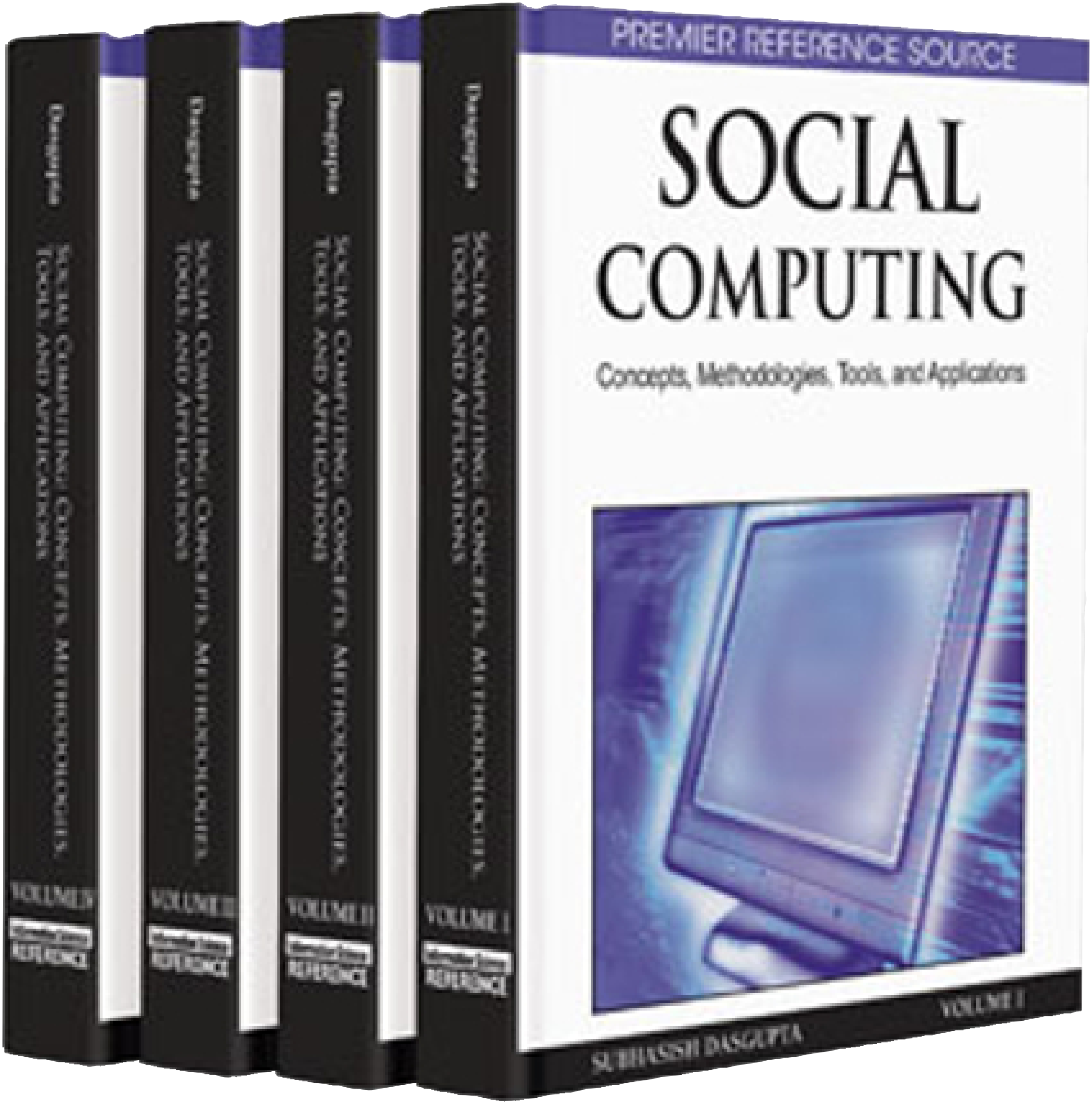
PREMIER REFERENCE SOURCE
SOCIAL COMPUTING
Concepts, Methodologies, Tools, and Applications
VOLUME I
SUBHASISH DASGUPTA
Dasgupta
SOCIAL COMPUTING: CONCEPTS, METHODOLOGIES, TOOLS AND APPLICATIONS
VOLUME I
VOLUME II
VOLUME III
REFERENCE

Social Computing:
Concepts, Methodologies, Tools, and Applications

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Information Science REFERENCE
INFORMATION SCIENCE REFERENCE
Hershey · New York

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Cover Design: Lisa Tosheff
Printed at: Yurchak Printing Inc.

Published in the United States of America by
Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com/reference

and in the United Kingdom by
Information Science Reference (an imprint of IGI Global)
3 Henrietta Street
Covent Garden
London WC2E 8LU
Tel: 44 20 7240 0856
Fax: 44 20 7379 0609
Web site: http://www.eurospanbookstore.com

Library of Congress Cataloging-in-Publication Data

Social computing : concepts, methodologies, tools and applications / Subhasish Dasgupta, editor.
p. cm.
Includes bibliographical references and index.
Summary: "This book uncovers the growing and expanding phenomenon of human behavior, social constructs, and communication in online environments, reflecting on social change, evolving networks, media, and interaction with technology and more"--Provided by publisher.
ISBN 978-1-60566-984-7 (hardcover) -- ISBN 978-1-60566-985-4 (ebook) 1. Information technology--Social aspects. 2. Technological innovations--Social aspects. 3. Internet--Social aspects. 4.
Technology--Social aspects. I. Dasgupta, Subhasish, 1966-
HM851.S62996 2010
303.48'34--dc22
2009047176

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

List of Contributors

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Volume 1

Section I. Fundamental Concepts and Theories

This section serves as the foundation for this exhaustive reference source by addressing crucial theories essential to the understanding of social computing. Chapters found within this section provide a framework in which to position social computing within the field of information science and technology. Individual contributions provide overviews of computer-mediated communication, social networking, and social software. Within this introductory section, the reader can learn and choose from a compendium of expert research on the elemental theories underscoring the research and application of social computing.

Section II. Development and Design Methodologies

This section provides in-depth coverage of conceptual architectures, frameworks and methodologies related to the design of social computing tools and technologies. Throughout these contributions, fundamental development methodologies are presented and discussed. From broad examinations to specific discussions of particular frameworks and infrastructures, the research found within this section spans the discipline while also offering detailed, specific discussions. Basic designs, as well as abstract developments, are explained within these chapters, and frameworks for designing successful e-learning environments, social search engines, and social software are examined.

Volume II

Section III. Tools and Technologies

This section presents extensive coverage of the tools and specific technologies that change the way we interact with and respond to our environments. These chapters contain in-depth analyses of the use and development of innumerable devices and also provide insight into new and upcoming technologies, theories, and instruments that will soon be commonplace. Within these rigorously researched chapters, readers are presented with examples of specific tools, such as social television, wikis, mobile photo galleries, and personal digital libraries. In addition, the successful implementation and resulting impact of these various tools and technologies are discussed within this collection of chapters.

Volume III

This section includes a wide range of research pertaining to the individual and organizational impact of social computing tools and technologies. Chapters included in this section analyze the usability of social software, the creation of social relationships in virtual communities, and social networking in educational settings. The inquiries and methods presented in this section offer insight into the implications of ubiquitous and pervasive computing at both an individual and organizational level, while also emphasizing potential areas of study within the discipline.

Section VI. Managerial Impact

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Section VII. Critical Issues

This section addresses conceptual and theoretical issues related to the field of social computing. Within these chapters, the reader is presented with analysis of the most current and relevant conceptual inquires within this growing field of study. Particular chapters discuss ethical issues in social networking, security concerns that arise when individuals share personal data in social networks, and reducing social engineering impact. Overall, contributions within this section ask unique, often theoretical questions related to the study of social computing and, more often than not, conclude that solutions are both numerous and contradictory.

Volume IV

Section VIII. Emerging Trends

This section highlights research potential within the field of social computing while exploring uncharted areas of study for the advancement of the discipline. Chapters within this section discuss social bookmarking, the emergence of virtual social networks, and new trends in educational social software. These contributions, which conclude this exhaustive, multi-volume set, provide emerging trends and suggestions for future research within this rapidly expanding discipline.

Preface

With increased access to social networking tools, the development of Web 2.0, and the emergence of virtual worlds, social computing crosses cultural boundaries to join people in the digital landscape.

As the world moves closer and closer to the integration of technology into traditional social behaviors, there is a greater need for innovative research and development into the various aspects of social computing. Information Science Reference is pleased to offer a three-volume reference source on this rapidly growing discipline, in order to empower students, researchers, academicians, and practitioners with a wide-ranging understanding of the most critical areas within this field of study. This publication uncovers the growing and expanding phenomenon of human behavior, social constructs, and communication in online environments and provides the most comprehensive, in-depth, and recent coverage of all issues related to the development of cutting-edge social computing technologies. This reference work presents the latest research on social change, evolving networks, media, and interaction with technology to offer audiences a comprehensive view of the impact of social computing on the way cultures think, act, and exchange information.

This collection entitled, "**Social Computing: Concepts, Methodologies, Tools, and Applications**" is organized in eight (8) distinct sections, providing the most wide-ranging coverage of topics such as: 1) Fundamental Concepts and Theories; 2) Development and Design Methodologies; 3) Tools and Technologies; 4) Utilization and Application; 5) Organizational and Social Implications; 6) Managerial Impact; 7) Critical Issues; and 8) Emerging Trends. The following provides a summary of what is covered in each section of this multi-volume reference collection:

Section 1, **Fundamental Concepts and Theories**, serves as a foundation for this extensive reference tool by addressing crucial theories essential to the understanding of social computing. Chapters such as, "Computer-Mediated Communication Learning Environments: The Social Dimension" by Stefania Manca, as well as "Online Communities and Social Networking" by Abhijit Roy, provide foundational overviews of how individuals interact with social computing tools and the impact these tools have on shaping and influencing behavior. "Mobile Social Networks: A New Locus of Innovation" by Nina D. Ziv and "Mobile Social Networks and Services" by Lee Humphreys offer investigations into the recent emergence of mobile social networks, reviewing current trends and technologies and offering suggestions for future research. As this section continues, authors explore the many uses of social software and its implications in contributions such as "Social Software (and Web 2.0)" by Jürgen Dorn, "Self-Organization in Social Software for Learning" by Jon Dron, and "Living, Working, Teaching and Learning by Social Software" by Helen Keegan and Bernard Lisewski. These and several other foundational chapters provide a wealth of expert research on the elemental concepts and ideas which surround investigations of social computing technologies.

Section 2, **Development and Design Methodologies**, presents in-depth coverage of design and architectures to provide the reader with a comprehensive understanding of the emerging technological developments within the field of social computing. A number of contributions, including “Distributed Learning Environments and Social Software: In Search for a Framework of Design” by Sebastian Fiedler and Kai Pata, “Electronic Classroom, Electronic Community: Designing eLearning Environments to Foster Virtual Social Networks and Student Learning” by Lisa Harris, and “A Methodology for Integrating the Social Web Environment in Software Engineering Education” by Pankaj Kamthan highlight the many methods for the effective design of social software and networks that support education. With contributions from leading international researchers, this section offers developmental approaches and methodologies for social computing.

Section 3, **Tools and Technologies**, presents extensive coverage of the various tools and technologies that define and continue to redefine social computing research and implementation. This section begins with “A Modern Socio-Technical View on ERP-Systems” by Jos Benders, Ronald Batenburg, Paul Hoeken, and Roel Schouteten, which discusses a specific approach to creating socio-technical systems. This section continues with an in-depth investigation of social television, contained within the selections “In Search of Social Television” by Gunnar Harboe, “Asynchronous Communication: Fostering Social Interaction with CollaboraTV” by Brian Amento, Chris Harrison, Mukesh Nathan, and Loren Terveen, “Examining the Roles of Mobility in Social TV” by Konstantinos Chorianopoulos, and “From 2BeOn Results to New Media Challenges for Social (i)TV” by Konstantinos Chorianopoulos and Pedro Almeida. With more than a dozen additional contributions, this section provides coverage of a variety of tools and technologies under development and in use in social computing and social networking communities.

Section 4, **Utilization and Application**, describes the implementation and use of an assortment of social computing tools and technologies. Including 20 chapters such as “Social Networking Sites and Critical Language Learning” by Andy Halvorsen, “Using Social Networking to Enhance Sense of Community in E-Learning Courses” by Steve Chi-Yin Yuen and Harrison Hao Yang, “Publishing with Friends: Exploring Social Networks to Support Photo Publishing Practices” by Paula Roush and Ruth Brown, this section provides insight into the utilization of social computing tools and technologies for both personal and professional initiatives. “Social Software Use in Public Libraries” by June Abbas offers suggestions for applying social software techniques such as tagging and cataloguing in library settings. “Designing for Disaster: Social Software Use in Times of Crisis” by Liza Potts presents another interesting application of social software, illustrating the need for sociotechnical interventions in systems design. Contributions found in this section provide comprehensive coverage of the practicality and present use of social computing by organizations and individuals.

Section 5, **Organizational and Social Implications**, includes chapters discussing the impact of social computing on organizational and individual behavior, knowledge, and communication. This section begins with an examination of organizational knowledge, investigating its foundations and management in chapters such as “Managing Organizational Knowledge in the Age of Social Computing” by V. P. Kochikar, “Social Software for Bottom-Up Knowledge Networking and Community Building” by Mohamed Amine Chatti and Matthias Jarke, and “The Essence of Organizational Knowledge: A Social Epistemology Perspective” by Fei Gao. “The Usability of Social Software” by Lorna Uden and Alan Eardley argues that despite the prevalence of Web 2.0 tools and technologies, there is little research on usability evaluation. Successful virtual communication and collaboration are explored in chapters including “Building Social Relationships in a Virtual Community of Gamers” Shafiz Affendi Mohd Yusof and “Entering the Virtual Teachers’ Lounge: Social Connectedness among Professional Educators in Virtual Environments” by Randall Dunn. While these two chapters present very different applications of virtual collaboration, they both offer definitions of virtual communities and offer depictions of how virtual environments both differ from and resemble face-to-face communities.

Section 6, **Managerial Impact**, presents focused coverage of social computing in the workplace. Fernando Garrigos' chapter "Interrelationships Between Professional Virtual Communities and Social Networks, and the Importance of Virtual Communities in Creating and Sharing Knowledge" analyzes, as the title suggests, the relationship between professional virtual communities and social networks, and describes how these communities create and share knowledge. "Managing Relationships in Virtual Team Socialization," by Shawn D. Long, Gaelle Picherit-Duthler, and Kirk W. Duthler provides an overview of the emergence of virtual teams in the workplace and explores the specific issues virtual employees must overcome in order be efficient and productive. Also included in this section are chapters addressing topics related to social engineering attacks and enterprise social software, presenting an empirical view of managerial considerations for social computing.

Section 7, **Critical Issues**, addresses vital, conceptual issues related to social computing such as ethical considerations, security, and privacy. Chapters such as "Security and Privacy in Social Networks" by Barbara Carminati, Elena Ferrari, and Andrea Perego and "Emerging Cybercrime Variants in the Socio-Technical Space," by Wilson Huang and Shun-Yung Kevin Wang tackle the difficult question of privacy and data security in online environments. In "The Emergence of Agency in Online Social Networks," by Jillianne R. Code and Nicholas E. Zaparyniuk, the authors explores how agency emerges from social interactions, how this emergence influences the development of social networks, and the role of social software's potential as a powerful tool for educational purposes. "Social Network Structures for Explicit, Tacit and Potential Knowledge" by Anssi Smedlund highlights the role of knowledge, asserting that it is embedded in relationships between individuals rather than possessed by these individuals. These and other chapters in this section combine to provide a review of those issues which are the subject of critical inquiry in social computing research.

The concluding section of this authoritative reference tool, **Emerging Trends**, highlights areas for future research within the field of social computing, while exploring new avenues for the advancement of the discipline. "Legal Issues Associated with Emerging Social Interaction Technologies" by Robert D. Sprague depicts potential legal issues that can arise from social interaction technology use, such as employee behavior online impacting the ability to get or maintain a job. Similarly, "Public Intimacy and the New Face (Book) of Surveillance; The Role of Social Media in Shaping Contemporary Dataveillance" by Lemi Baruh and Levent Soysal investigates privacy implications of sharing personal data in a public environment. Other issues, such as codes of conduct in social networking sites, are explored in chapters such as "Conceptualizing Codes of Conduct in Social Networking Communities" by Ann Dutton Ewbank, Adam G. Kay, Teresa S. Foulger, and Heather L. Carter. New opportunities for using technology to maintain a healthy social network are demonstrated in "Using Ambient Social Reminders to Stay in Touch with Friends" by Ross Shannon, Eugene Kenny, and Aaron Quigley. These and several other emerging trends and suggestions for future research can be found within the final section of this exhaustive multi-volume set.

Although the primary organization of the contents in this multi-volume work is based on its eight sections, offering a progression of coverage of the important concepts, methodologies, technologies, applications, social issues, and emerging trends, the reader can also identify specific contents by utilizing the extensive indexing system listed at the end of each volume. Furthermore to ensure that the scholar, researcher and educator have access to the entire contents of this multi volume set as well as additional coverage that could not be included in the print version of this publication, the publisher will provide unlimited multi-user electronic access to the online aggregated database of this collection for the life of the edition, free of charge when a library purchases a print copy. This aggregated database provides far more contents than what can be included in the print version in addition to continual updates. This unlimited access, coupled with the continuous updates to the database ensures that the most current research is accessible to knowledge seekers.

The diverse and comprehensive coverage of social computing in this three-volume authoritative publication will contribute to a better understanding of all topics, research, and discoveries in this developing, significant field of study. Furthermore, the contributions included in this multi-volume collection series will be instrumental in the expansion of the body of knowledge in this enormous field, resulting in a greater understanding of the fundamental concepts and technologies while fueling the research initiatives in emerging fields. We at Information Science Reference, along with the editor of this collection and the publisher, hope that this multi-volume collection will become instrumental in the expansion of the discipline and will promote the continued growth of all aspects of social computing research.

Social Computing:
Concepts, Methodologies, Tools, and Applications

Subhasish Dasgupta
George Washington University, USA

The World Wide Web has been widely used for a number of applications over the years. It has altered the way businesses work and connect to their customers. E-commerce and e-business applications are widespread with these transactions making up a significant part of the economy. In recent years, another phenomenon called social computing has changed the Web. Common citizens have flocked to social computing websites such as Facebook, MySpace and Twitter in the millions, making these sites the fastest growing properties on the Web.

In this editorial I provide an overview of the area of social computing. We first define the concept of social computing. Then I present an overview of the fundamental concepts and theories in the area of social computing, research in the area of social computing that includes tools and applications in this field, systems development and design applications, utilization and application of social computing, organizational impact of social networks, critical issues in the area, and emerging trends in the area of social computing. Please note that the material provided in this editorial in each of the areas discussed above is not exhaustive but a representation of the most important research and ideas related to social computing.

INTRODUCTION TO SOCIAL COMPUTING

Social computing refers to an area of computer science that is the intersection of social behavior and computational systems[1]. So, social computing implies two components: a social behavior component and a computational system or technical component. The technical component provides the environment in which people interact. Another definition of social computing is, "Social computing is the use of technology in networked communication systems by communities of people for one or more goals."[2] Social computing takes many forms including social networks, RSS, blogs, search engines, podcasts, wikis, and social bookmarking (or tagging). A number of other terms are used loosely to refer to social computing. They are: online communities, Web 2.0, virtual communities and social networking. These terms have similar definitions, and these definitions sometimes overlap (Parameswaran and Whinston 2007). Online communities are defined as groups of people who meet and interact with others, are connected by a specific interest, are brought together by means of a technical platform, and can establish social relationships or a sense of belonging to the group (Leimeister et al 2008). According to Preece (2000), a virtual community refers to people with a common or shared purpose, whose interactions are governed by policies in the form of tacit assumptions, rituals, protocols, rules and laws and whose use of computer systems to support and mediate social interaction and to facilitate a sense of togetherness. We see that the definitions of online communities, virtual communities and social computing are overlap. We use the social computing as the overarching concept that includes online and virtual communities, RSS, blogs, wikis, and other systems as stated earlier. But, I do use the terms social computing and social networking interchangeably.

In the next section I present some fundamental concepts and theories in information systems.

FUNDAMENTAL CONCEPTS AND THEORIES

The underlying theories and concepts in social computing include social network analysis, and social identity theory. The foundation of social computing lies in the underlying social network. A number of researchers have studied the social network using a technique called social network analysis. Social network analysis is based on the assumption that the relationships between interacting units are important. The social network perspective encompasses theories, models, and applications that are expressed in terms of relational concepts or processes. Along with growing interest and increased use of network analysis has come a consensus about the central principles underlying the network perspective. The following are some of the characteristics of social network analysis:

- Actors and their actions are viewed as interdependent rather than independent, autonomous units
- Relational ties (linkages) between actors are channels for transfer or "flow" of resources (either material or nonmaterial)
- Network models focusing on individuals view the network structural environment as providing opportunities for or constraints on individual action
- Network models conceptualize structure (social, economic, political, and so forth) as lasting patterns of relations among actors

The unit of analysis in network analysis is an entity consisting of a collection of individuals and the linkages among them (Wasserman and Fraust 1994).

Social identity theory states that a social category (e.g. nationality, political affiliation, sports team) into which one falls, or to which one believes one belongs, defines who one is in terms of the defining characteristics of the category (Hogg et al, 1995). Social networks either provide individuals with the social identity, or draw people in because they already belong to a social category that is represented in the social network. Social identity theory provides the basic explanation of an individual's behavior in social computing.

Social network analysis (or structure) and social identity theory are, in my opinion, the fundamental concepts of social computing. We examine research in social computing in the next section.

Table 1. A Sampling of social computing research

Research	Independent Variables	Dependent Variables
Chen, et al (2008)	National Culture	Trust
Ardichvili et al (2008)	Culture in virtual communities	Knowledge Sharing
Gupta and Kim (2007)	Cognition, Affect	Attitude
Shang et al (2006)	Involvement, Trust, Participation, Perceived Attitude	Loyalty
Talukder and Yeow (2007)	Usability, Marketing, Languages	Virtual Community Characteristics

SOCIAL COMPUTING RESEARCH

Most of the research in social computing examines social and managerial issues with the adoption and use of social networks. Here I will examine social variables that were considered in research studies on social computing. Table 1 provides a sampling of representative research in this field.

In the social computing research area, some studies have explored the diffusion of virtual communities. Lin (1998) extended the Technology Acceptance Model (TAM) to study the role of online and offline features in sustaining virtual communities. Based on a survey of 165 community members, Lin examined the role of online factors such as information quality, system quality, and service quality, and offline features such as offline activities on the sustainability of virtual communities. The researcher found that perceived usefulness, perceived ease of use, and offline activities are determinants of sustainability of virtual communities. Since this research was conducted in a non-profit virtual community, Lin recommends additional research for profit-oriented virtual communities. In another study of virtual community adoption, Song and Kim (2006) adapted a different theory in information technology acceptance. They used the Theory of Reasoned Action (TRA) examined the effect of subjective norms, tendency to social comparison, and social identity on a behavioral intention to use an Avatar service.

Leimeister (2008) developed and tested a model to examine antecedents of the formation of virtual relationships of cancer patients within virtual communities. They found that virtual communities provide an environment in which virtual relationships among patients is established and these relationships play an important role in meeting patients' social needs. Internet usage intensity (active posting versus lurking) and perceived disadvantages of computer-mediated communication are determinants of the formation of virtual relationships. These relationships have a strong effect on the virtual support of patients. This research did not support earlier research that had found that the effect of marital status, education, and gender were strong determinants of the formation of virtual relationships in virtual communities.

Since social computing takes place across national boundaries, global issues such as culture are very important. Culture refers to shared values and beliefs of individuals in a unit. The unit could be a nation, a region or even an organization. These different levels of culture impact how individuals operate in a social network. Chen et al (2008) investigated the role of national culture on trust and compared this across virtual communities in China, Hong Kong, and Taiwan. They found that there exists significant differences in individual trust, social presence, stickiness, and word-of-mouth. Ardichvili et al (2006) examined the role of culture on knowledge sharing across different countries such as US, Russia and Brazil. Other research has looked at the impact of individual variables on the individual's attitude towards the social network.

This sample of research in social computing shows that studies in this area are basically of two types. Some researchers are extending theories that already exist in other areas of information systems to include social computing. For example, researchers are testing the technology acceptance models such as the TAM and TRA to see if they are valid in a social computing environment. Other researchers are developing and testing theories and concepts that are unique to the social computing environment. They are using concepts from the social sciences such as social network analysis and social identity theory to explain the structure and working of social networks. This multi-volume collection will provide readers with an overview of the kinds of research that is being done so far in the area of social computing. But, this is a young research area with lots of research to be done.

EMERGING TRENDS

I believe that social computing will grow at a feverish rate for another couple of years. Newer applications will be developed and distributed on social networks. We will see more mobile applications of social computing in the years to come. Facebook, Twitter and LinkedIn already have applications for the iPhone, but newer applications will utilize the capabilities of mobile computing.

THIS COLLECTION

This multi-volume set is a collection of latest research in the area of social computing. The research covers all aspects of social computing: the social dimension and the technical dimension. Studies report on various cultural, social and individual factors that have an impact the success of virtual communities and social computing.

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ENDNOTES

[1] http://en.wikipedia.org/wiki/Social_computing

[2] http://socialcomputing.ucsb.edu/?page_id=14

About the Editor

Subhasish Dasgupta is Associate Professor of Information Systems and Director of the Master of Science Program in Information Systems Technology in the School of Business at George Washington University. Dr. Dasgupta received his BS (Physics) and MBA (MIS and Operations Research) degrees from the University of Calcutta, India, and PhD (Information Systems) from the City University of New York. His research interests include information technology adoption and diffusion, global information systems, virtual communities and social networking, and open source architectures. Dr. Dasgupta has published his research in journals such as *Journal of Strategic Information Systems*, *European Journal of Information Systems*, *Journal of Global Information Management* and *Journal of Information Education and Research* (now *Journal of Information Systems Education*). He has also presented many papers at international, national and regional conferences. Dr. Dasgupta serves as Editor-in-Chief of the *International Journal of Virtual Communities and Social Networking*.

Section I
Fundamental Concepts and Theories

This section serves as the foundation for this exhaustive reference source by addressing crucial theories essential to the understanding of social computing. Chapters found within this section provide a framework in which to position social computing within the field of information science and technology. Individual contributions provide overviews of computer-mediated communication, social networking, and social software. Within this introductory section, the reader can learn and choose from a compendium of expert research on the elemental theories underscoring the research and application of social computing.

Chapter 1.1
Social Influence and Human Interaction with Technology

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INTRODUCTION

This chapter discusses how information that supports innovation flows throughout an organization, the construction and effects of team composition, the innovative processes that teams employ, and the development, implementation, and evaluation of systems used to manage the flow and distribution of information. As Allen and Cohen (1969) point out, effective communicators rise in their organizations as a result of their willingness to engage information—by reading and conversing outside of their immediate settings, but as Tushman (1977) explains, that kind of outreach precipitates special boundary roles, which come about to satisfy an organization's communication network's role of bridging an internal information network to external sources of information. Thompson (1965) investigates the conditions necessary to move an organization from a single-minded focus on productivity to one of those that facilitate innovation. At times, that means engaging rival firms, and von Hippel (1987) demonstrates that information sharing is economically beneficial to the organizations doing the trading. Freeman's (1991) finding that information regarding innovative processes entails the development of effective information networks confirms how important it is for successful innovation that there exist effective external and internal communication networks, and that individuals collaborate to share information. von Hippel (1994) returns later in the chapter to qualify this point by showing that there is a direct correlation between the level of stickiness and the expense related to moving that information to a location where it can be applied to solving a problem.

Bantel and Jackson (1989) begin the section on team composition by suggesting that certain demographic factors affect a team's ability to be innovative, but resource diversity—including communication ability—is ultimately essential to innovation. For Howell and Higgins (1990), identifying a champion among a team's members will facilitate innovation, while Anconia and Caldwell (1992) find that the greater the functional diversity, the more team members communicated outside of

DOI: 10.4018/978-1-60566-038-7.ch004

their teams' boundaries. Scott and Bruce (1994) take a different vantage point, focusing on the individual and his or her influence on and adaptation to an organization's climate for innovation. The section on innovation process begins with Hage and Dewar (1973), who conclude that ultimately, the values held by an organization's elite group are more significant when predicting innovation than the values of any single leader or even the entire staff, but the correlation between a single leader and innovation should not be dismissed as a valid predictor of an organization's ability to innovate. Even so, as Daft (1978) has found, there is evidence to support the theory that there can be opposing innovative processes in an organization: one that begins at the lower levels of its hierarchy, and one that percolates down from upper levels. Even more radical, Quinn (1985) proposes that corporate executives understand and adapt to the fact that the innovation environment is filled with surprise, characterized by chaos, and virtually immune to control. The chapter concludes with Porter and Millar's (1985) article describing how information technologies affect management strategies and how these strategies are disseminated throughout a firm.

FLOW OF INFORMATION

In 1969, Allen and Cohen set out to explain the course that scientific and technological information takes in research centers and laboratories. Are there distinct pathways that information travels as it moves from external sources to people working with research labs? Their study, premised on the idea that research done while excluding outside information into the lab will ultimately fall short, consisted of examining patterns of technical communication in two different research labs, each of which had identifiable technical communication networks that arose from the nature of social interaction and work structure. The most effective communicators, those the authors refer to as the "sociometric stars," rose to prominence in the lab environment through their willingness to "either make greater use of individuals outside the organization or read the literature more than other members of the laboratory" (p. 12). In other words, either all members of an R&D team proactively seek the latest information regarding recent developments in the field, or managers bring in knowledgeable people to serve as consultants to the staff.

They also found evidence in existing literature that the lesser the rate of internal communication in an organization, the more chance there is that the research team will perform poorly, suggesting to managers that there is a need for external sources of information. Managers and project leaders can stave off the need for external consultants by recognizing that there are different rates of information flow when one considers the different demands spurred by organizational loyalty and structure, and the value of shared experience as opposed to the organizational schema that are inculcated in an academic setting. In other words, the affiliations, loyalties, and social relationships that develop among team members can be thought of as one way to see how the world works; conversely, training and information received in an academic setting and then brought into a research facility can be thought of as a different coding scheme that "introduces the possibility of mismatch and attendant difficulties in communication between organizations" (p. 12). Having team members who understand both schema, and therefore serve as translators, can mitigate the negative effects of such a mismatch.

Allen and Cohen identify previous literature concerning the effect of "prestige or status hierarchies in a social system [on] the flow of information." Essentially, those of high status will be more sociable and therefore more communicative with one another, whereas those of lower status tend not to like one another or communicate effectively with one another, "direct[ing] most of their communication toward the higher-status members, without complete reciprocation" (p. 16). At the time of their writing, Allen and Cohen believed that gatekeepers—those who could translate and facilitate communication among different hierarchical levels of an organization—would continue to transmit information, but management of the laboratories studied failed to see the value in that role, and therefore either discourage[ed] this activity by failing to reward it, or to reward the gatekeeper by promotion and thereby [made] it impossible for him to continue as a transmitter of information" (p. 19).

Boundary Roles and Innovation

Tushman (1977) uses previous organizational behavior and research and development literature to inform his understanding of how "special boundary roles" serve as a way for innovative organizations to facilitate necessary "cross-boundary communication" in a research and development lab. Particular attention is paid to the "distribution of these special boundary roles within the organization and their impact on subunit performance," and how boundary roles factor into the innovative process (p. 587).

There is often a strong need for an innovating organization to provide information to a variety of external information areas. This need precipitates special boundary roles, which come about to satisfy an organization's communication network's role of bridging an internal information network to external sources of information. These boundary roles occur at several places in the organizational structure, and the nature of their distribution depends on the type of work occurring within the organization. Tushman's findings are consonant with other research "on boundary spanning in general and highlights the importance of boundary roles in the process of innovation" (p. 587).

Tushman summarizes previous literature on the process of innovation development and dissemination, identifying the variety of steps and phases that result in decisions and coordinative efforts, and by communication patterns. Ultimately, however, Tushman focuses on the three-step innovation process offered by Myers and Marquis (1969): "idea development (the generation of a design concept), problem solving (technical efforts and problem solving in developing the proposed idea), and implementation (pilot production, inter-area coordination)" and point out that among the various positions and descriptions of these communicative patterns, "one important difference is the locus of critical information and feedback" (Tushman, 1977, p. 588).

Although Tushman recognizes the importance "of extra-organizational communication since the laboratory must receive up-to-date information about market and technological developments," he also points to other researchers' findings regarding the relevance of understanding external information such as user or market need, as well as maintaining an awareness of trends related to "new technological products, processes, and knowledge" (p. 589).

Special boundary roles are crucial to the flow of technical information between R&D labs and the larger organizations of which they are a part. The success of new projects is due, in large part, from an effective interaction between R&D teams and units such as sales, marketing, and the factory floor. Understanding that there are blocks to information flow and the hazards that complicate "transferring information across organizational interfaces," Tushman looks to systems theory research for reasons why such problems develop. The more complex any organization becomes, the more subgroups differentiate not only their tasks and goals, but their methods of accomplishing them and the social norms and behaviors that define them. Problems arise when there are discordant norms and coding schemes. When there is an overt disconnect between subgroups, and information cannot flow across organizational boundaries, yet project success is dependent upon effective communication, it is crucial that organizations "develop special boundary roles" (p. 590).

Referring to Allen and Cohen's (1969) point that the identification of key nodes in a communication network serve as a conduit for relevant external information into an internal communication system, "communication stars" must be identified and empowered to connect external sources of information to the R&D lab, as these stars are capable of translating and applying external information to the specific needs of the project team. At the same time, Tushman raises the question of how important it is to keep the boundaries between R&D and the larger organization clearly defined, as the difficulties inherent to differing coding schemas of different subgroups, even in an R&D setting, can hinder the integration of product development. Having information flow through agents who can effectively communicate and mediate—those occupying special boundary roles—will result in progress in innovative product development. Tushman's 1977 research "indicates that special boundary roles function to link the innovating system with various sources of external information and feedback. Thus, communication with external areas is not distributed equally among the innovating unit's staff but takes place through a limited set of individuals able to translate between several coding schemes. These individuals, or special boundary roles, are well connected to external information areas and are frequently consulted within the innovating unit. These boundary roles exist to mediate communication across several organizational interfaces" (p. 602).

Productivity and Innovation

Thompson's 1965 article reminds us of the enormous efforts toward structural changes in organizations that are necessary to initiate and promote innovative thinking. Before beginning his overview of contemporary organizational design and the forces behind it, he offers one premise and one definition: "No attempt is made to answer the question as to whether innovation is desirable or not," and by "innovation is meant the generation, acceptance, and implementation of new ideas, processes, products or services. Innovation therefore implies the capacity to change or adapt" (p. 2). His approach is comparative, taking typical bureaucratic architectures and juxtaposing them to what organizational and behavioral psychologists would suggest as conditions "conducive to individual creativity" (p. 1). What are the conditions necessary to move an organization from the rigid hierarchical structures that promote productivity to a variety of levels of hierarchy to facilitate innovation?

The typical successful organization can be viewed as "high [on] productive efficiency but low [on] innovative capacity" (p. 1). However, there is no synonymous relationship between adaptive and innovative organizations: a firm can adapt to new and varied pressures but fail to come up with new ideas. The distinction made between adaptive and innovative firms does not mean there is a void in terms of innovative practices. The innovative firm is capable of putting new ideas into practice. However, in order for any organization to function effectively, a "production ideology," the set of goals, objectives, and methods that "legitimizes the coercion of the individual by the group," needs to be articulated. In a vertical organization, this would mean goals set by an owner or executive group carried out through the efforts of employees who have been hired to do specific, discrete, and non-overlapping functions (p. 2).

Thompson characterizes "this [stereotypical] organization [as] a great hierarchy of superior-subordinate relations in which the person at the top, assumed to be omniscient, gives the general order that initiates all activity [and] authority and initiation are cascaded down" the chain of command, much like the military, where "complete discipline [is] enforced from the top down to assure that these commands are faithfully obeyed…each position is narrowly defined as to duties and jurisdiction, without overlapping or duplication[, and problems] that fall outside the narrow limits of the job are referred upward until they come to a person with sufficient authority to make a decision" (p. 3). While the egalitarian and horizontal organizational structure may seem to suggest that there is value in considering "the organization as a coalition" of people, skills, and efforts to achieve agreed-upon goals, "according to the Monocratic stereotype, the organization as a moral or normative entity is the tool of an owner, not a coalition" (p. 4).

How can members of stereotypical organizations adopt innovative methods when the "extrinsic reward system, administered by the hierarchy of authority, stimulates conformity rather than innovation"? The answer is to create an environment in which each member is personally committed to the organization's goals so that the rewards for creative thinking and action are primarily intrinsic rather than material. In such an environment, the concept of success is defined by the synergy between the individual and the organization's goals rather than the completion of a specific task, often preceded by the "normal psychological state…of…anxiety" (p. 6). Success eventually becomes synonymous with conformity, but that conformity is antithetical to creativity. Therefore, to "gain the independence, freedom and security required for creativity, the normal individual has to reject this concept of success" (p. 6). The "traditional bureaucratic orientation is conservative," a condition not conducive to innovation, which is in fact perceived as "threatening." Its primary concern is "the internal distribution of power and status" resulting in "the distribution of… extrinsic rewards." Reaction to innovative ideas is first and foremost characterized as "How does it affect us?" (p. 7).

To move toward an organizational structure that promotes innovation, several basic resources are needed, including "uncommitted money [and] time, [but also the human resources of] skills and good will," which inculcate a positive and unbounded sense of an individual's "limits of his capacities, so that he has that richness of experience and self-confidence upon which creativity thrives—a professional" (pp. 10-11). This will promote a "structural looseness" in the organization that puts "less emphasis on narrow, non-duplicating, non-overlapping definitions of duties and responsibilities," defines people by their "professional type rather than the duties type," creates a more open and freer sense of communication and "decentralizes…assignment and resource decisions" (p. 13). How costly this approach would be is something that Thompson, in 1965, simply could not predict, as management theorists "do not know the value of the novel ideas, processes, and products, which might be produced by the innovative organization, and we do not know that our present methods of costing and control are the best approach to achieving low-cost production" (p. 20). He believes, though, "that bureaucratic organizations are actually evolving in this direction," and that evolution is manifesting itself in attempts toward "increased professionalization, a looser and more untidy structure, decentralization, freer communications, project organization when possible, rotation of assignments, greater reliance on group processes, attempts at continual restructuring, modification of the incentive system, and changes in many management practices" (p. 20).

Informal Trading Knowledge

In von Hippel's 1987 article, his focus is on "the informal trading of proprietary know-how between rival (and non-rival) firms." Presaging the positive, cooperative spirit of the open source movement, von Hippel suggests that such information sharing is economically beneficial to the organizations doing the trading, but also that such activity is potentially beneficial in "any situation in which individuals or organizations are involved in a competition where possession of proprietary know-how represents a form of competitive advantage" (p. 291).

Innovation and Information Networks

Freeman's 1991 article begins by identifying and summarizing a major focus of 1960s empirical research on the flow of information from external sources into innovative business organizations, resulting in a reiteration of "the vital importance of external information networks and of collaboration with users during the development of new products and processes…whilst recognizing the inherent element of technical and commercial uncertainty" (p. 499). Freeman builds on von Hippel's sense of benefit deriving from industry-wide cooperation and seeks new ideas related to the process of networking innovators and their ideas. He discusses the development, in the 1980s, of flexible, regional networks that promote cooperative research among competing organizations, "and whether they are likely to remain a characteristic of national and international innovation systems for a long time to come, or prove to be a temporary upsurge to be overtaken later by a wave of takeovers and vertical integration" (p. 499).

By identifying and comparing innovations that succeed, and juxtaposing them against those that fail, Freeman finds that the failures both had lower resource investment and resulted in poorer product development. Comparative components included the size of the firm, which did not "discriminate between success and failure" (p. 500), and the size of a distinct research and development project, which did discriminate. Information regarding the design, manufacture, and sale of new products, and the innovative processes embedded therein, entailed the essential role of information networks "both in the acquisition and in the processing of information inputs" (p. 501). This confirms how important it is for successful innovation that there exist effective external and internal communication networks, and that they collaborate to share information.

How these networks are organized affects how an organization addresses systemic innovation, as the information networks themselves are "an inter-penetrated form of market and organization" that contain differing levels of cohesiveness among their members. Freeman defines a "network" as "a closed set of selected and explicit linkages with preferential partners in a firm's space of complementary assets and market relationships, having as a major goal the reduction of static and dynamic uncertainty." Freeman indicates that cooperation among regional firms, "as a key linkage mechanism of network configurations," can take a variety of forms, including "joint ventures, licensing arrangements, management contracts, sub-contracting, production sharing and R&D collaboration" (p. 502). Allowing that "in the early formative period of any major new technology system, almost by definition there are no dominant designs or standards and a state of organizational flux" (p. 510), it is logical that innovative business groups are not weighed down or restricted by industry standard or characteristic R&D techniques, but as adoption of technologies and methodologies takes place, "economies of scale become more and more important and standardization takes place," thus reducing the number of competing firms. However, Freeman points out that there is an alternative outcome to such standardization, particularly when one includes information networks as essential components to innovation, and that is that the number and productivity of autonomous firms "will grow still more important and will become the normal way of conducting product and process development" (p. 510).

Sticky Information

von Hippel returns to this cohort of top-cited articles on information flow in his 1994 piece on "sticky information" and its role in problem solving in innovative environments. He stresses the importance of uniting information and problem-solving skills in one location, be it on site in a lab or virtually via the Internet, as a prerequisite to solving any problem in the scope of product innovation. As long as information is easily available and inexpensive or free to get and share with others, where the information needed to solve a problem is used, is not at issue; but "when information is costly to acquire, transfer, and use—is, in our terms, 'sticky'—we find that patterns in the distribution of problem solving can be affected in several significant ways" (p. 429). There is a direct correlation between the level of stickiness and expense related to moving that information to a location where it can be applied to solving a problem. The thrust of the paper is on "four patterns in the locus of innovation-related problem solving that appear related to information stickiness" (pp. 429-430). Underlying these patterns are a few basic premises. First, when sticky information that problem solvers need is located in one place, the people will gravitate toward the information. When that information is distributed, problem solvers may do portions of their work at each of the locations. The third pattern is driven by cost: when the information is particularly sticky (expensive to obtain and/or share), problem solvers will divide their goal into sub-problems that can be addressed using the information held at any individual site. Lastly, not all locations of sticky information will receive the benefit of investment intended to reduce the expense of information at that location. Issues arising from the sticky information phenomenon result in the following four patterns, according to von Hippel (1994, p. 429): "patterns in the diffusion of information, the specialization of firms, the locus of innovation, and the nature of problems selected by problem solvers."

von Hippel draws an analogy between the costs of information transfer in problem solving and those of the physical manufacture of a product. Just as when there is sticky information needed to solve a problem, drawing the activity to the information to keep expenses low, a manufacturing firm will try to locate its facilities in such a way as to keep its transportation costs as low as possible. Citing research that indicates trial and error as a significant component of problem solving in cases in which sticky information is located at multiple sites, von Hippel suggests that problem solving will "sometimes move iteratively among these sites" or efforts will be extended toward "reducing the stickiness of some of the information" (pp. 432, 436).

TEAM COMPOSITION

Information Processes and Innovation

Bantel and Jackson's 1989 paper takes a demographic approach to investigating the leadership characteristics that result in a tendency to innovate, rather than avoid new approaches to both technical (products, services, and systems) and administrative (human and organizational) innovation. Previous research in this domain approached top decision makers such as CEOs as individuals making decisions on their own. Bantel and Jackson's demographic approach focused on characteristics as variables of top management teams: "We assume this dominant coalition acts as a decision-making unit for the organization" (p. 107). The authors looked at the demographics of top decision-making teams in 199 banks to discover the elements of team composition that supported innovative activity. Innovations "were identified through reference to the state of the art in the industry" (p. 108).

"The demographic characteristics of top management teams [that] were examined [included]: average age, average tenure in the firm, education level, and heterogeneity with respect to age, tenure, educational background, and functional background. In addition, the effects of bank size, location (state of operation), and team size were assessed. Results indicate that more innovative banks are managed by more educated teams who are diverse with respect to their functional areas of expertise. These relationships remain significant when organizational size, team size, and location are controlled for" (p. 107).

There are two basic organizational theory approaches to understanding the role that leaders play in effectuating a company's performance. Some hold that leaders and their abilities are environmentally determined (and therefore have relatively little ability to control organizational structure or reshape factors that support action), while others look at leaders as proactive decision makers who have a great deal of power over the direction of a firm. However, there is a middle position, which views organizational leaders as conduits that allow external influences into their firms, "thereby facilitating adaptation to the environment" (p. 107). These perspectives have shaped organizational behavior research, resulting in yet another opposition of approaches. Bantel and Jackson divide the field into the "direct assessment approach," which "directly assess[es] the psychological attributes of decision-makers and examine[s] their relationship to outcomes," and the "demographic approach," which the authors view as being more practical, but in terms of statistical analysis, has the disadvantage that "characteristics do not co-vary perfectly with the psychological attributes of interest" (pp. 107-108). These different approaches suggest differing hypotheses to study, with the psychological approach stressing "the role of cognitive resources in group problem solving," while the demographic approach suggests significant value in "the role of cohort effects in organization processes" (p. 108).

Perhaps more fundamental than the divergence of research approaches, the authors point out that there is not agreement on what "innovation" means. They describe the term as being actively inflected (innovation as process), as nominally inflected (innovation as the end product, a program or a service), and adjectivally (innovation as an descriptive attribute that an organization manifests). Their review of the literature indicates that most references to the term often take the nominal sense—the thing the firm sells. "In other words, the innovation 'process' culminates with innovation 'items', and firms that cycle through the process relatively frequently are described as 'innovative'" (p. 108).

The authors' analyses resulted in identifying "three phases of the decision process: (1) problem identification and formulation; (2) exploration, formalization, and problem solving; and (3) decision dissemination and implementation" (p. 108). The second phase has an impact on the number, nature, and effectiveness of solutions generated, as well as the scope and content of the discussions. If one focuses on differences of degree among group members in any factor, one will find that groups consisting of members at higher levels of "knowledge and ability" will out-perform those with lower levels when the shared task involves creative problem solving. When the factors studied are different in kind, when faced with "complex, non-routine problems," the more "variety in skills, knowledge, abilities and perspective," the more effective the team (p. 109).

Regarding team composition and its effect on the exchange of information, diverse groups in terms of organizational experience often suffer from limited communication. While there is an assumption that age and organizational tenure are positively correlated, demographic evidence dispels it. The authors caution researchers "to separate the effects of age and tenure because explanations differ for why age and tenure might be related to innovation" (p. 110). Their study resulted in the following demographic factors of team composition affecting a team's ability to be innovative: age, organizational tenure, educational background, and functional experience, but ultimately, their "results suggest support for the cognitive resources perspective, which posits that both resource level and diversity are important for innovation" (p. 120).

The Role of the Champion

Howell and Higgins (1990) take a different perspective on demographics, seeking empirical evidence to support the hypothesis of champions, individuals within an organization who take risks by introducing new ideas and innovative techniques to a group, process, or industry to promote their ideas. They sought evidence that "personality characteristics, leadership behaviors, and influence tactics…influence the emergence of champions in organizations" (p. 318). Their study relied on previous literature in entrepreneurship, transformational leadership, and influence, as there is a perceived positive correlation between entrepreneurs and champions. Champions often inspire others, and therefore they are perceived as leaders even though they do not have the hierarchical stature or title.

Howell and Higgins developed questionnaires and survey instruments that were completed by 25 matched pairs of perceived champions and non-champions, seeking responses concerning the personality characteristics, leadership behaviors, and influence tactics of champions of technological innovations. In sum, "champions exhibited higher risk taking and innovativeness, initiated more influence attempts, and used a greater variety of influence tactics than non-champions [and] showed that champions were significantly higher than non-champions on all paths in the model" (p. 317).

As the business environment becomes increasingly complex and competitive, finding leaders who can contribute positively to technological innovation—its identification, evaluation, and adoption—is an essential factor in productivity, competition, and survival. Success is in part reliant on there being a champion, someone who is not necessarily a corporate figurehead, but more often an individual who can contribute to an organization's success by promoting significant ideas and methods in an enthusiastic manner at critical points in that firm's or in a specific product's lifespan. As previous research has shown, "in order to overcome the indifference and resistance that major technological change provokes, a champion is required to identify the idea as his or her own, to promote the idea actively and vigorously through informal networks, and to risk his or her position and prestige to ensure the innovation's success" (p. 317). Champions should not be confused with gatekeepers, as their roles are quite different. The gatekeeper moves information from external sources to the cohorts within a project that will benefit by it. The gatekeeper is not necessarily a member of any of the project groups. Champions, on the other hand, as members of a project's cohorts, go outside the project and its sponsoring organization to find external information deemed beneficial, then uses their enthusiasm for the project as a tool aimed at convincing peers as to the use of the new idea.

Not all enthusiasts are champions. There are personality traits that contribute to one's ability to be a champion, including those resulting in being able to lead and influence others. Previous research has shown that "since innovation adoption is largely a process of influence… both with subordinates, as indicated by leadership behavior, and with peers and superiors, as indicated by influence tactics," champions are essential to innovation adoption (pp. 318-320). Transformational leaders, sometimes referred to as change agents, "use intellectual stimulation to enhance followers' capacities to think on their own, to develop new ideas, and to question the operating rules and systems that no longer serve the organization's purpose or mission" (p. 321). They boost the confidence levels and enhance the skill sets of their subordinates to the degree of their assisting in promoting and executing innovative strategies in response to challenges.

Howell and Higgins reviewed the literature on entrepreneurial personalities and found "that entrepreneurs desired to take personal responsibility for decisions, preferred decisions involving a moderate degree of risk, were interested in concrete knowledge of the results of decisions, and disliked routine work," and are often involved in innovative activities (p. 322). This is a profile consistent with that of innovators who display confidence in their abilities and seek opportunities to test and demonstrate them.

The recipe for a champion is a combination of personality traits such as enthusiasm and risk-taking, leadership skills strong enough to move people from accepted and comfortable practices to new and untested behaviors, and organization-wide vision that can result in the adoption of innovative practices. The authors believe that their study, as a concatenation of empirical evidence and established theory "in the domains of entrepreneurship, transformational leadership, and influence…provide organizational implications for the detection, selection, and development of champions." Champions are risk-takers, innovators, and informal transformational leaders, in their view, as opposed to what other researchers have suggested. It is not "that dispositional effects are less important than situational effects in influencing people's attitudes in organizational settings, [but that] our results suggest that by ignoring individual differences, one neglects major variables relevant to an important organizational human resource" (p. 336).

Functional Diversity

Anconia and Caldwell (1992) seek to understand the impact of functional diversity on product development teams, challenging the accepted wisdom that, as the complexity of tasks suggests an increase of the use of cross-functional and diverse teams, innovation in product development will be enhanced by combining engineers with other specialists. The authors looked at the performance of 45 high-tech new product development teams by integrating "group demography with other aspects of group theory to predict [their] performance." They looked at "the direct effect of group demography and the indirect effects created by demography's influence on internal processes and external communication" (p. 322). Specifically, their "study investigates two things: the direct effects of group heterogeneity on ratings of new product team performance, and the indirect effects of heterogeneity attributable to internal group process and to communication with non-group organization members" (pp. 325-326).

Their findings include different effects resulting from functional diversity (job tasks, domains, and limitations) and tenure diversity (length of time in a position) on team communication. The more functional diversity there was, the more team members communicated outside of their teams' boundaries, with groups such as marketing and management. Moreover, "the more the external communication, the higher the managerial ratings of innovation" (p. 321). When looking at tenure diversity, its effects were centered on how team members interacted rather than how and how much they communicated with external groups. The more diverse the tenure, the greater the level of improvement in group dynamics such as setting and buying into group goals and priorities, which yielded positive team assessments of performance. Sometimes, though, diversity is not wholly good and not solely positive, as it can also directly impede team performance. As the authors found, "Overall the effect of diversity on performance is negative, even though some aspects of group work are enhanced. It may be that for these teams diversity brings more creativity to problem solving and product development, but it impedes implementation because there is less capability for teamwork than there is for homogeneous teams" (p. 321). It is up to the team to navigate the negative functions of diverse teams so that the positive effects that diversity has on team interaction can be realized; this can be accomplished through increased communication and proactive resolution of conflict. Concurrently, it is up to management to recognize the tensions and impediments of diverse team composition so that the team does not suffer from organizational pressures from above, and the team is rewarded for its combined outcomes rather than individuals' functional outcomes.

Previous research has established that different demographic factors affect different variables. Age and sex affect economic states, geographic movement patterns, and crime rates, for example. How do demographic factors affect organizations and teams? Researchers have related demographic composition to employee turnover, to supervisors' performance evaluations of subordinates, and to types and levels of innovative practice within organizations. "For product development teams, two variables are likely to be of particular importance: the homogeneity of organization tenure and the mix of functional specialties" (p. 322). If a team is cross-functional, it has greater access to a wider array of expertise than if it were uni-functional. If a cross-functional team includes representatives from other departments of an organization, such as marketing, product transfer is facilitated. The authors also suggest that similarity in organizational tenure leads to enhancement of team integration because of increased "attractiveness of members to one another" (p. 323). Previous research also indicates that demographic diversity results in more conflict, and less team cohesion and ineffective communication than a homogenous team. Research on team conflict indicates that there will be more conflict among team members when individuals are relying on each other for task completion but they share different goals; the literature on group formation and effectiveness indicates that teams with diverse members often have difficulty integrating different values and cognitive styles. Their conclusion is that, if "not managed effectively, this diversity can create internal processes that slow decision making and keep members from concentrating on the task" (p. 323). Tenure diversity, for a new team member, also poses such negative factors as fewer opportunities to interact, differences in experience and perspectives, and a sense of exclusion from those group members who were teamed together at the same time. These distinctions hinder a team's ability to establish goals or set priorities.

The research literature on innovation also finds that diverse teams suffer from difficulties in reaching agreement or setting goals and establishing priorities. As new product teams have to obtain and share resources and information from other entities within an organization so that their tasks and goals can be accomplished, understanding the role of team communication—both internal and external—is important. High performing teams have greater amounts of communication among team members than low performing teams and organizations. If a team has a member that can translate and transmit information from the outside to the other team members, group performance can be enhanced.

The authors conclude by indicating that team productivity can increase when a team is composed of people with diverse sets of skills, knowledge, and interpersonal relationships with others in the organization. Tenure diversity can also be a positive factor, if the team takes advantage of its "range of experiences, information bases, biases, and contacts. Members who have entered the organization at different times know a different set of people and often have both different technical skills and different perspectives on the organization's history" (p. 325). However, "from a managerial perspective these research findings suggest that simply changing the structure of teams (i.e., combining representatives of diverse function and tenure) will not improve performance. The team must find a way to garner the positive process effects of diversity and to reduce the negative direct effects. At the team level, training and facilitation in negotiation and conflict resolution may be necessary. At the organization level, the team may need to be protected from external political pressures and rewarded for team, rather than functional, outcomes. Finally, diverse teams may need to be evaluated differently than homogeneous teams" (p. 338).

Individual Adaptation

Unlike Anconia and Caldwell, Scott and Bruce (1992) focus on the individual and his or her influence on and adaptation to an organization's climate for innovation. The authors ground their research in social interactionist theory and address the questions of how "leadership, work group relations, and problem-solving style affect individual innovative behavior directly and indirectly through perceptions of a "climate for innovation" (p. 581). Does the actual job or task that an individual is working on influence innovative behavior? Previous research has indicated that there is a "moderate relationship between climate and performance." To ascertain whether or not a job task proves to be a facilitator or hindrance to creativity, the authors "tested whether type of job assignment moderated the relationship between innovative behavior and each of the predictors in the model" (p. 581). They hypothesize that an individual's perception of the organizational climate for innovation is affected by the variables of leadership, work group relations, and problem-solving style, and used structural equation analysis to determine that the model proposed explained 37% of the variance in innovative behavior, concluding that task type actually does moderate the relationship between leader role expectation and innovative behavior (p. 580).

Referring to the accepted belief that managing innovation grows more difficult as an individual's attention is diverted from assigned task or goal, understanding both the motivation for innovative behavior and the nature of an environment that can foster motivation is essential. "Managing attention is difficult because individuals gradually adapt to their environments in such a way that their awareness of need deteriorates and their action thresholds reach a level at which only crisis can stimulate action" (p. 580).

There are three stages of individual innovation: problem recognition and the beginnings of solution generation, seeking of sponsorship or buy-in for that solution from those within the innovative environment, and the production of a model or prototype that can be used by a wider array of stakeholders. Innovation turns out to be the outcome of four interacting systems: an individual, a leader, a work group, and the climate for innovation (p. 582). What distinguishes Scott and Bruce's research from the literature addressing the relationship among tasks, technology, perception of climate, and effectiveness is their attention to how a task affects the moderation of the climate of innovation at the individual level. "When a task is routine or when individual discretion is low, the relationship between climate and innovative behavior is likely to be weaker than when the task is non-routine and high discretion is granted" (p. 588). Their summary of findings includes "leadership, support for innovation, managerial role expectations, career stage, and systematic problem-solving style to be significantly related to individual innovative behavior, and the hypothesized model explained almost 37 percent of the variance in innovative behavior" (p. 600).

The Innovative Process

Hage and Dewar (1973) elucidate the practicality of "elite values" as a concept and discuss how to go about measuring them empirically. "There are both formal and behavioral criteria, and one can easily imagine a continuum of elite participation with the precise cutting point of membership and non-membership remaining indistinct. Therefore, various definitions of membership need to be explored" (p. 279). To do so, the authors juxtapose for comparison concepts of elite values and those identified as criteria for leaders and members with the "three structural variables of complexity, centralization, and formalization" (p. 279). The amount of variance among these terms supported their being considered as independent variables. Hage and Dewar present the hypothesis that what the elites of an organization value has a direct effect upon what the organization accomplishes, but complicate the question by suggesting four alternative explanations for an organization displaying behaviors associated with elite values.

The first explanation involves organizational structure, as previous research has shown that structural variables such as complexity, centralization, and formalization are related both to rates of program change and the prediction of other organizational performances. One should also consider task structure, the second explanatory idea, as an organization maintaining a diversity of tasks will have a diversity of perspectives applied to them. This interplay of task and perspective "produces a creative dialectic that results in the development of innovative products and services," as a diversified task structure necessitates a diversified pool of professionals, each having access to specialized knowledge and sources of information (pp. 279-280). Third, Hage and Dewar note the "inverse relationship between centralization and program innovation." The more influential, elite members of an organization who can effect change and retain that power, the less opportunity there will be for non-elites to implement innovative ideas, as their suggestions would be concomitant with suggestions for change in "power, privilege and reward." Fourth, if power is centralized, there is less opportunity for innovation resulting from exchange of ideas or "the creative dialectic implied by complexity or diversity of tasks" (p. 280). Hage and Dewar gauged the degree of centralization by asking staff to describe the amount of participation they had in decision making, aggregating their responses as an average of positional means, with staff classified according to task assignment and hierarchical position in the organization (p. 283), suggesting that there is complementarity between elite size and degree of centralization.

There is a truism in organizational research that leaders are the source of strong influence. The authors describe leadership in organizations as "an interactive process wherein the leader provides certain services to the organization in exchange for legitimacy, respect, and compliance with his wishes by the staff" (p. 280). But leaders also act as mediators, spokesmen, and decision makers, and therefore the value they bring to an organization can be summarized as an agent of uncertainty reduction; power and influence increase as the general level of uncertainty among the staff decreases.

The authors conclude that ultimately, the values held by the elite group are more significant when predicting innovation than the values of any single leader or even the entire staff, but the correlation between a single leader and innovation should not be dismissed as a valid predictor of an organization's ability to innovate. "The association between Elite values and performance gives one some basis for arguing that statements about the goals of an organization from members of the Elite are probably more adequate than the executive director's perceptions alone" (p. 287).

A Dual-Cored Model of Organizational Innovation

Daft (1978) investigated the innovative process in an educational setting and examined the "behavior of administrators' vis-à-vis lower employees as innovation initiators…for a sample of school organizations [and relates his findings] to the professionalism of organization members, organization size, and frequency of innovation adoption" (p. 194). What leads administrators and other technical employees in this domain to adopt innovative approaches to problem solving? Daft offers findings of previous research to support the theory that there can be opposing innovative processes in an organization: one that begins at the lower levels of its hierarchy, and one that percolates down from upper levels. Therefore, his "findings are used to propose a dual-core model of organizational innovation" (p. 193).

Do organization leaders have primary impact on organizational innovation, as Hage and Dewar (1973) propose, linking innovation adoption to the "status and sociometric centrality of organization top administrators," or to top administrators' "cosmopolitan orientation," or perhaps with individual administrator's "motivation to innovate" (Daft, 1978, p. 193)? The answer is elusive, but much of the accepted research on innovation to the time of Daft's article suggests that leaders are active in the innovation process, acting as the connection between the organization's hierarchy and the technical environment in which staff and administrators work. By mere status and rank, organizational leaders are in position to innovate, and they can serve in supporting roles as well, by finding funds to implement new programs. By virtue of their leadership status, top administrators also influence innovation by setting priorities and goals (p. 193). Daft's concern is to find "underlying organization processes" that support innovation, as such information would be beneficial in providing knowledge that supports innovative alternatives to existing problems, and basic knowledge of organizational innovative processes would facilitate new ideas that may eventually provide innovative techniques that can be adopted (p. 194).

The two components of Daft's dual-core model derive from the organizational/human and the technological/mechanical orientations of a firm. This dichotomy is illustrative of how innovative ideas can come from either end of an organization's hierarchy, with administrative innovations moving from top to bottom, and technical innovations moving from bottom to top; therefore, innovative "ideas follow different paths from conception to approval and implementation" (p. 195). Keeping in mind that the larger an organization is, the more complex and refined the division of labor, it is not unusual that technical staff will be most concerned with technical innovations that are within their scope of work. This is in keeping with the elements of professionalism that define this group as a working unit, as they base the esteem they offer on team members' "education and training, participation in professional activities, exposure to new ideas, autonomy, and the desire for recognition from peers rather than from the formal hierarchy" (p. 196).

Daft summarizes the different roles that administrators and technical staff play in the innovation process, with the basic distinctions in definition of the groups being that a "technical innovation is an idea for a new product, process or service. An administrative innovation pertains to the policies of recruitment, allocation of resources, and the structuring of tasks, authority and reward. Technical innovations usually will be related to technology, and administrative innovations will be related to the social structure of the organization." This being the case: "(1) Each group is expected to initiate innovations pertaining to their own organization task; (2) this division of labor is expected to heighten as employee professionalism and organization size increase; (3) the absolute number of proposals initiated by each group is also expected to increase as professionalism and size increase; but (4) the greater number of proposals may not lead to greater adoptions because professionalism and size may be associated with greater resistance to adoption" (p. 197).

This does not mean that there are barriers between the two domains in terms of initiation and development of innovative strategies and solutions. In both the administrative and technical components of an organization, the process of innovation is often based on the professionalism of the employees and offered by individuals who are domain experts who will most likely use and benefit from the innovation proposed. In some organizations, "the amount of innovation and the degree of coupling between the two cores may be a function of technology, rate of change, and uncertainty in the environmental domain as well as employee professionalism" (p. 206). However, Daft finds that administrative innovation tends to happen in anticipation of changes in factors in the administrative domain, such as new goals and objectives, hierarchy, and control structures. In sum, organizations usually adopt more administrative than technical innovations, and the "technical core appears to be subordinate and tightly coupled to an active and influential administrative core" (p. 207).

Innovation Success Factors

Quinn's 1985 article opens a window onto the results of a multi-year, worldwide study of innovative companies, and highlights some of the "similarities between innovative small and large organizations and among innovative organizations in different countries" in an effort to understand the pervasive perception that world technological leadership is passing from the United States to our international rivals in Europe and the Far East (p. 73). While some would hold bloated U.S. corporate bureaucracies responsible for stifling innovation, Quinn suggests that there are large companies that understand what it takes to promote the innovative process and reap its rewards, like so many entrepreneurs who accept "the essential chaos of development, pay close attention to their users' needs and desires, avoid detailed early technical or marketing plans, and allow entrepreneurial teams to pursue competing alternatives within a clearly conceived framework of goals and limits" (p. 73). Small companies are associated with successful production of innovative ideas and products for several reasons, including that "innovation occurs in a probabilistic setting." Quinn refers to the very high percentages of venture failure—failures that the general public and corporate competitors never see—as one reason. On the opposite end of the spectrum are large corporations that might want to promote a new concept or product but are limited by the knowledge that innovation brings with it the real costs of failure. Unlike a new, small business, a large corporation does not want to "risk losing an existing investment base or cannibalizing customer franchises built at great expense" or attempt to "change an internal culture that has successfully supported doing things another way" or dismiss "developed intellectual depth and belief in the technologies that led to past successes." Emergent companies are not scrutinized and restricted by "groups like labor unions, consumer advocates," and should their venture fail, they "do not face the psychological pain and the economic costs of laying off employees, shutting down plants and even communities, and displacing supplier relationships built with years of mutual commitment and effort" (pp. 73-74).

Quinn's findings, supported by previous research in the management of innovation, yield a list of "factors [that] are crucial to the success of innovative small companies," including:

1. **Need orientation**: A personality trait held by inventor entrepreneurs. "They believe that if they 'do the job better,' rewards will follow."
2. **Experts:***and fanatics* are two adjectives applicable to company founders "when it comes to solving problems."
3. **Long time horizons:** Unlike their large corporation counterparts, inventor entrepreneurs, fanatics that they are, tend to "underestimate the obstacles and length of time to success. Time horizons for radical innovations make them essentially 'irrational' from a present value viewpoint."
4. **Low early costs:** Innovators often are not burdened by large fixed costs such as rent, payroll, and employee health care plans, tending to minimize expenses by maximizing existing space.
5. **Multiple approaches:** "Technology tends to advance through a series of random—often highly intuitive—insights frequently triggered by gratuitous interactions between the discoverer and the outside world. Only

highly committed entrepreneurs can tolerate and even enjoy this chaos."

6. **Flexibility and quickness:** Two traits associated with and resultant from each of the items above, with the added benefit of being undeterred "by committees, board approvals, and other bureaucratic delays, [allowing] the inventor-entrepreneur [to] experiment, test, recycle, and try again with little time lost."
7. **Incentives:** While small-scale innovators realize that they will personally reap the benefit of their success, Quinn recognizes that they "often want to achieve a technical contribution, recognition, power, or sheer independence, as much as money."
8. **Availability of capital:** Quinn's assessment at the time of publication posits "America's great competitive advantages [to be] its rich variety of sources to finance small, low-probability ventures" (pp. 75-76).

Juxtapose these eight factors for innovative success against what Quinn terms "bureaucratic barriers to innovation," and one has a comprehensive picture as to how and why many in 1985 viewed America as losing its role as the world's technological leader:

1. **Top management isolation:** Similar to what Bantel and Jackson would posit five years later, Quinn suggests that "senior executives in big companies have little contact with conditions on the factory floor or with customers who might influence their thinking about technological innovation."
2. **Intolerance of fanatics:** As is often the case in many domains where an unknown challenges the status quo, Quinn finds that large "companies often view entrepreneurial fanatics as embarrassments or troublemakers."
3. **Short time horizons:** Ladened with the weight of public perception and stockholder expectation, corporations often feel the "need to report a continuous stream of quarterly profits," which is antithetical to "the long time spans that major innovations normally require."
4. **Accounting practices:** "By assessing all its direct, indirect, overhead, overtime, and service costs against a project, large corporations have much higher development expenses compared with entrepreneurs working in garages."
5. **Excessive rationalism:** Large entities need to be managed and often via cautious business practices that are prescriptive and constrained in comparison to free-wheeling entrepreneurial techniques. "Rather than managing the inevitable chaos of innovation productively, these managers soon drive out the very things that lead to innovation in order to prove their announced plans."
6. **Excessive bureaucracy:** As a direct result of excessive rationalism, "bureaucratic structures require many approvals and cause delays at every turn."
7. **Inappropriate incentives:** The process of innovation is rife with surprise, which is poisonous to the "reward and control systems in most big companies." Large, bureaucratic organizations cannot permit challenges to their "well-laid plans, accepted power patterns, and entrenched organizational behavior" (pp. 76-77).

Quinn proposes that corporate executives understand and adapt to the fact that the innovation environment is filled with surprise, characterized by chaos and virtually immune to control. If they begin to adopt and implement some of the techniques and perspectives that successful entrepreneurs practice, and bring "top-level understanding, vision, a commitment to customers and solutions, a genuine portfolio strategy, a flexible entrepreneurial atmosphere, and proper incentives for innovative champions, many more large companies can innovate to meet the severe demands of global competition" (p. 84).

IT Use for Competitive Advantage

Porter and Millar (1985) address the role of information technology in an organization's strategy for competitive advantage. It is not insignificant or obvious to point out that at the time of this article's publication, information technologies fulfilled primarily quantitative functions. 1985 preceded ubiquitous e-mail, graphical user interfaces, and the Internet as a global communication network. As the authors indicate, "Until recently, most managers treated information technology as a support service and delegated it to EDP departments." Porter and Millar's goal is to "help general managers respond to the challenges of the information revolution" such as it was in 1985. Presciently enough, they are quick to point out that "managers must first understand that information technology is more than just computers." Indeed, understanding how managers can put these tools to use for competitive advantage is essential, as IT is "transforming the nature of products, processes, companies, industries, and even competition itself" (p. 149).

How should managers view information technologies in order to assess and implement their strategic significance? How and why do these technologies change "the way companies operate internally as well as altering the relationships among companies and their suppliers, customers, and rivals"? They should begin by recognizing the general ways in which technology affect business competition: "it alters industry structures, it supports cost and differentiation strategies, and it spawns entirely new businesses." Once these outcomes have been recognized, managers can follow the authors' five-step plan to "assess the impact of the information revolution on their own companies." Looking back with over 20 years of growth and change in information technologies, it is to the authors' credit for indicating early on how business advantage will derive from our abilities to make strategic use of the increasingly convergent and linked technologies that process the information (p. 149).

Porter and Millar urge managers to understand that the "role of information technology in competition is the 'value chain,' [a] concept [that] divides a company's activities into the technologically and economically distinct activities ['value activities'] it performs to do business." Profitability derives from a business's ability to create more value than "the cost of performing the value activities." Competitive advantage is achieved when "a company…either perform[s] these activities at a lower cost or…in a way that leads to differentiation and a premium price (more value)" (p. 150).

One can assess the potential profitability of a company by understanding its structure, which Porter and Millar contend is "embodied in five competitive forces…the power of buyers, the power of suppliers, the threat of new entrants, the threat of substitute products, [and] the rivalry among existing competitors." The degree to which the strength of these five forces coalesces obviously "varies from industry to industry as does average profitability." What managers need to keep in mind, however, is that the "strength of each of the five forces can also change, either improving or eroding the attractiveness of an industry" (p. 155). Moreover, given that "information technology has a powerful effect on competitive advantage in either cost or differentiation…technology affects value activities themselves or allows companies to gain competitive advantage by exploiting changes in competitive scope" (p. 156).

What specific steps can managers take to avail themselves and their companies of the strategic advantages for which information technologies have already provided positioning? Porter and Millar offer the following five:

1. **Assess information intensity:** "A company's first task is to evaluate the existing

and potential information intensity of the products and processes of its business units."

2. **Determine the role of information technology in industry structure:** "Managers should predict the likely impact of information technology on their industry's structure."
3. **Identify and rank the ways in which information technology might create competitive advantage:** "The starting assumption must be that the technology is likely to affect every activity in the value chain."
4. **Investigate how information technology might spawn new businesses:** "Managers should consider opportunities to create new businesses from existing ones."
5. **Develop a plan for taking advantage of information technology:** "The first four steps should lead to an action plan to capitalize on the information revolution" (pp. 158-159).

Ultimately, "companies that anticipate the power of information technology will be in control of events. Companies that do not respond will be forced to accept changes that others initiate and will find themselves at a competitive disadvantage" (p. 160).

CONCLUSION

A laboratory that places a reliance on internal information, while excluding outside information from flowing into the lab, will ultimately fall short of its potential for discovery. This is demonstrated by the success of researchers inside a laboratory, who make greater use of individuals outside the organization and/or the literature (Allen & Cohen, 1969). This work lays a critical foundation for the need to boundary-span and the existence and importance of different types of roles within a research environment, and for organizations involved with innovation in general. These boundary roles satisfy an organization's communication network's role of bridging an internal information network to external sources of information (Tushman, 1977). Boundary roles and the interface between employees inside an organization with employees outside of an organization are highlighted in the discussion of the importance of informal trading of proprietary know-how between members of rival (and non-rival) firms (von Hippel, 1987). This work arguably sets the theoretical ground for the open source movement, while Freeman's (1991) consideration of benefit derived from industry-wide cooperation and networks of innovators similarly sets the theoretical stage for industry/government consortia focused on pre-competitive research. While the importance of boundary spanning and working/interacting with individuals outside the organization has been discussed, the criticality of close proximity is stressed, due to the "stickiness of information" (von Hippel, 1994).

Enormous structural changes in an organization are necessary to initiate and promote innovative thinking (Thompson, 1965). The focus on structural change is to move an organization away from one being highly efficient but low on innovation, to one that is high on innovation while retaining as much efficiency as possible. Some of these changes are illustrated by findings associated to the nature of team structures that support innovation. Leadership characteristics that result in a tendency to innovate are suggested to be a function of the top management team, rather than the CEO (Bantel & Jackson, 1989). A critical part of the management team, in relation to a specific innovation, is that of the *champion*. Champions are identified as the key individuals within an organization who take risks by introducing new ideas and innovative techniques to a group, process, or industry to promote their ideas (Howell & Higgins, 1990). Moving from managers to team members, it was found that the more functional diversity in an organization's product development team, the more team members communicated outside of their teams' boundaries with groups such as marketing and management. External communication corresponded to higher managerial ratings of innovation (Anconia & Caldwell, 1992). Also important is focusing on the individual's influence on and adaptation to an organization's climate for innovation. It is found that organizational climate for innovation is affected by the variables of leadership, work group relations, and problem-solving style, concluding that task type moderates the relationship between leader role expectation and innovative behavior (Scott & Bruce, 1994). Having considered teams, some final thoughts are offered on the innovative process.

There is complementarity between elite size and degree of centralization, and this is important for the acceptance and integration of innovation (Hage & Dewar, 1973). In other words, the upper management or elite are the enablers or disablers of innovation. This view is expanded on from findings that there can be opposing innovative processes in an organization: ones that begin at the lower levels of an organization's hierarchy, and ones that percolate down from upper levels—a dual-core model of innovation (Daft, 1978). The consideration of the differences associated with firm, size, region, and incumbent vs. emergent companies is offered though a multi-year study (Quinn, 1985). Finally, early advice was offered on the role of information technology in obtaining competitive advantage (Porter & Millar, 1985):

1. Evaluate the existing and potential information intensity of products and processes.
2. Predict the likely impact of information technology on industry structure.
3. Identify and rank the ways that information technology may offer competitive advantage.
4. Embrace the idea that information technology promotes the spawning of new businesses from existing ones.

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This work was previously published in Principle Concepts of Technology and Innovation Management: Critical Research Models, edited by Friedman, Roberts, Linton, pp. 82-107, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.2
Social and Human Elements of Information Security:
A Case Study

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ABSTRACT

This chapter attempts to understand the human and social factors in information security by bringing together three different universes of discourse – philosophy, human behavior and cognitive science. When these elements are combined they unravel a new approach to the design, implementation and operation of secure information systems. A case study of the design of a technological solution to the problem of extension of banking services to remote rural regions is presented and elaborated to highlight human and social issues in information security. It identifies and examines the concept of the 'Other' in information security literature. The final objective is to prevent the 'Other' from emerging and damaging secure systems rather than introducing complex lock and key controls.

DOI: 10.4018/978-1-60566-036-3.ch008

AI can have two purposes. One is to use the power of computers to augment human thinking, just as we use motors to augment human or horse power. Robotics and expert systems are major branches of that. The other is to use a computer's artificial intelligence to understand how humans think. In a humanoid way. If you test your programs not merely by what they can accomplish, but how they accomplish it, they you're really doing cognitive science; you're using AI to understand the human mind.

-Herbert Simon

INTRODUCTION

Information security falls within the broad category of security. All the while when designing systems, designers employ an underlying model of the "human being" who is either an "attacker," "adversary," "eavesdropper," "enemy," or "opponent," apart from the normal user of a system who is a "beneficiary," "customer," or "user." For the sake of simplicity, let us call the human being who interacts with the information system in the normal, authenticated, and authorized user mode as a legitimate "user." Let us call a human being who interacts with the system performing some illicit operations not within the legitimate framework as the "other." It is important to understand that the same person may switch between different modes from user to the other depending on the context. Most security systems employ a model of the "other" in relation to which the security features of systems are designed.

This chapter focuses on fundamental underlying premises that are implicitly or explicitly employed while constructing secure information systems. This chapter attempts to open the door for a new approach to the study of information security. It examines the human and social factors in information security from the perspective of a model of human behavior and cognitive science. A real world case study is the basis from which insights are drawn from the process of its design (but not actual implementation). We attempt to outline three distinct universes of discourse and frames of reference and try to relate them together. First, we look at the underlying broad philosophical assumptions of security frameworks in general. Second, we choose a model of human behavior from a systems perspective and situate a cognitive science approach within it. Third, we analyze the technical fabrication of information security protocols in the context of human and social factors, drawing insights from a case study. We discuss and highlight issues in providing secure messaging.

The philosophy of security section discusses the reason why at all we need secure systems. Secure systems are products of a particular time, space, and the level of technology currently available in a society. From the nature of humanity we draw the conclusion that all human beings have the potential to create security hazards. However, whether a person is a legitimate user of the system or the "other" (at the individual level) is determined by his or her cognitive (rational) capacities, emotions (affective states), intent (will), spirituality (belief systems adhered to), and the overt behavior of the individual that is expected of him or her. This provides an explanatory framework to understand why individuals who are intelligent opt to undertake malicious activities (e.g., "hackers" and "terrorists"). The social setting in which the individual is embedded to a great extent determines his or her predisposition to choose act the role of "the user" or the "other." The expression of the "collective conscience" of the community to which he or she belong gives sustenance to the emotional basis, the formation of will, the spiritual basis, and specifies public action that is encouraged. Though these particular human and social factors are not treated in depth in this chapter, it points out that these factors have to be studied seriously and an approach should be taken to prevent the emergence and continued presence of the "other" in the social space. This probably is a more secure way of ensuring implementation of security features.

We look at a case study where information security is of key concern in a modern financial system. The case study outlines a design process for remote banking that offers several technical and managerial challenges. The challenge is to be able to extend banking to communities that hitherto have had no experience in banking and to those who are illiterate. This chapter outlines the technical issues that need to be addressed to make remote banking a reality. From this case study, we draw conclusions of how the "other" is present in the design of the project. We have only emphasized and dealt with the cognitive model of the "other" among the several human and social factors involved in providing a secure financial system. We conclude the chapter paving the way for a deeper social science research that needs to the address the problem of the causes of formation of malicious or subversive intent, process of its sustenance, its expression, presence, and persistence. This will enable creation of secure systems.

PHILOSOPHY OF SECURITY

To understand human factors in information security we must have a framework to comprehend both the "human" and "security." Let us first address the question "Why security?" A simple description of the human being and human nature gives us the answer. Human beings are products of nature and interact with nature. Humans have the ability to create or fashion things out of natural material. They have the power to destroy forms and recreate newer forms, for example, they can melt iron, make steel, build edifices, and construct cars and aircrafts. Humans have the power to break and make things. This human potentiality makes them destroyers while at same time being creators (e.g., cutting trees to make furniture). The potential threat while safeguarding an artifact or a possession comes from other humans (and possibly from his or her own self too). A layer of security is therefore necessary to protect an entity from being destroyed accidentally or deliberately. Borders are an essential security feature that preserves the form of an entity and provides an inner secure space ("privacy"). Borders delineate and define distinct spaces. What is within and what is outside. Humans have the capability to break open "security" features (the husk, shell, case, or skin that covers and protects a seed or fruit).

In their quest to attain mastery over the universe, humans have developed tools that are efficient in interacting with nature intimately. Whenever humans develop a new tool that is technologically advanced than the current level of technology, then the new technology can also be deployed as a weapon. The invention of knives gave rise to swords, dynamite for mining gave rise to grenades, the capability to generate nuclear power gave rise to nuclear weapons, and so on. When a certain technology becomes out of date the weapons also become outdated, for example, we no longer use bows and arrows, swords and even firearms—we no longer witness duels or fencing. Security frameworks of yesteryears are no longer meaningful today—castles and fortresses are no longer strongholds, they have been replaced by different types of defense establishments (e.g., the Windsor castle and many fortresses dotted all over India). Previously, photographing a dam was thought to be a security risk. But with today's satellite capabilities and inter continental ballistic missiles, the information of the location of a dam cannot be kept secret (e.g., Google Earth). The security frameworks of a particular time are contingent upon the level of technology that the society has achieved.

Since humans have the innate potentiality to destroy and consume, if something is to be preserved from destruction then it is necessary to safeguard it with a layer of security. Particularly with respect to information security, one needs to be clear whom you need to protect information from. What are the threats to information security—where does it arise from? The employee, customer, the competitor, or the enemy? Malicious attacks from "hackers" or even from your own self? While constructing systems, it has to be taken into account that:

A human being will exploit a vulnerability in a system, if there is a vulnerability existing in the system, to his or her advantage at cost of the system.

All security frameworks are built with the *other* and the *other's* capability in mind.

HUMAN FACTORS: A BEHAVIORAL MODEL

When we talk about "human" factors that influence information security, we first need to identify and define what we mean by "human" factors. Human factors are taken into account in a wide variety of fields, for example, aeronautics, ergonomics, human-computer interaction, medical science, politics, economics, and so forth. Each of these fields considers human factors from several different aspects. In aviation, human factors mean cognitive fidelity, whole body motion, and physiological stress (Garland, 1999). Ergonomics deals with user interface design, and usability—making products in the workplace more efficient and usable. Anthropometric and physiological characteristics of people and their relationship to workspace and environmental parameters are a few of the human factors taken into consideration in ergonomics. The other factors may include the optimal arrangement of displays and controls, human cognitive and sensory limits, furniture, and lighting design.

We need a model of the "human" in the context of information security. Models provide us with important relationships between variables. Philosophical positions give us a foundation to construct scientific models over empirical data. While scientific models are often reductive in nature (i.e., entities are studied in isolation), systems models study interactions between components. The sum of parts is greater than the whole. The systems model of human behavior gives us a possible basis to identify the sources of threat to information security. Information security cannot be achieved purely from the standpoint of cryptographic algorithms (lock and key mechanisms) alone, but from understanding human behavior and the social context in which humans are embedded (Dhillon, 2007).

The systems model of human behavior identifies three major components of the mind as well as the biological and spiritual underpinnings (Huitt, 2003). Eysenck (1947), Miller (1991), and Norman (1980) provide empirical support for the three dimensions of mind (or human personality) for example:

1. Cognition (knowing, understanding, thinking—processing, storing, and retrieving information);
2. Affect (attitudes, predispositions, emotions, feelings); and
3. Conation (intentions to act, reasons for doing, and will).

These three components of the mind can be used to address several issues that can arise in the context of information security. An individual's thinking (cognition), feeling (affect), and willingness (volition, conation), as well as overt behavior and spirituality are constituents that interact to give appropriate human responses to stimuli from the environment. A second characteristic of the systems model of human behavior is that human beings do not operate in isolation; they are products of a variety of contexts—environments that surround the individual human being that he or she is in constant interaction play a major role in the individual's responses and interactions with the world (see the next section on social factors for a detailed discussion).

There are therefore five major components of the human being in the systems model of human behavior (Huitt, 2003):

1. **Cognitive component:** Perceives, stores, processes, and retrieves information
2. **Affective component:** Strongly influence perceptions and thoughts before and after they are processed cognitively
3. **Conative component:** The intent of the human actor
4. **Spiritual component:** How humans approach the mysteries of life, how they define and relate to the sacred and the profane

5. **Behavioral system:** Explicit action of the human being and the feedback received from other members of the community.

Of these, the major component that we are concerned with is the cognitive component. We would like to explore this cognitive component from the framework of cognitive science. Briefly, here we will outline how other components are influential in information security. Human emotions, the basis of the affective component is a subject that has been explored in psychology (Huitt, 2003). A variety of emotions impact how humans relate with information systems. Anger, fear, and anxiety are known to influence the adoption and usage of information systems (Athabasca University, 2000), for example, the introduction of computerized systems in the banking industry in India faced organized, stiff resistance during the initial phases as bank employees had apprehensions of threats of job loss and retrenchment (Goodman, 1991). The conative component (human will) determines at what level an individual or a group of people will adopt information technology. The human being can be influenced by cultural factors ("we" and "they"), the religious position he or she has abided by (spirituality), and also the collective memory (social factors) in which he or she has been contextualized.

While this chapter essentially focuses on a cognitive science perspective, it also admits the limitations of cognitive science in general. In this chapter we have taken a limited attempt to study only the cognitive component of the mind as opposed to treating other components such as the affective, the conative, the spiritual, and the overt action of the human being. There are philosophical criticisms raised by Dreyfus (1992) and Searle (1992) to cognitive science. They claim that this approach is fundamentally mistaken in the sense that cognitive perspective does not take into account (Thagard, 2004):

- The ***emotion*** challenge: Emotions can be the basis for action in human thinking.
- The ***consciousness*** challenge: The ability to do what is good and what is evil influences the cognitive model of the human being.
- The ***world*** challenge: The physical environment in which a human being is located influences his or her thought.
- The ***body*** challenge: Health conditions can determine one's thought patterns.
- The ***social*** challenge: Human thought is always embedded in symbol, ritual, and myth and is part of a collective conscience.
- The ***dynamical systems*** challenge: The human mind is a continuous dynamic system, and does not always compute in the traditional sense.
- The ***mathematics challenge***: Human thinking is not mathematical—the brain does not compute using numeric quantities will making calculations, for example, the speed at which a human being drives a car is not computed using equations.

The systems model of human behavior does accommodate all the criticisms to a pure cognitive science approach.

SOCIAL FACTORS (SYSTEMS AND ECOSYSTEMS)

Systems cannot be completely understood without understanding the ecosystem within which they are embedded. Human behavior is not merely a function of an individual's cognitive components. There are three levels of ecology that are identified by the systems model of human behavior (Huitt, 2003). Huitt's framework is discussed. The first level of the ecology or the context of human behavior is the micro-system. The family, the local neighborhood, or the community institutions such as the school, religious institutions, and peer groups form part of the micro-system where individual formation occurs. The second level is the meso-system. This influence arises from social institutions or organizations where the human being does work (employment) or obtains pleasure (entertainment). The micro-system institutions filter and mediate the influence of these meso-systems and institutions with which the individual interacts. The third level is the macro-system. The third level of influence relates to the international region or global changes or aspects of culture. Ecological parameters can influence human behavior significantly. The German defeat in the First World War that led to an economic catastrophe leading to the Second World War is a case in point. All human actions of individuals in the German world or the Allied world had to be influenced by the war during the world wars.

The sources of security threats can emerge from the global environment, the meso-system, or the micro-system. An individual's motivation to destroy can emerge from any of these sources. In a context of war between two communities, each may perceive the other as a threat (e.g., world wars). Two organisations may compete against each other for their share of the market (e.g., Microsoft vs. Apple). Families may have animosities with other families (e.g., the Capulets and the Montagues). Therefore, each of these of these ecological levels may strongly impact as to whom the individual treats as the "other."

Cognitive Science and Security

Cognitive science emerged when researchers from several fields studied complex representations and computational procedures of the mind. Cognitive science is the interdisciplinary study of mind and intelligence, embracing philosophy, psychology, artificial intelligence, neuroscience, linguistics, and anthropology (Thagard, 2004). The computational-representational approach to cognitive science has been successful in explaining many aspects of human problem solving, learning, and language use.

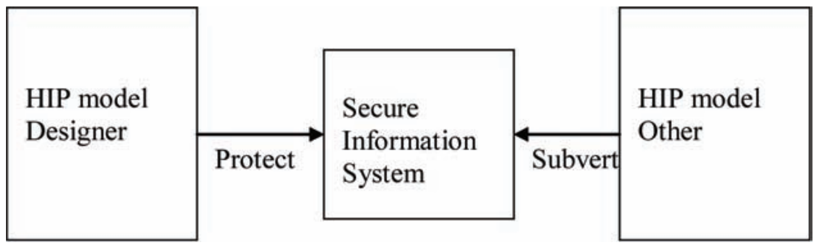
Cognitive scientists build computer models based on a study of the nature of intelligence, essentially from a psychological point of view. This helps comprehend what happens in our mind during problem solving, remembering, perceiving, and other psychological processes. AI and cognitive science have been able to formulate the information-processing model of human thinking (Association for the Advancement of Artificial Intelligence, 2007). Rapaport (2000) puts it this way:

The notion that mental states and processes intervene between stimuli and responses sometimes takes the form of a 'computational' metaphor or analogy, which is often used as the identifying mark of contemporary cognitive science: The mind is to the brain as software is to hardware; mental states and processes are (like) computer programs implemented (in the case of humans) in brain states and processes.

Whereas when we talk about human factors in information security, we are primarily interested in the human information processing model. An understanding of human information-processing characteristics is necessary to model the *other's* capability and action. Characteristics of the human as a processor of information include (ACM SIGCHI, 1996):

- Models of cognitive architecture: symbol-system models, connectionist models, engineering models
- Phenomena and theories of memory
- Phenomena and theories of perception
- Phenomena and theories of motor skills
- Phenomena and theories of attention and vigilance
- Phenomena and theories of problem solving

Figure 1. Cognitive model of the designer of secure information systems



- Phenomena and theories of learning and skill acquisition
- Phenomena and theories of motivation
- Users' conceptual models
- Models of human action

While cognitive science attempts to build a model of the human as an information processor (HIP model), it deals with only one individual unit as its basis. However, the design of security features in information systems design has to take into account two or more processing units as the basis of the model. The technical fabrication of secure systems incorporates a model of the "Other." A careful analysis of the Global Platform (see case study) or EMV standards reveals the process of how the designer attempts to build secure financial information systems where the "attacker" is always present in the scenario. The cognitive model of the "attacker" is the human factor that the system attempts to protect itself against (Fig. 1). The *other's* technical competence is assumed to be equivalent to that of the designer. The destructive capability—the computational-representational model of the "other" is the source of threat for the designer, to protect against whom the designer designs his or her security features.

THE CASE STUDY: FINANCIAL INCLUSION USING INFORMATION TECHNOLOGY

Financial inclusion means extending banking services at an affordable cost to the vast sections of disadvantaged and low-income groups. Financial Inclusion Task Force in the UK has cited three priority areas requiring serious attention: access to banking, access to affordable credit, and access to free face-to-face money advice (Kumar, 2005). The Reserve Bank of India (RBI) has noticed that more than eighty percent of adult rural Indians (245 million, roughly the size of U.S. population) do not hold a bank account (Nair, Sofield, & Mulbagal, 2006). The Reserve Bank of India has mandated that banks extend their outreach taking banking service to the common man (Reserve Bank of India, 2005).

Extending banking to the rural areas where there are no bank branches, consistent power supply, or communication links such as telephones or Internet is a daunting task. This calls for newer approaches in taking banking to remote regions. One solution that RBI has come up with is to enable customers' intermediate banking facilities through business correspondents who act as agents on behalf of banks (Reserve Bank of India, 2006). As law mandates, any transaction on an account involving cash has to be made within the physical premises of the bank. The business correspondents are appointed by the banks and have the authority to accept deposits or make cash payments when customers would like to withdraw or deposit money from or to their accounts at locations other than bank premises.

The experience of microfinance institutions in India while taken into account suggested that cash management is a problem in rural India. The transport of cash is expensive and dangerous. A solution was sought whereby the cash that is available in the villages could be circulated and kept within the region would lead to less security hazards in cash management. Instead of opening full-blown brick and mortar bank branches in remote districts (an expensive proposition), it was proposed that with the help of modern information technology and managerial capabilities of business correspondents, banking functionalities could be extended to remote regions. It is known that information technology solutions to deliver banking services have been able to reduce transaction costs (e.g., ATMs). The business requirements for the proposed solution are outlined. We also discuss in the next section how these requirements could possibly be implemented using information technology as a vehicle.

Business Requirements for the Financial Inclusion Initiative

The basic idea of the financial inclusion initiative is to extend banking services to the un-banked and under-banked rural population. The rural communities that reside in remote regions were the target beneficiaries of the scheme.

Information technology should enable banks to provide services that have the following business requirements:

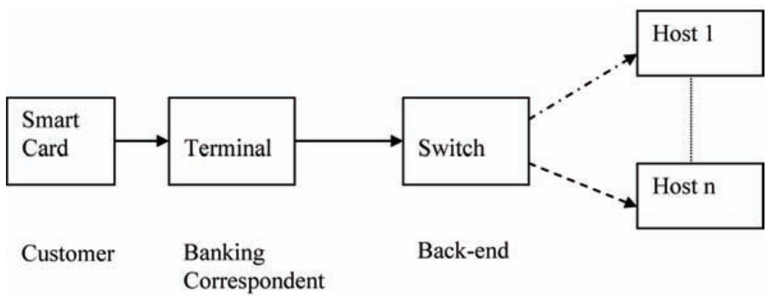
- Banking services such as deposits, withdrawals, and funds transfer are to be provided.
- Each customer must be identified uniquely by some means especially fingerprints. Biometric authentication using fingerprints proved to be more secure than personal identification number (PIN) based authentication. As most customers are illiterate, they would not be able use PINs to authenticate themselves (in some pilots it was noticed the rural customers who could not keep their PIN secret had written it down on the card itself!).
- Both online and off-line transactions must be possible.
- Balance enquiry and mini-statement showing last ten transactions must be possible at all terminal locations.
- No transaction should be lost in the entire system.

Technical Implementation Issues (Problems and Solutions)

The model solution proposed for the financial inclusion initiative is outlined in Figure 2. Each customer is given a smart card with his primary account number and other personal details such as address, nominee details, and contact information stored within it. The smart cards are to be used at bank terminals owned by banks and operated by business correspondents. The customer is authenticated using the biometric fingerprint of the customer stored in the smart card. These terminals have connectivity through GSM, CDMA, PSTN, or Ethernet depending upon the type of connectivity available at the local place of operation. However connected, the communication finally happens through an IP connectivity to the back-end switch. The network switch connects a particular terminal with an appropriate bank host. All customer details and account information including current balance is held at the bank host. The smart card is used for customer authentication whenever transactions are made at bank terminals. Figure 3 provides an overview of the technological solution to the financial inclusion initiative.

The technical issues addressed in the design of the system:

Figure 2. Model solution for the financial inclusion initiative



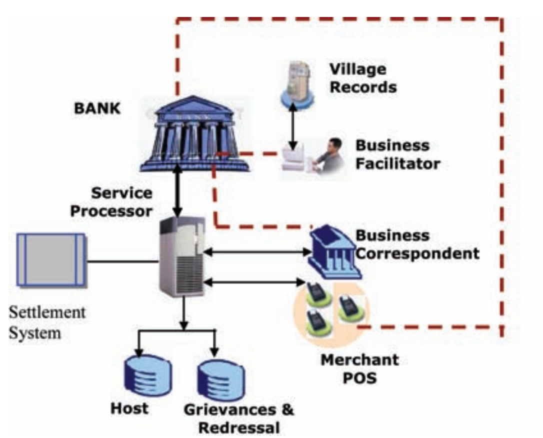
- The choice of the appropriate smart card (ISO 7816, Global Platform)
- The internal layout and file structure of the smart card (personalization)
- The choice of the terminal (Level 1—EMV certified)
- The communication protocol between the terminal and the smart card (EMV)
- The communication protocol between the terminal and the switch (ISO 8583)
- The customization of the switch software
- A card management system
- A terminal management system

The Smart Card

Smart cards have been widely used in various sectors such as transport, retail outlets, government, health (insurance), mobile telecom, and in the financial sector. Smart cards come in different flavors with differing operating systems, memory capacities, and processing power (Rankl & Effing, 2003). Smart cards come with different operating systems like MultOS, Payflex, or Java. Certain operating systems are vendor specific. Smart cards differ in terms of the memory capacity that is available within them. There is a tradeoff between the cost and the level of security required. A crypto card that uses public key infrastructure (PKI) offers more security and is relatively more expensive than a smart card that permits only static data authentication.

A wide range of smart card with different memory capacities exist from 8K, 16K, 32K, and 64K. It was a business requirement specification that the customer's fingerprint templates need to

Figure 3. Technological solution for financial inclusion—an overview



be stored in the smart card. Also, since the last 10 transaction details had to be stored within the smart card for balance enquiry and mini-statement, a smart card with as much EEPROM memory as possible was needed. The fingerprint template ranges from half a kilobyte to one kilobyte in size. Considering the storage of templates for four fingers, this would take about four kilobytes of space. A normal, rudimentary software application on the smart card takes about four kilobytes. Therefore, the final choice was a 32K card. Smart cards were specified to adhere to ISO 7816 standards (physical characteristics and cryptographic requirements).

The information contained in the smart card is to be held securely, only to be read and updated using secure symmetric keys. This solution using symmetric keys, though weaker than a PKI solution, was adopted mainly due to cost considerations. A PKI enabled, Europay MasterCard Visa (EMV) compliant cryptographic smart card costs four times as much as a normal card. The affordability of the customer determined the level of security that could be offered. Since the account balances were anticipated to be low—a lock costlier than the value it protects was discarded. A secure access module (SAM) at the terminal provided the necessary computational security to read and access the information in the smart card. Derived keys and diversified keys are used for this purpose (Rankl & Effing, 2003).

Smart cards can contain multiple applications. Global platform is an industry wide standard that provides a layer of management while handling multiple smart card applications. Global platform specifies the security requirements that a card and the application should have while making secure smart card applications. Table 1 samples

Table 1. Sample from global platform perception of security threats

1.	High level threats are classified security concerns as: - The manipulation of information on card including modification of data, malfunction of security mechanism, - The disclosure of information on card - The disclosure of information of card as design and construction data.
2.	*The cloning of the functional behavior of the smart card on its ISO command interface is the highest-level security concern in the application context.*
3.	The attacker executes an application without authorization to disclose the Java card system code.
4.	An applet impersonates another application in order to gain illegal access to some resources of the card or with respect to the end user or the terminal.
5.	The attacker modifies the identity of the privileged roles.
6.	An attacker prevents correct operation of the Java card system through consumption of some resources of the card: RAM or NVRAM.
7.	The attacker modifies (part of) the initialization data contained in an application package when the package is transmitted to the card for installation.
8.	An attacker may penetrate on-card security through reuse of a completed (or partially completed) operation by an authorized user.
9.	An attacker may cause a malfunction of TSF by applying environmental stress in order to (1) deactivate or modify security features or functions of the TOE or (2) deactivate or modify security functions of the smart card. This may be achieved by operating the smart card outside the normal operating conditions.
10.	An attacker may exploit information that is leaked from the TOE during usage of the smart card in order to disclose the software behavior and application data handling (TSF data or user data). No direct contact with the smart card internals is required here. Leakage may occur through emanations, variations in power consumption, I/O characteristics, clock frequency, or by changes in processing time requirements. One example is the differential power analysis (DPA).

some of the security requirements that global platform card security specification addresses (GlobalPlatform, 2005).

Corporations such as Visa and MasterCard have built their own EMV standard applications such as Visa Smart Debit/Credit (VSDC) or MChip, respectively. The design issue is whether to adopt one of these applications (with suitable customization) or to build a custom application from scratch. Adopting any of these standard applications has the advantage of worldwide interoperability. But the price is heavy in terms of licensing and royalty fees that the poor rural customer has to bear when every transaction is made.

Issues in Storing Value in the Smart Card

Permitting off-line transactions (as connectivity is poor) require that account balance information be carried within the smart card. The value stored in the cards has to be treated as electronic money or currency. However, apart from technicalities of implementing an electronic purse, there are legal constraints. Electronic currency has not yet been afforded the status of legal tender. Electronic wallets have so far been unsuccessful in the market in Europe (Sahut, 2006).

Certain types of smart cards have an e-purse facility implemented in the card itself. The common electronic purse specifications (CEPS) standard outlines the business requirements, the functional requirements and the technical specifications for implementing e-purses. However, CEPS is considered as a dead standard in the industry. Whenever there is a situation where the value of currency can be written by the terminal onto the card, the security risk dramatically increases. Therefore, the possibility of offering offline transactions as a business requirement had to be compromised.

Issues in Customer Authentication using Biometric Identification

In today's payment systems scenario in India, a normal magnetic stripe card that is used for debit or credit applications. The magnetic stripe card holds the customer's primary account number (PAN), name, and some authentication information (such as enciphered PIN). No account balance information is held in the card. These cards facilitate only online transactions.

The business requirements for this initiative demanded that off-line transactions should be accommodated since connectivity is poor in rural India. This meant that the card needed to carry the account balance to allow offline transaction facilities. Therefore, the option of a smart card was taken. The smart card is to carry biometric (fingerprint) identification details, customer information, and bank account information. However, since the card should also possibly be used with other existing financial networks, a magnetic stripe was also needed in the card (e.g., using the same cards in ATMs apart from the terminals). So a combination of chip and magnetic strip solution was proposed.

The fingerprint template was to be stored in the card so that every time the customer wanted to do a transaction, a fingerprint scanner could extract the image and terminal could compute the template for feature matching. The biometric validation process could either take place at:

- **The Card:** The biometric fingerprint template is held within the card. The terminal reads the fingerprint and creates the template. The templates are compared inside the card using the intelligence within the card.
- **The Terminal:** The terminal reads the biometric fingerprint and converts it to a template, and it is compared with the template stored read from the smart card into

the terminal. Terminals also have memory requirements and limitations.

- **The Back-end Host:** The back-end stores both the image and the template. The comparison is made with the biometric template stored within the smart card. This solution is costly in terms of telecommunication costs since the fingerprint template needs to be communicated to the back-end host over wired or wireless telecommunication networks for every transaction the customer makes.

The Terminal

The interaction between the card and the terminal is specified in the Europay, MasterCard, and Visa (EMV) standard. The terminal was chosen to be one with Level 1—EMV compliant hardware. The software on the terminal had to be Level 2—EMV compliant software. An EMV Level 2 certification guarantees software on the terminal that is reasonably secure. The software handles the communication between the smart and the terminal communication. The EMV process is discussed in section below.

EMV Standards for Smart Card: Terminal Communication

EMV standard is a specification of a protocol that governs the communication between the terminal and the smart card (EMVCo, 2004). Essentially, terminal verifies whether the card belongs to the acceptable family of cards, the card authenticates whether the terminal is a genuine one, and finally, the cardholder has to be authenticated, that is, whether the cardholder is the one whom he/she claims to be. There are several steps in the EMV process:

- Initiate application
- Read application data
- Data authentication
- Apply processing restrictions
- Cardholder verification
- Terminal action analysis
- Card action analysis
- Online/off-line processing decision
- If online, then issuer authentication and script processing—go to step 11
- If off-line process the transaction
- Completion.

Though there are several steps (we will not delve into the details here), we discuss only the process of static data authentication (SDA) as an example of an EMV process. The terminal verifies the legitimacy of the data personalized in the card. This is to detect any unauthorized modification or tampering of the data after personalization of the card (Radu, 2003).

The public key of the certificate authority (CA) is stored in the terminal. The CA signs the public key of the card issuer (e.g., a bank) using the CA's private key and this certificate is stored in the smart card. The issuer uses its private key to digitally sign the static data (those data items that are to be protected from tampering). The signed static data is stored on the card. When the terminal wants to verify the authenticity of the data the following steps are done:

- The terminal retrieves the certification authority's public key.
- The public key of the issuer is retrieved from the certificate.
- Retrieve the signed static data.
- Separate the static data and its signature (hash result).
- Apply the indicated hash algorithm (derived from the hash algorithm indicator) to the static data of the previous step to produce the hash result.
- Compare the calculated hash result from the previous step with the recovered hash result. If they are not the same, SDA has failed. Else SDA is successful.

Table 2. Sample ISO 8583 messages (Source: http://en.wikipedia.org/wiki/ISO_8583)

Message Type Indicator	Type of Request	Usage
0100	Authorization request	Request from a terminal for authorization for a card-holder transaction
0200	Acquirer financial request	Request for funds
0400	Acquirer reversal request	Reverses a transaction
0420	Acquirer reversal advice	Advises that a reversal has taken place

This procedure verifies whether the card has been tampered with or not. The cardholder verification method (CVM) verifies whether the card belongs to the cardholder or not. Traditionally, the cardholder uses a personal identification number (PIN). In the financial inclusion project it is envisaged to use biometric fingerprint authentication for the CVM.

Terminal: Host Communication

Once the user is authenticated, the terminal communicates with the host to make transactions. The transactions include deposit, withdrawal, and funds transfer or utility payments. ISO 8583 is the protocol that governs this communication between the smart card and the terminal. ISO 8583 defines the message format and communication flows. ISO 8583 defines a common standard for different networks or systems to interact. However, systems or networks rarely directly use ISO 8583 as such. In each implementation context, the standard is adapted for its own use with custom fields and custom usages. In the financial inclusion project, the message arrives in the switch in the EMV format. The message is stripped of EMV formatting and encryption; a customized ISO 8583 message is generated and passed on to the host. The communication between the terminal and the switch happens over the air or over the wire using a telecommunication network. Table 2 provides a small sample of messages.

HUMAN AND SOCIAL FACTORS IN INFORMATION SECURITY

Before outlining the possible abuses of the system by its various participants, it is important to note that in a complex information system as discussed in the case could be compromised by both the insider (personnel who construct and maintain the system) and people who are end users of the system (outsiders). We briefly dwell upon the problem of insider threats before addressing the possible problems created by outsiders to the system.

The Insider

Shaw, Ruby, and Post (1998) identify the sources of threats can emerge from employees (full time and part time), contractors, partners, and consultants in the system. People who are emotionally distressed, disappointed, or disgruntled can be manipulated and recruited to commit damaging acts. Introverts (people who "shy away from the world while extroverts embrace it enthusiastically"—H. J. Eysenck) like intellectual pursuits rather than interpersonal relationships are vulnerable to act destructively. Profiles of possible perpetrators of security threat are people who are socially isolated, computer dependent, and gain emotional stimulation and challenge through breaking security codes consequently beating security professionals. High rates of turnover reduce loyalty of employees to particular organizations. Moreover, computer professionals have weak ethics and they see any unprotected data as fair game for attack. Certain predisposed traits in individuals when exposed to acute, stressful situations produce emotional fallout that leads them to act in ways subverting the system.

A study of illicit cyber activity in the banking and financial sector (United States Secret Service, 2004) reveals that most of the security incidents required very little technical training and skills. In 87% of the cases studied, simple and legitimate user commands were used to create the security incidents and 13% of cases involved slightly more sophistication like writing scripts or creating "logic bombs." About 80% of the users were authorized users. Only few (23%) were employed in technical positions. Most of the system subversion activities were planned in advance by the perpetrators and their intent of the actions were known to other people such as potential beneficiaries, colleagues, friends, and family. Most of the attacks were carried out during normal business hours and at the work place. Revenge, dissatisfaction with company policies, desire for respect, and financial gain were some of the motivating factors identified by the study.

Threats, whether they emerge from inside or outside, whatever be the source of their motivations (the different ecological levels and individual dispositions that influence human behavior), at the point of attack the perpetrator applies logic or a heuristic strategy to make his or her move. Therefore, the designer needs to anticipate the possible scenarios where the system can be compromised. The designer therefore has an anticipated intricate model of the *other's* cognitive thought processes and possible "moves." Against this backdrop, the designer secures the system in the best possible manner (like building a fortress), for example, "bus scrambling"—individual bus lines are not laid out in sequence in a smart card microcontroller, rather they are scrambled so that the potential attacker does not know which bus line is associated with which address bit or function (Rankl & Effing, 2003). In this respect, cognitive science can play a significant role in uncovering, mapping, and addressing the heuristics, the strategies, and the logic employed by potential attackers.

The modern banking system, on the whole, is rather vulnerable as it is heavily dependent and exposed to various consultants and vendors. Vendors take care of security risks within their organizations, for example, smart card manufacturers have to secure the entire process of production of smart card, key management process, transport and distribution process, and card personalization process. The banking electronic system relies heavily on outsourcing certain key functionalities such as database management where "ethical" and regulatory aspects do not govern the interface and interaction. Every time a vendor "opens" a banking database either for maintenance or for troubleshooting, the risks of exposure are quite phenomenal.

We have discussed the technicalities of secure financial transactions that can happen in the financial inclusion project in the earlier section. If there occurs a security breach or incident, either in the authentication process using the smart card or in the interaction between the cardholder and the business correspondent, the entire system will collapse. Any of the human participants in the financial system can attempt to subvert the system—the outsider to the system, the customer, or the business correspondent. We discuss three possible scenarios that could lead to comprising of the financial system.

First, we look at a masquerader who either steals or obtains a smart card that is in use in the project. Second, we look at problems a customer can create when offered facilities for off-line transactions. Third, we consider the case of a dishonest business correspondent who can exploit the illiteracy (vulnerability) of the customer.

The Outsider

The outsider to the system who obtains a card may be able to use the card to his or her advantage. Since the EMV standard does not provide for biometric fingerprint authentication, this has to be incorporated with the cardholder verification method (CVM). In the extreme case, it may be possible for the outsider to alter the biometric of a card and use it to masquerade as the user.

The Other Customer

Secondly, in the case where off-line transactions were to be permitted, the card has to carry financial information such as account balance. The possibility of abuse or misuse by the customer had to be accounted for. The customer could make several offline transactions and claim to loose the card. If the card were to be reissued to customer with balances available at the host (not as yet synchronized with the offline terminal information), then the bank stands to loose financially. One could not trust the customer not to resort to this avenue.

The Other Banking Correspondent

Thirdly, the problem of dishonest business correspondents (those operating terminals doing transactions on behalf of the bank) came to the fore. Suppose a rural customer who was illiterate would like to withdraw cash from his/her account then the business correspondent can debit a larger value than what was disbursed to the customer. Though a printed receipt would be made available to the customer, since the customer is illiterate this would not be of any practical use. This gives rise to a flaw in the system. This technical loophole could only be overcome with some form of social surveillance as well as taking care to appoint trustworthy business correspondents. A possible administrative solution was to provide a hotline for customer complaints of this kind of system abuse by business correspondents. Once a business correspondent is identified as committing fraud, the bank authorities could take appropriate action.

This financial inclusion project highlights the limitations of approaching information security from the viewpoint of technicalities alone. It requires a solution whereby all the parties involved are bound by ethics as well appropriate social controls (administrative procedures to handle disputes and violations). Human and social factors have to be taken into account to be able to provide a good solution to the problem of remote banking.

CONCLUSION

This chapter attempts to place the human and social elements of information security within a wider context. It discusses some philosophical underpinnings underlying security ventures. The chapter takes the systems model of human behavior as a basis and situates a cognitive science approach within. It discusses the design a real world case of a secure financial system of how it characterizes and accounts for the "other." The design of the technical system is entirely based on the current level of information technology today and how it is employed in a remote banking application scenario.

The source of much of our technical aspects and capabilities (e.g., cryptography) in information security emerged in the historical context of world wars—battling with a real, flesh and blood "enemy." But today systems designers' battles with the "other" in their imagination to construct secure systems. This chapter attempts to outline the need for a broader approach to information security incorporating philosophy, social and cognitive sciences. Security should be approached from first principles. This approach may provide different ways to handle security. The implications for information security may be derived from a general philosophy of security. Since security is essentially a psychological, political, social, and historical phenomenon, there is a need to "model" the human (and the "other") in the frames of references of these sciences. This will better able societies and organizations to understand the source and nature of threats and deal with them at that level, rather than at the level of technical fabrication alone, for example, deep-seated emotional memory wounds of lost battles long ago may stir and motivate a "hacker" or a "terrorist." The philosophical question to address is "How do you prevent the "other" from emerging and operating adversely in the world?" The social and moral fabric of society needs as much attention as the design of security of protocols.

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This work was previously published in Social and Human Elements of Information Security: Emerging Trends and Countermeasures, edited by M. Gupta; R. Sharman, pp. 116-132, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.3
Computer-Mediated Communication Learning Environments:
The Social Dimension

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INTRODUCTION

The social, relational, and affective dynamics are receiving more and more attention in the study of learning processes, as cognitive, affective, and emotional dimensions of learning seem to be closely related. This kind of co-origination, borne out in the context of neurosciences, artificial intelligence, cognitive psychology, and education, has also been recognized in the field of Web-based learning. The research framework of computer supported collaborative learning (CSCL) has emphasized the role that a well-established social dimension plays in collaborative learning and group-based working within communities of learners. According to the socioconstructivist model, learning always implies a social dialogical process where individuals are mutually engaged in the construction and sharing of new knowledge (Scardamalia & Bereiter, 1994; Wenger, 1998). Pedagogical approaches based on these assumptions combine the advantages of a learning strategy that promotes deeper level learning, critical thinking, and shared understanding with those related to the development of social and communication skills (Garrison & Anderson, 2003).

What characterizes the intertwining of the educational and sociopsychological dimensions in these settings is that they are strictly linked to the dialogues that participants mutually construct. Most of the learning experiences that occur on the Internet are characterized by written and asynchronous communication (Lapadat, 2002). And the written discourse deeply influences also the socio-affective dimension of learning.

The present review aims at presenting the most recent and promising research studies that tackle the linguistic nature of the emotional and affective dimension of learning in Web-based learning environments. Its purpose is to emphasize how computer-mediated communication (CMC) may convey specific social affordances in the expression of affective and social domain of learning.

DOI: 10.4018/978-1-59904-845-1.ch016

BACKGROUND

Early approaches in the study of CMC noted that the lack of nonverbal cues (e.g., facial expression, posture, gesture, proximity) would limit the richness and scope of communication (Short, Williams, & Christie, 1976). CMC was thought to be an impoverished means of communication giving little chance to gather important information about the context, the commonly shared rules of conduct and their influence on communication, all of which foster uninhibited speech and flaming. Moreover, as anonymity, which is a frequent feature of online interactions, reduces these control indicators, communication would be more de-individualized and de-personalized, and that would have different and unpredictable consequences on the various speech contexts. Lacking nonverbal indicators, CMC was seen to be characterized by a very low level of social presence, and it was thought that this feature could invalidate the learning purpose.

In recent times, a number of studies have shown that with written communication alone, typically used in chat and e-mail, it is possible to stimulate social and affective presence, provided that interlocutors are allowed to manage their time freely. Other authors underlined the similarity between the development of relationships in both face-to-face and online contexts, showing that although the latter need more time to grow, they can be more socially oriented than the former (Walther, 1996). Users compensate for the communicative lack of written discourse with linguistic inventions and adaptations (e.g., emoticons, typographical marks, and other textual features, including the use of capital letters, ellipses, exclamation marks, as well as typing errors) in order to express with appropriate orthographical strategies the aspects of nonverbal communication (Crystal, 2001). In this way, a higher degree of familiarity and intimacy in content, style, structures, and timing of the exchanged postings would not only be a linguistic adaptation able to incorporate colloquial and informal registers, but it could also strike a balance between the features of the medium and an acceptable level of immediacy.

In the context of distance learning, social presence has been recently redefined as "the ability of participants in a community of inquiry to project themselves socially and emotionally, as 'real' people (i.e., their full personality), through the medium of communication being used" (Garrison, Anderson, & Archer, 1999, p. 94). According to this reformulation, social presence seems to support cognitive objectives as it encourages and supports meaningful critical thinking processes in a community of learners. Emotion arousal influences the cognitive, metacognitive, and motivational aspects of the learning process, especially when socially oriented (Wosnitza & Volet, 2005) and affective objectives that result in engaging and rewarding group interactions may lead to an increase in academic, social, and institutional integration and results (Rourke, Anderson, Garrison, & Archer, 1999).

The studies that have adopted this new conceptual perspective have investigated social presence, among other characteristics, as a predictor of satisfaction and perceived learning (Richardson & Swan, 2003) and as an indicator of success and quality of the learning experience (Swan & Shih, 2005). Others underline the relationship between the role of the tutor/instructor and the affective and cognitive learning in the online classroom (Baker, 2004). All of them focus on the fundamental connection between the cognitive and affective elements of learning processes.

THE LINGUISTIC EXPRESSION OF THE SOCIAL DIMENSION OF LEARNING

If traditional approaches to measuring social presence and the affective dimension of learning used different combinations of survey instruments (e.g., scale-graduated questionnaires and semistructured or unstructured interviews) and analyses of students' online interactions through quantitative methods (e.g., frequency of messages, etc.), in recent times, the expression of the social dimension has been investigated through other means. Since the pioneering work of Henri (1992), the content analysis approach has become one of the most valuable ones. Classifications of text features into categories and indicators have been proposed, with the aim of capturing the new styles and characteristics of human communication which rely on asynchronous written discourse.

There are a number of ways in which textual indicators are able to manifest social presence and express representation of learners' affective domain. Rourke et al. (1999), for instance, identified 12 indicators of social presence belonging to three categories (affective, interactive, and cohesive), based on previous research, literature, and analysis of transcripts, which were applied to transcripts of online communication. To these, Swan and Shih (2005) added new indicators that match quite well with the ones derived both from face-to-face analysis and research on previous online learning.

Job-Sluder and Barab (2004) examined how participants in a community of practice express a shared group identity in their discussions on the basis of the use and frequency of singular and plural first person pronouns; the aim of the study was to investigate the role of identity formation in learning processes in the context of preservice and in-service teacher development. Inductive methodology guided the approach of a research study that proposes a model of engagement able to capture the dynamic nature of learners' interaction by means of the philosophical hermeneutic circle (Ziegler, Paulus, & Woodside, 2006). These studies have contributed to emphasize the importance that linguistic specificities of written communication have in the expression of social presence and affective dimension of learning. Linguistic creativity is indeed what distinguishes writing in CMC settings from written language in other kinds of communicative contexts (Crystal, 2001). Yet, the examination of specific features of language in creating an effective climate of social presence has not been carried out adequately.

Only in recent times, for instance, the role that metaphors and figurative language in facilitating the expression of emotions and affective domain in Web-based learning environments has been investigated. Literature in linguistics and cognitive science state that metaphoric language has a central role in every day discourse, because it seems to shape the ways in which we think, creating a bridge from abstract domains to perceptual experience and helping to understand a new domain of experience in terms of what is already familiar. Moreover, figurative language has a central role in establishing a climate of closer intimacy between speakers, as the power of imagery seems to facilitate the sharing of personal experience and to create emotional involvement. Studies in Web-based learning settings have shown that figurative language may be a creative way through which students at a distance may give substance and concreteness to the immaterial place of the Web. It can allow participants to represent their affective domain (their emotions and feelings) and to conceptualize the main learning components on the Web (Manca & Delfino, 2007). In this study, the use of figurative language, as a special communicative tool that creates that sense of closeness and intimacy that literal language cannot achieve, is shown to be an original and creative way to communicate through the written expression of emotions and social presence.

NEW HORIZONS OF EXPLORATION

In an online learning community, cognitive and metacognitive processes are closely linked with the social and affective dimensions. Learning always involves a deepening process of participation in a community, and it is closely connected to that of construction of identity. Being part of a group or a community means, most of all, building a common and shared identity with the other members. Indeed, participation especially implies the reorganization of individual identities and the construction of a collective and shared identity within the community (Wenger, 1998).

If we assume that participants are able to construct individual and collective identities, as well as to express their emotional and affective horizons through writing processes, we need to ask how one projects oneself on the Web and which images of self are constructed and proposed to others. In the context of learning settings, cyberspace may be a "space" where the narratives of the self usually maintained in a face-to-face situation are more readily disrupted. Hence, there is more possibility of exploring modes of identity formation, both on the students' and tutors' side (Bayne, 2005).

From this perspective, narrative is being recognized as one of the most promising and emerging areas of interest in digital learning environments (Dettori, Giannetti, Paiva, & Vaz, 2006). Narrative has been shown to be a powerful cognitive tool for meaning construction in organizing external knowledge representation and as a way to structure human experience. Storytelling, as a means through which people may communicate their emotions and feelings, is strictly intertwined with those aspects of learning related to motivation, engagement, social interaction, and personal meaningfulness. In CMC learning contexts, the use of narratives can improve the social dimension of online learners and contribute to collaborative student learning through the sharing of personal experiences and the construction of a common identity.

Another promising approach is based on the theory of dialogical self. The relatively new concept of dialogical self in psychology is closely related to narrative psychology, constructivism, and cultural psychology. It explores the reciprocal influences that occur between the construction of the self and the cultural environment, as well as the specific impact of digital environments. In an online learning environment, self-positioning strategically supports the creation of a virtual learning community and also stresses the relationship of individual development with the sense of belonging to a community (Ligorio & Pugliese, 2004).

From a methodological perspective, along with approaches that tackle the content analysis of written communication, other methods are gaining further consideration. Among others, social network analysis focuses more on the study of the whole learning community, rather than on the individual who takes part in it. It examines the ways in which participants communicate with each other by exploring the depth of collaboration and the frequency of communication between participants, considering notions such as relation and structure of a network. The first applications of these notions to online communities have revealed that this method is especially helpful for understanding how a community is born and grows through the complexity and density of the network nodes and links (e.g., Aviv, Zippy, Ravid, & Geva, 2003).

CONCLUSION AND IMPLICATIONS FOR PRACTICE

The constant growth of online education is rapidly changing how and when people, especially adults, choose to engage in a learning experience. Today, it is more a question of choosing the most convenient and personally suitable way to receive "instruction" and training rather than attending a traditional "physical" institution. This shift of perspective is gradually changing our view of the social nature of learning processes, too. The latter, as we have seen, are always deeply intertwined with the affective, emotional, and relational factors that usually emerge in a community of learners. In contexts of such a nature, the process of learning is mostly interrelated with that of becoming, the process of sharing practices and knowledge with that of constructing a common and shared identity.

Identifying new and more suitable methods with which to investigate how these relationships are constructed is becoming an imperative in the field of ICT. More conservative views of the ways people experience the immaterial dimension of learning in cyberspace should be accompanied by, if not substituted with, new and more appropriate methods. This sort of paradigm shift also affects how affectivity and sociability, which influence and transform the learning dimension, should be investigated. Becoming aware of the potentialities of learning communities that rely on written discourse communication would enhance our exploration of these processes and help us to design and support more effective learning environments based on ICT use.

Previous sections have enlightened how written communication is able to convey specific and unique social and emotional affordances in the context of Web-based learning. For this reason, rather than comparing face-to-face and online settings and seeing the latter as characterized by an impoverished communication, researchers should look at how the pragmatic needs of an online setting might be satisfied thanks to the richness of written language. These considerations have profound implications for practitioners as well. The examples shown above underline that numerous are the textual indicators of social presence in Web-based learning environments that could be adopted in the design and conducting phases. The use of figurative language (in the forms of metaphors, analogies, etc.), for instance, may be encouraged and adopted during the design and conduct of online learning courses as a stimulus to manifest and share those personal emotions and feelings that are always deeply rooted in any new learning experience. The adoption of metaphors by tutors may foster students' sense of belonging to a larger community and provide a framework for role assignment, identity, and responsibility. Along with other facilitation measures, tutors/instructors would be able to use a further feature of aiming at encouraging interaction based on figurative language that would serve as a stimulus to facilitate the intertwining of the social dimension with learning processes.

On the narrative side, measures of this kind may be adopted as a more effective means of achieving quality discussions more than using traditional materials. Online instructors could combine encouragement of personal storytelling with the utilization of stories as a designed teaching strategy to deliver content, to discuss post assignments, or to tackle negative feelings of frustration and of being overwhelmed. A narrative pedagogy goes indeed beyond the information dimension of learning and renders apparent the social basis of learning and knowledge.

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KEY TERMS

Community of Practice: First used in 1991 by Jean Lave and Etienne Wenger, the concept refers to the process of social learning that occurs among people who share a common interest in some subject or problem and are linked to each other over an extended period to share ideas, find solutions, and build innovations. The concept of community of practice has been recently associated with knowledge management and organizational development.

Computer-Mediated Communication: CMC is any form of communication between two or more people who interact via computer on the Internet. CMC mostly occurs through e-mail, chat, instant messaging, bulletin boards, list-servers, and MUDs (some also include audio and video communication). Today Wiki and Weblogs emerged as special forms of socially-oriented collaborative writing.

Content Analysis: This is a research technique based on the analysis of transcripts of interactions. Specific indicators are counted, classified, and interpreted as descriptive data to create an understanding of the content. It is a crossover technique that combines qualitative and quantitative methods. It includes the following phases: unitization, coding, inter-rater reliability tests, analysis and interpretation.

Social Constructivism: Social constructivism emphasizes the importance of culture and context in the process of knowledge construction. Learning is meant to be a social process that occurs when individuals take part in social activities. Instructional models based on this perspective stress the need for collaboration among learners and with practitioners in society.

Social Network Analysis: SNA has emerged as a new approach for understanding relationships among participants in an online learning environment. It serves to identify a set of structural variables such as density, connectivity, and heterogeneity that are implied in a network, and incorporates mathematical and statistical devices to measure individual positions within a network of participants.

Social Presence: Social presence was initially defined as the degree of other person salience in a mediated communication and the consequent salience of their interpersonal interactions. The term was soon after associated with the concept of media richness, according to which social presence is a quality of the communication medium itself. In more recent times, it has been redefined as the ability of participants in a community of inquiry to project themselves socially and emotionally, as "real" people, through the medium of communication being used.

This work was previously published in Encyclopedia of Information Communication Technology, edited by A. Cartelli; M. Palma, pp. 121-126, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.4
Online Communities and Social Networking

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INTRODUCTION

Technology has enabled communities to move beyond the physical face-to-face contacts to the online realm of the World Wide Web. With the advent of the highways in the 1950s and 1960s, "communities" were created in suburbia. The Internet, on the other hand, has over the last two decades, enabled the creation of a myriad of "online communities" (Green, 2007) that have limitless boundaries across every corner of the globe.

This essay will begin by providing a definition of the term "online communities" and then describing several typologies of this phenomenon. The various motivations for joining communities, how marketers create social bonds that enhance social relationships, as well as strategies used by firms in building online communities are also discussed. We conclude by discussing strategies for managing online communities, leveraging them for social networking, researching them, as well as directions for future research.

DOI: 10.4018/978-1-60566-014-1.ch145

DEFINITION

A "community" refers to an evolving group of people communicating and acting together to reach a common goal. It creates a sense of membership through involvement or shared common interests. It has been considered to be a closed system with relatively stable membership and demonstrates little or no connection to other communities (Anderson, 1999).

With the rapid growth of the Internet, the geographic boundaries constraining the limits of communities are no longer a factor, and the functions of maintaining a community can be fulfilled virtually from anywhere in the globe. This is the basic essence of an online community, which is also synonymous with e-community or virtual community. Several authors have attempted to provide a formal definition of the term for semantic clarifications. The major definitions are as follows:

- Social aggregations that emerge from the Net when enough people carry on public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace. (Rheingold, 1993)

- Groups of people who communicate with each other via electronic media, rather than face-to-face. (Romm, Pliskin, & Clarke 1997)
- Computer mediated spaces where there is a potential for an integration of content and communication with an emphasis on member generated content. (Hagel & Armstrong 1997)
- Online Publics are symbolically delineated computer mediated spaces, whose existence is relatively transparent and open, that allow groups of individuals to attend and contribute to a similar set of computer-mediated interpersonal interactions. (Jones & Rafaeli, 2000)

While Rheingold (1993) provides one of the earliest definitions of the term, and one that is most quoted in the literature (Kozinets, 2002), many may question whether "with sufficient human feeling" is a necessary condition for online community formation. Romm et al.'s (1997) definition may not sufficiently distinguish it from general Web sites. Hagel and Armstrong (1997) emphasize member generated content, while Jones and Rafaeli (2000) use the term "virtual publics" instead of online community. Others, like Bishop (2007), have pointed to the phenomenon of "de-socialization" or less frequent interaction with human in traditional settings, as a consequence of an increase in virtual socialization in online communities. Based on the above definitions the term may be simply defined as a group of individuals with common interests who interact with one another on the Internet.

TYPOLOGIES OF ONLINE COMMUNITIES

Online communities come in different shapes and sizes and may have memberships of a few dozen to millions of individuals. These communities may extend from active forums like discussion groups and chat rooms to passive ones like e-mails and bulletin boards. Given that these communities are not geographically constrained, their size can be much bigger than typical physical communities and many millions of them exist on the Internet. Uncovering archetype or gestalt patterns is fundamental to the study of social science and research, and several authors have proposed classification schemes for configurations of online communities.

Lee, Vogel, and Limayem (2003) in their review of classification schemes of online communities identify Hagel and Armstrong's (1997) and Jones and Rafaeli's (2000) typologies as being the most popularly referenced. Kozinets (2002) too delineates four kinds of online communities. These three typologies are reviewed, and a further popular typology of affinity groups proposed by Macchiette and Roy (1992) as applied to the online environment is also proposed.

Hagel and Armstrong (1997) propose four major types of online communities based on people's desire to meet basic human needs: *interest, relationship, fantasy,* and *transaction.* Jones and Rafaeli (2000) further segment these communities by *social structure*, that is, communities formed based on social networks, for example, online voluntary associations, cyber inns, and so forth, and *technology base*, that is, types of technology platforms, for example, e-mail lists, Usenet groups, and so forth.

Kozinets (2002) proposed the four types of communities as *dungeons*, that is, online environments where players interact, such as for online video games, *circles,* (interest structured collection of common interests), *rooms* (computer-mediated environments where people interact socially in real time), and *boards* (online communities organized around interest specific bulletin boards).

Finally, Macchiette and Roy (1992) proposed a typology of affinity communities that can also be used for classifying online communities. They defined communities as either being: *professional* (e.g., doctors, lawyers, etc.), *common interest* (e.g., hobbies, interests), *demographic* (e.g., by gender, age, etc.), *cause-based* (e.g., Sierra Club, Green Peace), and *marketer generated* (e.g., Disney, Nintendo) communities. These communities may also be constructed in the online environment.

It is also interesting to make other dichotomous distinctions of online communities such as: (a) between *formal* (e.g., associations) vs. *informal* communities, (b) *commercial* (which offers goods and services to make revenues that in turn fuels community operations) vs. *noncommercial* (communities created from the ground up by a group of individuals, e.g., with an interest in stamp collection), and (c) *open or public* (where everyone regardless of their qualifications and individual profile can enter the community and participate) vs. *closed or private* (where outsiders are not allowed into the community, or where membership is very difficult to obtain).

ONLINE COMMUNITIES: MOTIVATIONS, MODE OF PARTICIPATION, CHARACTERISTICS, AND BENEFITS

Rayport and Jaworski (2004) present a model of how the various components of an online community can be integrated. An adapted version of the model is shown in Figure 1.

The model illustrates how members' motivations for joining the online community, their mode of participation, and the community's degree of connectedness in many ways determine the characteristics of the community, which in turn influences the benefits sought by the members in these communities. The various components of the model are discussed next.

Motivations

A member's reasons for joining a community may depend on a wide range of factors, such as affiliation (others like them are members of the community), information (about experiences, ideas, and issues), recreation (meeting people, playing around, sharing stories, etc.), or transaction (e.g., those who join a Web site for buying and trading possessions).

Mode of Participation

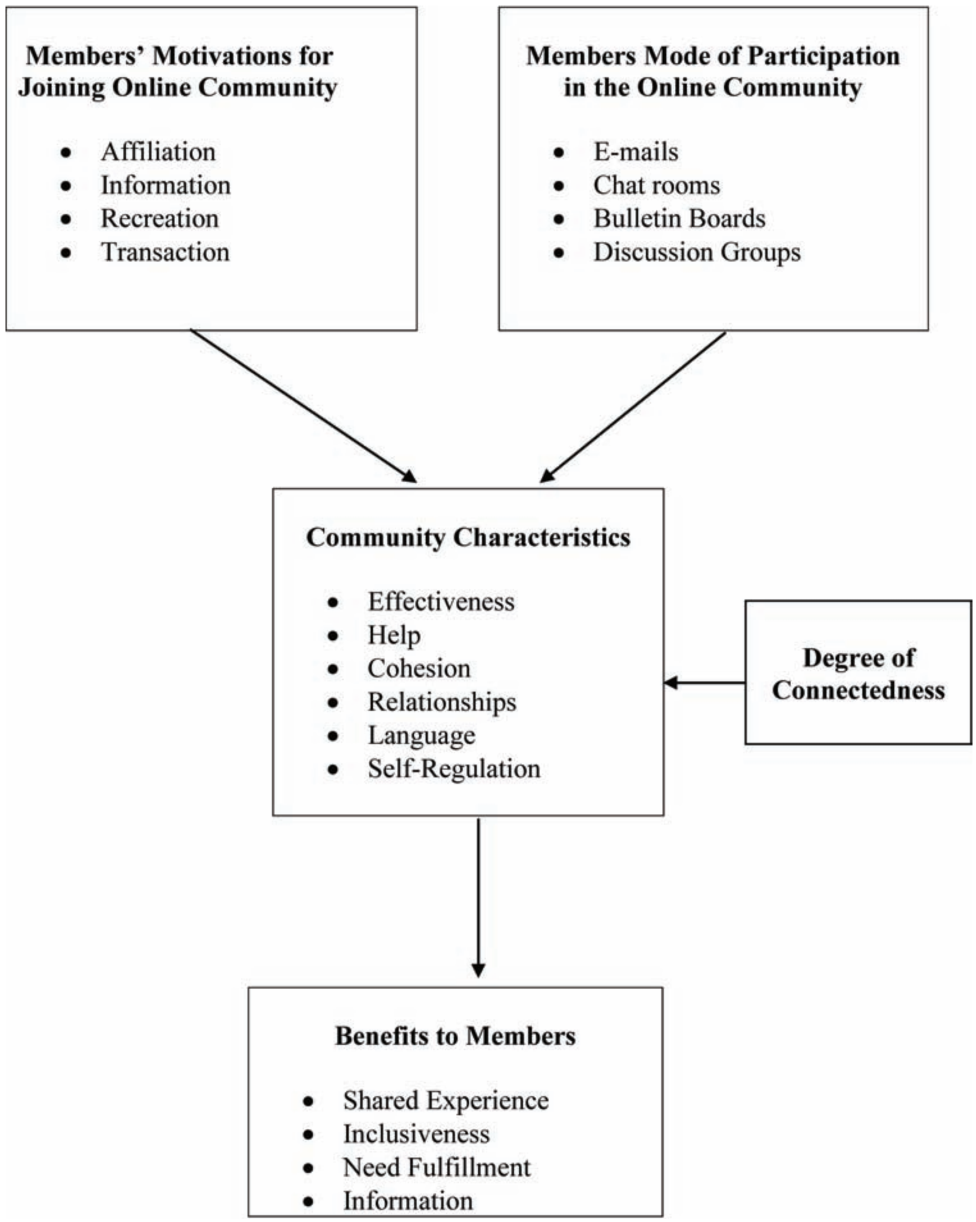
Participation can occur in a myriad of ways, for example, through e-mails, chat rooms, discussion groups, online events, blogs, social networking Web sites (e.g., *MySpace, Facebook, Orkut,* etc.), sharing photographs (e.g., *Flickr*), wikis (e.g., *Wikipedia*), bulletin boards, and so on. Some (such as discussion groups, chat rooms) have more active members than passive members (e.g., e-mail, bulletin board or posting, or watching viewing content on *You Tube*).

Characteristics of Online Communities

With the growth and maturity of online communities, certain characteristics are prevalent. Adler and Christopher (1999) identify six such characteristics:

- **Cohesion:** Members seek a sense of belonging and develop group identity over time.
- **Relationships:** Community members interact and develop friendships over time.
- **Effectiveness:** The group has an impact on members' lives.

Figure 1. Online communities: Motivations, mode of participation, characteristics, and benefits



- **Help:** Community members feel comfortable asking and receiving help from each other.
- **Language:** Members develop shared communication tools that have a unique meaning within the community.
- **Self-Regulation:** The community develops a system for policing itself and sets ground rules of operation.

Benefits to Members

Adler and Christopher (1999) further point out that the members of the online community develop various emotional benefits depending on the communities that they join. They include inclusion, shared information and experiences, need fulfillment, and mutual influence among others.

Degree of Connectedness in Online Communities

The degree of connectedness in online communities also plays a significant role in how a online community develops. They can be classified as weak, limited, or strong. This primarily depends on the degree of interactivity between and among members.

- **Weak:** Members of these sites have no opportunities of interacting with each other on an one-on-one basis, for example, newspaper Web sites and corporate Web sites.
- **Limited:** These communities offer limited opportunities for members to interact with other, for example, reading and posting information or opinions.
- **Strong:** These communities offer chat rooms and message boards and allow users to form strong bonds with each other.

Research has shown that both strong and weak connectednesses have their own advantages. While weak ties are shown to facilitate such tasks as finding jobs (Granovetter, 1973), strong ties are required to facilitate major changes in the communities (Krackhardt, 1992).

Stages of Online Community Life Cycle

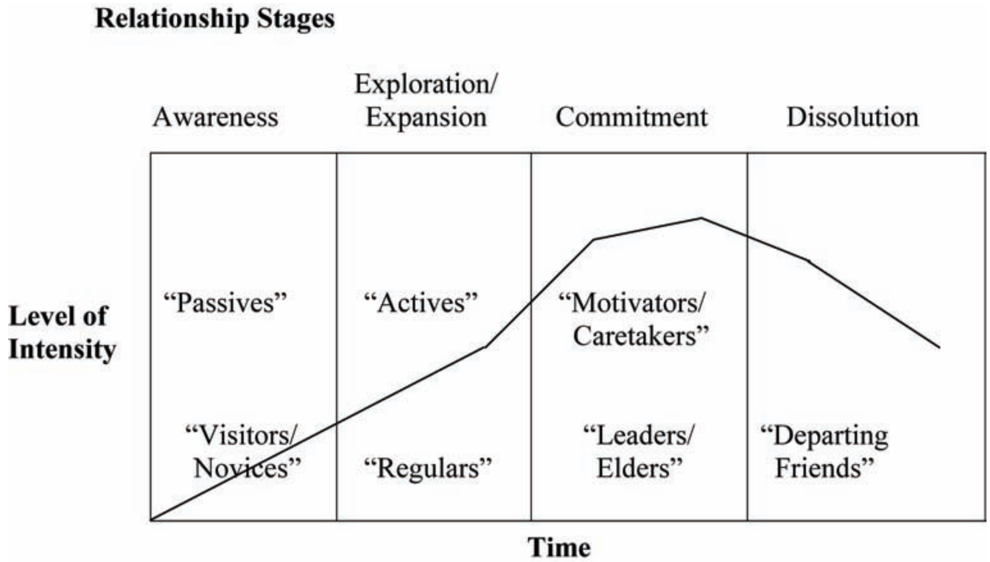
Kim (2000) proposes a five stage online community building process which progresses as follows:

1. **Visitors:** These are individuals who "lurk" in the online community, yet do not participate in them.
2. **Novices:** They are new members or "newbies" who are usually passive and are busy learning the rules and culture of the online community and thus are not actively engaged in it.
3. **Regulars:** They are established members comfortably participating in the exchanges and make up the largest segment of the online community.
4. **Leaders:** These members are volunteers, contractors, and staff who create topics and plan activities that keep the online community running.
5. **Elders:** They are respected members of the online community who are always eager to share their knowledge and pass along the culture of the community to the newer members.

Mohammed, Fisher, Jaworski, and Paddison (2004) further suggest four relationship stages: awareness, exploration/expansion, commitment, and dissolution, and the varying level of intensity patterns as online community members go through membership life cycle. At the initial "awareness" stage, members have the lowest intensity levels and are likely to be considered visitors up until the exploration stage. At this second stage, these novices develop greater intensity and commitment to the site. The equity building efforts over time translate into the online members becoming regulars and subsequently leaders or elders. Finally, over time even the most committed members outgrow a community and become "departing friends." Figure 2 illustrates these stages.

Farmer (1994) had earlier described four similar stages through which individuals in online communities mature. According to him, members begin as *passives* (attending a community, yet not actively engaging in it), and then go on to become *actives* (participating in communities and taking part in conversations). The highest levels of participation are displayed by *motivators* (those who create conversation topics and plan activities)

Figure 2. Intensity patterns of the different types of online communities at various relationship stages (adapted from Mohammed et al., 2004)



and *caretakers* (those who act as intermediaries between members).

The "passives" are analogous to the "visitors" and "novices." the "actives" are similar to the "regulars," while the "motivators" and "caretakers" are equivalent to the "leaders" and "elders" in the Mohammed et al. (2004) model.

STRATEGIES FOR MANAGING SUCCESSFUL ONLINE COMMUNITIES

Duffy (1999) outlines the eight critical factors for community success as recommended by *Accenture*, the Management Company. They are:

- Increasing traffic and participation in the community.
- Focusing on the needs of the members by using facilitators and coordinators.
- Keeping the interest high by provoking controversial issues.
- Involving the community members in activities and recruiting.
- Providing tools and activities for member use.
- Managing the cultural environment.
- Encouraging free sharing of opinions and information.
- Obtaining financial sponsorship.

Social Networking in Online Communities

In the last few years, several social networking sites like *My Space, FaceBook,* and *Orkut* have come up which allow individuals to build up the equivalent of their circle of friends (Scott, 2007). Some communities allow simple access to friends or acquaintances, while others have provisions for improving skills or contacting people with particular types of expertise.

A recent study reported by Steel (2007) showed that *Webkinz.com, Clubpenguin.com,* and *Zwinky.com* received the virtual world sites to most unique visitors with 6.0, 4.7, and 4.4 million visitors in

September 2007. Most notably, all three sites primarily target young teenagers, who happen to be the most active participants of these communities.

Researching Online Communities

Kozinets (2002) suggests using "netnography," involving ethnographic techniques in studying online communities for providing insights into the symbolism, meanings, and consumption patterns of online communities. The method is derived from "ethnography" which was developed in the field of anthropology. Netnography, or ethnography on the Internet, involves the study of distinctive meanings, practices, and artifacts of online communities.

Rather than approaching the problem from a positivistic or scientific point of view, where a researcher begins with a theory, develops and tests hypotheses, and draws conclusions, netnography approaches the construction of meaning in online communities in an open ended manner using inductive techniques using grounded theory. Since the research technique by nature is unobtrusive, ethical research guidelines must strictly be followed such as: (a) fully disclosing his or her presence, affiliations, and intentions to online community members; (b) ensuring confidentiality and anonymity to respondents; and (c) seeking and incorporating feedback from the online community being researched.

Market research firms are increasingly following individuals into virtual communities such as *My Space, FaceBook* and *Second Life* (Story, 2007). By using online focus groups and questionnaires, they are able to get immediate feedback and make decisions about how best to target them in these environments. For example, at CC Metro, an imagined island on the Web, visitors can set up an "avatar" or a virtual alter ego, which can then shop and dance at the *Coca Cola* diner, visit a movie theater, as well as buy clothes and other accessories for their avatars, while surreptitiously being monitored by the firm.

FUTURE RESEARCH ISSUES

There are several issues relating to online communities that are worth investigating (Maclaran & Catterall, 2002). First and foremost is the issue of whether or not they facilitate socialization or whether they are a threat to civilization. Some see them as a way of enhancing social capital between families, friends, and acquaintances, empowering individuals and organizations, creating new ways of relating to each other. Innovative firms leverage this power to create growth and create loyal customers. Others see them as a far cry from the regular face-to-face interactions, creating weak ties between strangers instead of strengthening existing ties between friends and neighbors.

Other issues deal with how to integrate online and off-line communities and developing appropriate metrics for such integration. How can these communities reduce member churn and build loyalty? What are the appropriate metrics for measuring community strength? Hanson (2000) suggests using content attractiveness, member loyalty, member profiles, and transaction offerings as possible metrics for measuring this phenomenon. Under what circumstances is loyalty developed through member-to-member relationships vs. content attractiveness vs. the transaction offerings? What is the most appropriate way of classifying the typologies and taxonomies of these communities? How are intentional social actions generated in such communities (Bagozzi & Dholakia, 2002)? How can stronger brands be built through the use of such communities (McWilliam, 2007)? Are online communities likely to replace regular face-to-face associations in the long run?

Other related research issues pertain to motivation aspects (Igbaria, 1999) and network dynamics (Wellman, Salaff, Dimitrova, Garton, Gulia, & Haythornwaite, 1996) and effects. What business models are likely to work the best for various types of online communities (Hanssens & Taylor, 2007; Reid & Gray, 2007)? How are trust, privacy (Luo, 2002), and satisfaction issues (de Valck, Langerak, Verhoef, & Verlegh, 2007) different between off-line and online environments? What rules of engagement and social structure governs such networks (Cindio, Gentile, Grew, & Redolfi, 2003), and what factors impact the members' continuance in these communities? How do various forms of market structure impact member interaction in these communities (Sohn & Leckenby, 2007)? What ethical dilemmas and challenges do researchers face in researching electronic communities (Hair & Clark, 2007)? What differences are there in online communities across countries? For example, Talukdar and Yeow (2007) have identified interesting differences in such communities in Bangladesh and the United States. Finally, has the balance of power shifted to consumers over firms, with the rapid growth of virtual communities? (Chen, 2007).

Online communities of all shapes and forms are rapidly evolving and creating values for their respective members. Many such communities have over millions of members. These communities will continue to attract the interest of researchers from a wide range of academic fields in the future.

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KEY TERMS

Affinity Communities: Communities that are based on profession, common interest, cause, demographic, or marketer generated phenomenon.

Characteristics of Online Communities: Online communities are characterized by their level of cohesion, effectiveness, helpfulness of members, quality of the relationships, language, and self-regulatory mechanisms.

Netnography: Using ethnographic techniques to study online communities.

Online Community: A group of individuals with common interests who interact with one another on the Internet.

Online Social Media: Uses online community members' collaborative attempts in connecting information in various forms including internet forums, Weblogs, wikis, podcasts, pictures, and video. Examples of such applications include *MySpace* and *Facebook* (social networking), *You Tube* (video sharing), *Second Life* (virtual reality), and *Flickr* (photo sharing).

Online Social Networking: Necessitates the use of software to involve communities of individuals who share interests and activities. *MySpace, Facebook*, and *Orkut* are currently some of the most popular online social networking sites.

Stages of the Online Community Life Cycle: Online community members go through four relationship stages: awareness, exploration/expansion, commitment, and dissolution.

This work was previously published in Encyclopedia of Multimedia Technology and Networking, Second Edition, edited by M. Pagani, pp. 1072-1079, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.5
IT and the Social Construction of Knowledge

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INTRODUCTION

In a dynamic environment, knowledge is the only valid asset that allows organizations to adapt and change. That is why knowledge is one of the few resources on which any organization can support its sustained success. This resource, in its turn, appears as a result of a repetitive process of learning.

Learning is a social product—knowledge is social and has synergic possibilities—therefore, its value increases when it is shared, enriched, and developed beyond the individual, proportioning coherence to the interpretations of the members of the group (Brown & Duguid, 2001; Nonaka & Takeuchi, 1995). Many researchers have pointed out that the capacity of an organization to get into the environment, interpret it, and understand it, in short, to learn it, requires dialogue and discussion among its members. Through dialogue (Isaacs, 1993), each member exhibits a perception or personal image of the world, and these perceptions will affect the other members when they are shared during interaction. Together, the discussion of individual perceptions produces a shared image of reality.

In addition, collective knowledge is a needed complement to the individual (Brown & Duguid, 1991). First of all, there are problems that require the integration of individual knowledge. Second, and not less important, collective knowledge implies that the members of an organization that share it are going to act according to the same criteria and that makes the organization predictable beyond individual contingences. For example, it is of little use for a driver to know the obligation to drive on the right if the others do not know such obligation (as anyone who has driven in countries where they drive on the left will have been able to confirm at the slightest distraction). It is collective knowledge that supplies standards of conduct whose validity stems precisely from the fact that it is collective.

The idea of social construction of knowledge links it to the communities that create, use, and transform it. According to this, if learning is the result of personal experience and processes of interaction

DOI: 10.4018/978-1-59904-883-3.ch084

among individuals, this should be understood in relation to the social and cultural context in which these experiences and interactions take place, that is, in relation to communities of practice.

Over the last decades, the popularity of communities of practice has grown considerably in literature related to knowledge management as a consequence of the importance that an environment of collaboration has had in the generation of knowledge (Cox, 2005; Garavan & Carbery, 2007; Roberts, 2006). They are emerging as a complement to the existing structures and radically galvanize knowledge sharing, learning, and change. In the present-day society of knowledge, these are becoming essential.

Experience has shown over and over that what makes for a successful community of practice has to do primarily with social, cultural, and organizational issues, and secondary only with technological features (Peltonen & Lämsä, 2004). However, an increasing number of communities of practice are geographically distributed and must rely on some kind technology for keeping in touch. And even those that are colocated often need to process data, information, or knowledge. So, appreciation of this central role of technological has emphasized technical initiatives to promote collaboration in communities of practice (Cross, Laseter, Parker, & Velasquez, 2006).

On this basis, this chapter begins with a description of the communities of practice. This is followed by a review of the role of information technology management. The challenges of managing communities of practice are subsequently discussed and brief conclusions drawn.

BACKGROUND

The concept of community of practice was originated in the context of a social theory of learning. Contrary to the idea that human learning occurs in isolation, a social theory of learning insists on the situated nature of human cognition and, thus, in learning as embedded in social practice (Brown, Collins, & Duguid, 1989).

Originally, the term was coined by Jean Lave and Etienne Wenger (1991) based on work in the late 80s when they investigated apprenticeship in various types of communities ranging from midwives in Mexico to butchers in U.S. supermarkets and quartermasters on U.S. Navy ships. Their idea of a community of practice is close the sociology of Tönnies, as noticed by Brown and Duguid (2001).

In particular, Wenger, McDermott, and Snyder (2002) define communities of practice as groups of individuals who share a worry, a set of problems under similar perspectives, or a common interest about a subject, and through communication among its members, share and generate a body of group knowledge. The operative of the communities is totally different. When there are not geographic barriers among its members, they can meet periodically; in other cases, when there is a long distance or the members' agendas are full, they may opt for interchange of ideas through the Internet, video conferences, or any other resource.

They may or may not have an explicit agenda or they may not even follow the agenda closely. Equally, they may or may not go beyond the limits of an organization. Whichever way they choose, communities of practice have something in common (Wenger, 1998):

The domain: A community of practice is not a merely a club of friends or a network of connections between people. It has an identity defined by a shared domain of interest.

The community. In pursuing their interest in their domain, members engage in joint activities and discussions and help each other to share information. They build relationships that enable them to learn from each other.

The practice. Members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, and ways of addressing recurring problems. This takes time and sustained interaction.

Belonging to a community of practice implies the existence of mental models shared by its members that often lends to a series of unspoken understandings within the actions, social relationships, and experiences of the community (Brown & Duguid, 2001). Handley et al. (2006) suggest that communities of practice emphasize interaction, interpretation, and the ongoing process of sense-making, story telling, and representation. Therefore, the decisions that characterize the members of the group are only slightly formalized and arise from their own tradition.

Throughout this process a high level of confidence is generated based on the knowledge that each has of his/her own potential and of those members of the group. This model of performance creates, in addition, a strong tie among the members of the community that lets both ideas flow within its womb and people work together in a more efficient way. So, an informal atmosphere is created that offers its members the needed support and stability to be able to seek new ways of acting, taking risk, and, in a nutshell, having initiative. Thus, the communities of practice can be described as a "playful community," characterized by a strong work ethic around collective knowledge sharing, mutual challenging, and ongoing learning (Garavan & Carbery, 2007).

Because its primary product is knowledge, the concept of community of practice has been identified as the setting for effective knowledge sharing. Calling them "knowledge communities" might sound like another "soft" management fad, as if they were our first knowledge-based social structure. But that is not the case. Communities of practice are deeply rooted in the real world. They are formed through practice.

Communities of practice refer to groups that have been practising together long enough to develop into a cohesive community with a relationship of mutuality and shared understanding (Lindkivist, 2005). According to Seely Brown the word "practice" is fundamental because in a community of practice the creation of knowledge, innovation, and learning is produced while one does daily work. This converts the communities of practice into a key concept as a basic unit of analysis especially in the most knowledge-intense enterprises.

In this way, communities of practice take the analysis of research to the point where things happen, where work is developed, and where one can work and observe individual behaviour, resolution of interests, and the creation of identity. Communities of practice are natural constructions that respond to the need that the people in a practice recognize each other as colleagues and it is that mutual recognition that gives the community a meaning and lets it be useful. It emerges from a work-related or interest-related field and its members volunteer to join (Arbonies, 2005).

Thus, we see how the communities differ for other work teams. Communities of practice must not be confused with other work teams, which are formal and work together, assigned by a superior, to develop a concrete project or task and are subject to the duration of such project or to changes that can arise in the organization of the enterprise. Communities of practice are informal, however, they can lend to the formation of work or project teams, especially if they are made up of members of a particular organization. They organize themselves, meaning they set their own agendas and establish their own leadership. Membership in a community is self-selected. They know if they have something to give and whether they are likely to take something away (Wenger & Snyder, 2000). What keeps their members together is the passion, the compromise, and the identification of their components with the subject matter of the community of practice. Their duration is infinitely tied to the interest of the members to keep the team alive.

Storck and Hill (2000) suggest that the differences between teams and communities can be characterized as follows:

- Team relationships are established when the organization assigns people to be team members. Community relationships are formed through practice.
- Similarly, authority relationships within the team are organizationally determined. Authority relationships in a community emerge from interaction through expertise.
- Teams have goals, which are often established by people not on the team. Communities of practice are only responsible to their members.
- Teams rely on work and reporting processes that are organizationally defined. Communities develop their own processes.

THE ROLE OF INFORMATION TECHNOLOGIES IN COMMUNITIES OF PRACTICE

Information technologies are often pointed out as the anchor to achieve collaboration (Alavi & Leidner, 2001; Gold, Malhotra, & Segars, 2001) and thus to develop the communities of practice (Cross et al., 2006). The advantages of modern information technologies as a major issue for learning and knowledge in organizations have been widely recognized in literature (Alavi & Leidner, 2001; Nonaka & Takeuchi, 1995). They are accepted as a real pipeline to codify, organize, and disseminate information and knowledge, thereby removing barriers of time and location. At the same time, they create an interconnected environment that is a medium to vertically and horizontally integrate efforts within communities of practice, and in this way to shorten the length of the transformation cycles. As result, and based on the works of Van den Brink (2003), an effective information technology infrastructure demands a combination of two related dimensions: the convergent and the divergent dimension.

The divergent dimension is about having information and explicit knowledge components online, indexed and mapped, with easy access and accurate retrieval for all members of communities of practice. It greatly affects how data and information are gathered and stored. In this situation the emphasis is put on explicit knowledge. The convergent dimension plays the role of enhancing analysis and discourse, and supports a virtual network that is not constrained by barriers of time and place. It improves coordination and communication between members of communities of practice by transferring knowledge from those who posses it to those who need or can use it. Here the emphasis is on tacit knowledge.

Several tools are present at the divergent dimension: integrated document management, document imagining, data warehouse, data mining, business intelligence, Intranet, and Internet. These tools hold collections of knowledge components that have a structured content like manuals, reports, articles, best practices, customer inquiries and needs, competitor analysis, and experience with production. A content classification scheme or taxonomy is used to organize knowledge, facilitate grouping, sort visualization, searching, publication, manipulation, refinement, and navigation. It mostly helps to explicit knowledge, since it can be expressed in symbols and communicated through these symbols to other communities of practices members. It can be easily accessed and used by communities of practice's members.

Regarding the convergent dimension, its functionality is incorporated in tools as e-mails, calendaring and scheduling, groupware, work management system, process support system, and so forth. Its goal is to facilitate group and teamwork regardless of time and geographic location. It offers communities of practice's members the opportunity to interact and exchange views and thoughts with each other. It is thus useful to transfer tacit knowledge, the one that is difficult to express and communicate to other people because it cannot be codified and articulated.

Both the convergent dimension and the divergent dimension configure the potential of information technologies to support communities of practice' capability to generate and utilize knowledge. Therefore, it is feasible to presume that the relationship between the convergent dimension and the divergent dimension may produce variations in the communities of practice. While some communities of practice tend to emphasize one dimension over other, other companies are able to manage the correct balance between both dimensions, or even adjust them in accordance with knowledge characteristics or environmental conditions.

FUTURE TRENDS

In some organizations, the communities themselves are becoming recognized as valuable organizational assets. Whereas the value was previously seen as being relevant to the individual members of a community, it is now often recognized that benefits can also accrue to the organization itself (Lesser & Storck, 2001). Communities of practice can drive strategy, generate new lines of business, solve problems, promote the spread of better practices, develop people's professional skills, and help organizations to recruit and retain talent (Wenger & Snyder, 2000). They are advocated as an innovative collaborative strategy for combining working, learning, and innovation (Gongla & Rizzuto, 2001; Palinscar & Herrenkohl, 2002).

Given the importance of these outcomes, many organizations have spent time and resources designing and implementing communities of practice in an attempt to connect people to others with similar issues and to collect knowledge valuable to the organization. To get communities going—and to sustain them over time—managers should align communities and their members with business needs (Vestal, 2006). In this way, communities of practice remain vibrant and attractive to members and important to the business. Fluctuating business strategies and job changes greatly impact participation in and the effectiveness of communities of practice. Therefore annual and systematic alignment checks should be conducted by communities of practice. In order to do this, community leaders and assistants should transmit business objectives to the community.

While aligning organizational goals and those of communities of practice is the first step on the road to success, many authors consider that the efficiency of a community depends on the existence of an atmosphere which promotes confidence, compromise, creativity, and innovation (Roberts, 2000). It is therefore essential to have a climate of organization open to the production and application of new ideas, initiative, collaboration, and the establishment of quality relationships that promote individuals to share their information beyond the formally established channels.

Specifically, informal as opposed to formal learning is emphasized and it is suggested that both the training and socialization processes will probably be ineffective if they are based on a formal routine, rather than on more informal and innovative experiences. It is difficult for communities of practice to be structured on a basis of decisions coming from the management, particularly taking into account the frequency with which a community can cross the boundaries of an organization, and therefore, be outside the confines of management decisions. Rather the opposite occurs: they emerge spontaneously around a reduced group of people that are interested in knowing and improving the way of doing things and bringing more people with similar interests together.

Their goals depend on the interest of their members in a specific subject and the learning that it implies. As a result, their members help each other without middlemen, tasks are delegated without scepticism, control processes are moderate and casual, and the individuals feel they can communicate their views or intuition through dialogue and cooperation. They do not yield to anyone but themselves and they do so in terms of satisfaction.

Although they are not structured responding to management decisions, the recognition and stimulus they receive can determine their level of productivity. Chin and Carroll (2000) offer some pragmatic advice in this context. They identify steps in which collaboration can be implemented by a community of practice, including group formation, the derivation of goals, objective, and hypotheses, the definition of task, their negotiation and allocation among the members, the identification of resources, detailed analysis, and discussion and dissemination of findings. Additionally, it is essential that the management be aware of the social position of the process of knowledge creation. This means

- Not impeding members of the organization to belong to communities of practice in the belief that because of this they will neglect their other work.
- Increasing the development of the members of the community.
- Helping to create leaders with wide perspectives, who assume risks and facilitate interaction among the members of the community.
- Providing places where their members can express themselves freely about the way to face problems and analyze solutions as a group.
- Negotiating the border between the community of practice and the formal organization; for example, community of practice teams and other organizational units.

Furthermore, organizations should be prepared to invest time and money in helping communities of practice to reach their full potential. This means intervening when communities run up against obstacles in their progress, such as IT systems that do not serve them or reward structures that discourage collaboration. In this respect, Wenger and Snyder (2000) point out that one way to strengthen communities of practice is to provide them with official sponsors and supports teams. Such sponsors or teams do not design the communities of practice or prescribe their activities or outcomes. Instead, they work with the internal community leaders to provide resources and coordination.

Finally, it is important to use nontraditional methods to asses the value of their contribution to the organization. The difficulty in assessing their contribution is that communities of practice are often hidden assets, appearing neither on an organization chart nor on a balance sheet (Lesser & Storck, 2001). Wenger and Snyder (2000) refer to this same idea saying that results generally appear in the work of teams and business units, not in communities themselves. As a result, it is often hard to determine if a great idea that surfaced during a community meeting would have bubbled away in a different setting.

Due to the difficulty in objectively establishing the value of the communities of practice, the use of more intangible indicators, more related to measurements of intellectual capital (Edvinson & Malone, 1997) or social capital (Naphiet & Ghosal, 1998) is required. Indirect approximations, such as the capacity of generating new knowledge for some people and how deeply integrated they feel in a community of practice can give a more exact idea although not accompanied by numbers.

CONCLUSION

In nature a simple parallelism to communities of practice can be found: The fact that trees standing alone grow slowly whereas, when they are grouped together, they compete for light and due to this competition, all grow. Communities of practice are emerging, following this parallelism, like a vehicle used by its members in the search for light (knowledge) and for its growth through exchange with others who are recognized as equals.

Given the great capacity that communities of practice have to increase available knowledge within the organization, it is no wonder the interest in their management. However, the nature of the willingness of its members makes it impossible to rigorously speak of managing communities from a board of directors that has no hierarchy over them. In order to take the highest advantage of some informal structures over which one has no control, a certain astuteness from management is required in order to keep the right distance, not overwhelming members with the weight of the formal organization nor leaving them completely alone. So, the management must understand what a community of practice is, how it works, and what kind of exchanges it can establish. Finally, it is also important for management to realize that they are nonformal sources of creation of knowledge, and therefore, their value is not easy to comprehend and even less to quantify.

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KEY TERMS

Knowledge: It is defined (Oxford English Dictionary) variously as (i) facts, information, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject, (ii) what is known in a particular field or in total; facts and information, or (iii) awareness or familiarity gained by experience of a fact or situation.

Knowledge Management: KM comprises a range of practices used by organizations to identify, create, represent, and distribute knowledge for reuse, awareness, and learning. It has been an established discipline since 1995 with a body of university courses and both professional and academic journals dedicated to it.

Knowledge Transfer: In the fields of o and organizational learning, knowledge transfer is the practical problem of getting a packet of knowledge from one part of the organization to another (or all other) parts of the organization.

Organizational Learning: An area of knowledge within organizational theory that studies models and theories about the way an organization learns and adapts.

Situated Learning: A model of learning first proposed by Jean Lave and Etienne Wenger (1991). It suggests that all learning is contextual, embedded in a social and physical environment.

Social Organization: It can be defined in a narrow sense as any institution in a society that works to socialize the groups or people in it. Common examples include education, governments, families, economic systems, religions, and any people or groups that you have social interactions with. It is a major sphere of social life organized to meet some human needs.

Virtual Organization: An organization existing as a corporate, not-for-profit, educational, or otherwise productive entity that does not have a central geographical location and exists solely through telecommunication tools.

This work was previously published in Encyclopedia of Human Resources Information Systems: Challenges in e-HRM, edited by T. Torres-Coronas; M. Arias-Oliva, pp. 577-583, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.6
Social Learning Aspects of Knowledge Management

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INTRODUCTION

There are probably as many variations of knowledge management definitions as there are practitioners and researchers in the discipline. Complete consensus in such a group would be a surprising finding. This is because the two words are loaded with pre-existing meanings that do not always sit comfortably in juxtaposition, so what it means to "manage knowledge" is difficult to ascertain, and hence comes to mean different things to different people.

We do know however, that knowledge exists in the minds of individuals and is generated and shaped through interaction with others. In an organizational setting, knowledge management must, *at the very least*, be about how knowledge is acquired, constructed, transferred, and otherwise shared with other members of the organization, in a way that seeks to achieve the organization's objectives. Put another way, knowledge management seeks to harness the power of individuals by supporting them with information technologies and other tools, with the broad aim of enhancing the *learning capability* of individuals, groups, and in turn, organizations (Ali, Warne, Bopping, Hart, & Pascoe, 2004). Social learning, in this context, is defined as learning occurring in or by a cultural cluster or organizational group or team and includes procedures for transmitting knowledge and practices across different work situations, settings, and time. However, the application of technology must be guided by the needs of the organization and its workers. As Davenport (2005, p.162) states, "While I don't question the importance of technology in organizations today, it's only one source of knowledge and learning for knowledge workers."

BACKGROUND

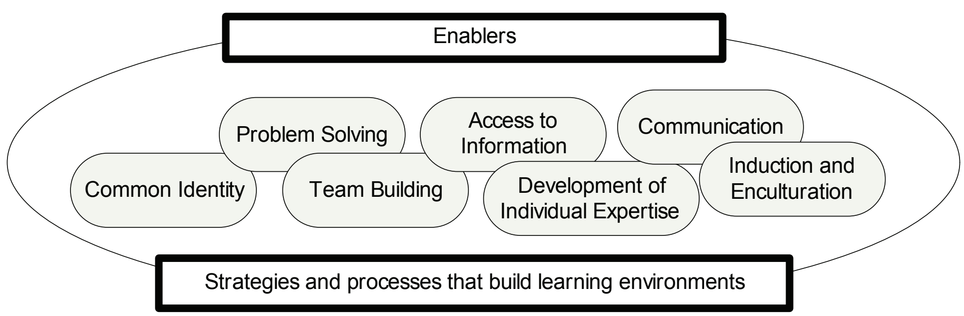
In this article, we examine both theoretical and practical socio-cultural aspects of knowledge management based on years of research by the authors in a large and diverse organization. The study involved numerous functional settings of the organization and the researchers used qualitative and quantitative methodology to gather data. Elements required to build an organizational culture that supports knowledge management are discussed. Unless otherwise specified, words in double quotes in the text are direct quotes from personnel in research settings.

ENABLERS OF SOCIAL LEARNING

The research team identified seven basic categories that constitute enabling processes and strategies to facilitate social learning: common identity, problem solving, team building, access to information, development of individual expertise, communication, and induction and enculturation (see Figure 1).

- **Common identity:** A common ground/understanding to which many people/groups can subscribe, and requires a shift from seeing oneself as separate to seeing oneself as connected to and part of an organization unit. Based on our research, motivators impacting on *common identity* are: goal alignment, cultural identity, gendered identity, language, morale, and workplace design (spatial and physical design).
    - Doney et al. (1998) discuss the relationship between goal alignment and group cohesiveness, claiming that the extent of group cohesiveness relies on the extent to which a team's goals are clear and accepted and also on the degree to which all members adopt team behaviors.
    - The term cultural identity refers to member's sense of self in relation to the specific "tribe" and "tradition" to which they belong and how this distinctiveness applies in their workplace. Cultural identity is another important motivator for social learning because, like common identity, it impacts on the extent to which staff feel that they are part of the system or alienated from it.
    - Gendered identity relates specifically to one's sense of self, which is imbued with the social, cultural and historical constructions surrounding femininity and masculinity. Gender identity, because of its relationship with common identity, was also seen to impact on social learning (Agostino, 1998).
    - Language is another important factor fundamental to the overall social learning processes. By reflecting the

Figure 1. Constructs enabling social learning



social and political relationship between various members, language can impact on common identity. Language is also important in terms of creating a shared understanding among workers and their relationship to the wider organization. "Words are bullets. Never, never use imprecise language." Thus learning the specific work related language is of central importance to broader social learning development, and is an important outcome of the enculturation process.

    - Morale has been a significant focus in the overall study because the research team found evidence of low morale being coupled with higher levels of alienation towards senior management. Such alienation has obvious implications for the broader understanding of a common identity and thus for social learning.
    - Workplace design and proximity also threatens common identity when staff are not working in the same location. "[Building X] and us. We don't see them. There is not any spirit that we are belonging to one branch. I have more to do with [a specific area] than anything else and I've made some good contacts in there... who I sit around with."

- **Problem solving:** A core activity. It fosters social learning, because each problem represents an opportunity to generate knowledge. Motivators associated with this enabler are: networking, perceptions of the organization, systemic understanding, and time for inquiry and reflection.
    - An individual's personal and social networks are an important means of acquiring, propagating, and sharing knowledge. As Davenport and Prusack (1998) claim, when those who are in a position of "know-how" share their expertise, they contribute to problem solving. Personal networks were seen to function as channels supporting both "information pull" and "information push." Atkinson and Moffat (2005) state that sharing of information is based on trust developed through social interaction, shared values, and beliefs. A human is a node in such interactions and a link is a bond that people develop which is based on mutual trust. Therefore, a significant component of a person's information environment consists of the relationships he or she can tap into for various informational needs.
    - Individual and shared perceptions of the organization, and how they operate, provide an essential backdrop to problem solving within an organizational context. These perceptions may consist of deeply ingrained assumptions, generalizations, or even pictures or images that influence how people understand their organizational world and how they should act within it (Senge, 1992). The importance of these perceptions cannot be stressed enough, because they directly influence the construction of individuals' knowledge and understandings that they draw upon in their day-to-day-activities.
    - Effective problem solving often requires a systemic understanding of organizational and inter-organizational issues. Systemic understanding requires a holistic view of an organization and its inter-relationships, an understanding of the fabric of relationships and the likely effect of interrelated actions (Davenport, 2005; Senge, 1992).

- ◦ Inquiry and reflection together are a powerful means of enhancing social learning and knowledge creation. Inquiries, or questions, are triggered by problems that require solutions or explanation. Reflection allows time for examination, contemplation and, often, resolution of the inquiries. To use a common metaphor, it is perhaps the best means for distinguishing between the forests and the trees of everyday working life.

- **Team building:** Working together and understanding what each member is trying to do. Team building was seen to be essential for effective social learning and problem solving. As team-members got to know each other they become aware of each other's strengths and weaknesses, what they could or could not do, their expertise and experience. Motivators associated are: leadership, team-based morale, performance management, public recognition and reward systems, use of humour, and workplace design (Warne, Ali, & Pascoe, et al., 2003).
  - o In general, the caliber of leadership within the settings studied was to be admired. The leaders and managers were innovative and they motivated and developed their staff, mainly by demonstrating that staff are highly valued and by acknowledging expertise and knowledge regardless of their pay or position. Another team building issue that emerged was that people were appreciative of informal "drop ins" by senior managers inquiring how they were doing. This "roving management" was said to contribute to better cohesion of teams, to promote system thinking, to help to focus on overall goals, and to facilitate communication and feedback.
  - ◦ "Team spirit" and "team cohesiveness" are both important values within the work culture and work ethic, nonetheless, there was nothing uniform about this in the settings studied. Some teams did not see the significance of their particular tasks to the overall goals of the organization. However, good examples of teamwork and team spirit were also evident. There were instances where teamwork was well integrated into daily work and where people worked collaboratively. Such teams were goal oriented and were not only teams in structure but in spirit and were led by a leader who saw his/her role as serving team members rather than just having the position of a leader (Warne et al., 2003).
  - ◦ For many employees, the performance cycle is annual and the outcome of a performance report often determines the prospects of one's career progression. Some felt somewhat uneasy as their performance evaluation was due relatively early into their posting cycle. A well planned performance appraisal system should help to make equitable and unbiased decisions regarding staff selection, placement, development, and training (Wood, 1989). Researchers were told that there was often a lack of clear communication about performance expectations. Also, an annual performance appraisal appears to be too long to wait for recognition of good work and too late to correct a performance problem. Morgan (1989) and Wood (1989) explain that to maximize positive results, the appraisal process should be two ways, it should facilitate and coach staff in doing their jobs effectively, and it should be frequent and informal.
  - ◦ It was observed that humor was used for smoothing discussions that were

becoming heated and to stop the conflict from escalating whilst also enabling the conflicting subordinates to save face. At meetings, humor was used to assist in uniting people around common themes and to make criticism palatable.

  ◦ One way of and increasing team and individual morale is to publicly acknowledge outstanding work. Making employees feel appreciated, and saying, "Thank you, we know that you are a good employee, we value you and your work," is a big factor in motivation (Mitchell, 2000). Key informants stated that public recognition of good work was scarce and that a written or verbal word of praise, a pat on the back often means more, for example, than a pay raise—"praise is better than money" and praise is needed at all levels.
  ◦ Workplace design was seen to have impact on social learning. Staff located at small isolated outposts were at risk of feeling isolated and did not identify strongly with the parent organization. As stated earlier, outposted staff identified more with the workplace with which they were based than their Branch where they affiliated. This was further exacerbated by the fact that they often felt excluded by their colleagues.

- **Access to information:** The easy availability of corporate information in whatever format was observed to effect knowledge acquisition and generation of new knowledge and social learning. Motivators associated are: record keeping, networking, meetings, and information technology (IT) infrastructure.
  ◦ The researchers observed that general familiarity with records keeping procedures was quite poor. Some people have developed their own personal records keeping systems but there was little uniformity in these and no adherence to file naming conventions and standards. As some informants stated: "I believe that physical files in the … are no longer managed well because their management has been farmed out to outside bodies." or "I think we have problems with passing on information in the organization as a whole. We just don't do it very well." The issue of electronic records, particularly e-mail messages containing evidence of business transactions, posed problems not only in the setting studied but also in the ADO at large.
  ◦ Personal networks from previous postings as well as newly acquired contacts in the new environment play a vital role in knowledge construction and acquisition. New knowledge often begins with the individual and through conversations people discover what they know, what others know and in the process of sharing, new knowledge is created. Knowledge sharing depends on the quality of conversations, formal or informal, that people have. Sharing of information has a behavioural component and the emphasis is usually on one-to-one networking initiative and effort. It requires time and space (physical, cognitive and social) to develop the sense of safety and trust that is needed for information sharing. Webber (1993) aptly describes it "conversations—not rank, title, or the trappings of power—determine who is literally and figuratively 'in the loop' and who is not."
  ◦ Meetings are another means of accessing information and those that

were observed varied significantly in format and the protocols in place. At the tactical headquarters, meetings that were mission related provided excellent opportunities for learning. Strict protocols were observed at these briefings (e.g., allowing participants to discuss errors or problems encountered during missions without assigning blame or shame to individuals). There were few equivalent meetings at the strategic headquarters, other than some induction sessions and briefings and it appeared that learning how to do one's job was not given quite the same priority.

    - The researchers observed that information access due to failings in the IT infrastructure inhibited access to information within the strategic settings. Another issue that caused problems was the difficulty in finding information on the shared drive. Since there was no specific person responsible for maintaining the shared drive and for naming folders, it was left to the discretion of the document originator where information would be stored.

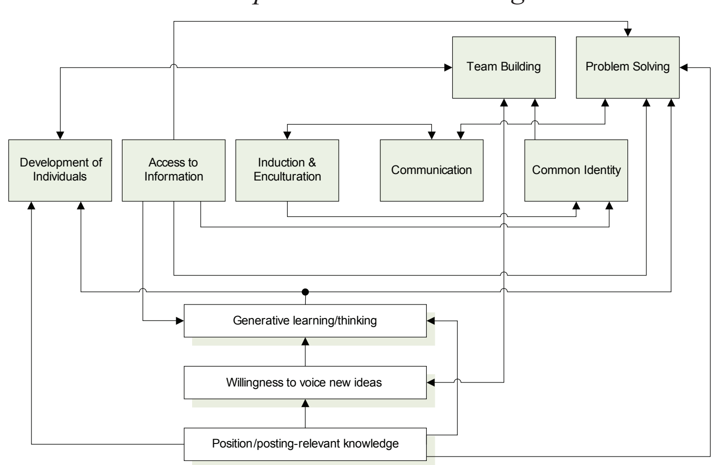
- **Development of individual expertise:** The acquisition and development of expertise was seen as an integral part of social learning. Motivators associated with this enabler are: career trajectories, professional currency, professional training, postings and promotion, and mentoring.
    - A career trajectory describes the positions, roles, and experience that individuals have accumulated, up to and including the position they currently hold. While not excluding personal experiences outside of a work or training context, a well designed career trajectory generally equips an individual with the skills, experience, maturity, and personal networks needed to successfully fill a particular posting.
    - The term professional currency has a somewhat different meaning within different environments. However, professional currency promotes social learning in the same way that appropriate career trajectories do so—by providing a foundation for the generation of new knowledge.
    - Appropriate professional training is a significant component of the development of individual expertise and, therefore, a fundamental for generating new knowledge. Training courses are important to furthering individuals' expertise, as well as for forming the personal networks that subsequently develop. However, in times of budgetary constraints, training money is often the first to go, with damaging consequences for the organization's ability to learn and manage their knowledge.
    - Mentoring is regarded as an effective method of assisting the development of individual expertise, especially for junior staff a degree of informal mentoring was seen to be built into elements of the training program in some of the settings studied. In terms of developing a career trajectory, the knowledge acquired through mentoring may also be important when individuals want to prepare themselves for specific roles in the future.
- **Communication:** Essential to effective learning within an organization and to effective social learning. Motivators associated with this enabler are: overall communication climate, formal and informal information flows, time for inquiry and reflection, use of humor, language, and workplace design.

- Supportive communication climates are being positively linked to open and free exchange of information and constructive conflict management. Characteristics of a supportive communication climate include a culture of sharing knowledge, treating each other with respect, and generally behaving in a cooperative manner. Research has established the link between supportive organizational communication climates and generative learning (Bokeno, 2000; Ruppel, 2000) and with higher levels of organizational commitment (Guzley, 1992).
- An important element of generative learning is for organizational members to be able to engage in dialogue, which is open and is based on inquiry and reflection. A supportive communication climate is a prerequisite for such dialogue and it requires learning how to recognize defensive patterns of interaction that undermine learning (Senge, 1992).
- The issue of workplace design and its impact on teams, network building, and on accessing information arose repeatedly during the study. Physical location and proximity to each other had the potential to promote the transfer of pertinent knowledge. The point was made that in addition to more quickly obtaining answers to questions about particular tasks, an open plan workplace enabled one to tap into pertinent knowledge by overhearing others' conversations. Hutchins (1996) uses the term "horizon of observation" to describe the area of the task environment, which can be seen, and is therefore available as a context for learning by team members.

• **Induction and enculturation:** Facilitates social learning by providing a foundation upon which an individual can become fully productive. Issues associated with this enabler are: timeliness and comprehensiveness of the process, buddy/mentoring system, handovers and information packages, and training.

- Good induction is more that just an introduction to new job and workmates; it is a way of helping people find their feet. Attitudes and expectations are shaped during the early days of new employment and work satisfaction is linked to well timed and conducted

Figure 2. Enabling processes and their impact on social learning



work orientation (Dunford, 1992; George & Cole, 1992). The interviews clearly indicated a relationship between meaningful and timely induction and subsequent job satisfaction. An interesting finding was that those who were not properly inducted or enculturated into the organization saw no need and responsibility to actually prepare any form of handover for anyone who may take over their position in the future.

- Although highly desirable, it was not always feasible to conduct an induction program at the beginning of a new posting cycle. In the interim, a "buddy" or "mentoring" system could fill in the gap. A "buddy" would be an experienced workmate who could be available to answer questions and assist the orientation of new members during the initial few weeks. Some interviewees said that having a buddy when they started was invaluable to settling into a new job and to effective learning.
- The researchers were repeatedly told that early training is an important part of effective induction and enculturation. It is an opportunity to learn the explicit knowledge that is taught as part of formal training. It is also an opportunity to be exposed to the attitude and cultural perceptions of colleagues and peers.

These factors enabling social learning identified from our data are by no means exhaustive, however, based on the available data the research team could see a relationship between these enablers and social and generative learning. Figure 2 depicts these relationships and their impact on social learning.

FUTURE TRENDS

Whether by design or necessity, humans tend to collaborate to achieve set goals. In fact, this sharing of information and knowledge, and the willingness to cooperate, are key elements for learning, innovation and advancement in general. The progress and proliferation of information technology greatly facilitate this process. However, this widespread application of information technology and emphasis on sophisticated networks for information sharing and social learning leads to a false assumption that once all networks are in place the information will be shared and freely disseminated. The subtle difference between "the network" and "to network" is the key. "The network" is a noun, the information technology, and can only be the enabler. "To network" is the verb, the human behaviour, the action, and the main focus. Therefore, the future trends in the area of social and organisational learning must look beyond the acquisition of technical enablers to individual and organizational behaviour (e.g., organizational structure, processes, and tactics) in order to shift emphasis from a technology-centric approach to a people-centric capability, ensuring that people will get the systems they need and want.

CONCLUSION

Organizations seeking to improve information sharing and knowledge generation need to develop a greater awareness of the processes and strategies of organizational learning. Organizational knowledge is distributed across functional groups and its generation and continual existence is dependant on the overall communication climate which is embedded in the organizational culture. This study indicates that information sharing and subsequent knowledge generation would be successful when interactive environments are cultivated before other (e.g., technology-based solutions are implemented). Therefore, the communication strategy in any organization must take into account the role played by informal and personal networks and trust in information sharing to optimise the process of transferring critical data to facilitate speedier decision-making. Technology should only be designed and applied after a thorough investigation of the work practices and work preferences of the people and teams in the organization.

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KEY TERMS

Career Trajectory: Describes the positions, roles, and experience that individuals have accumulated, up to and including the position they currently hold.

Common Identity: A common ground/understanding to which many people/groups can subscribe, and requires a shift from seeing oneself as separate to seeing oneself as connected to and part of an organizational unit.

Communication Climate: Extend to which there is an open and free exchange of information, transparency of decision-making, and how constructively conflict is managed.

Knowledge: An understanding gained through experience or learning: the sum, or a subset, of what has been perceived and discovered by an individual. Knowledge exists in the minds of individuals and is generated and shaped through interaction with others.

Knowledge Management: In an organizational setting, it must, *at the very least*, be about how knowledge is acquired, constructed, transferred, and otherwise shared with other members of the organization, in a way that seeks to achieve the organization's objectives.

Social Learning: Learning occurring in or by a cultural cluster and includes procedures for transmitting knowledge and practices across different work situations/settings and time.

Systemic Understanding: A holistic view of an organization and its inter-relationships, an understanding of the fabric of relationships and the likely effect of interrelated actions.

This work was previously published in Encyclopedia of Information Science and Technology, Second Edition, edited by M. Khosrow-Pour, pp. 3501-3507, copyright 2005 by Information Science Reference (an imprint of IGI Global).

Chapter 1.7
Agents and Social Interaction
Insights from Social Psychology

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ABSTRACT

Social interaction represents a powerful new locus of research in the quest to build more truly human-like artificial agents. The work in this area, as in the field of human computer interaction, generally, is becoming more interdisciplinary in nature. In this spirit, the present chapter will survey concepts and theory from social psychology, a field many researchers may be unfamiliar with. Dennett's notion of the intentional system will provide some initial grounding for the notion of social interaction, along with a brief discussion of conversational agents. The body of the chapter will then survey the areas of animal behavior and social psychology most relevant to human-agent interaction, concentrating on the areas of interpersonal relations and social perception. Within the area of social perception, the focus will be on the topics of emotion and attribution theory. Where relevant, research in the area of agent-human interaction will be discussed. The chapter will conclude with a brief survey of the use of agent-based modeling and simulation in social theory. The future looks very promising for researchers in this area; the complex problems involved in developing artificial agents who have mind-like attributes will require an interdisciplinary effort.

DOI: 10.4018/978-1-60566-236-7.ch003

INTRODUCTION

As our technologies become more interactive in nature, the necessity of building in a social component has become more important than ever. The present chapter will review and discuss a variety of theories that have been used to guide academic research and development in the area of multi-agent interaction. Of particular interest are those models specifying an underlying theory of the character and development of social interaction, as well as those that have focused attention on the affective components of human-agent and agent-agent interaction.

As originally conceived (e.g., Maes, 1995), software agents were to carry out tasks on our behalf such as seeking out information that we might be interested in, or finding the best prices for products, or even carrying out negotiations on our behalf. The notion that we would have a relationship with an agent and how that relationship would unfold, and even how the agent could be designed with social capabilities in mind seemed somewhat far removed from the issues related to the design of an autonomous search agent.

In order to develop more life-like agents that are capable of interacting in a believable way with humans, it is necessary to imbue them with some of the same attributes that are thought to underlie human social interaction. Otherwise, the agents may be thought of by users as dumb or simply annoying (e.g., the Microsoft Office Paperclip). The development of simulations of an agent's interactions with humans (or with other agents) thus could be guided by some underlying theory of social interaction. If so, then which theories of human social interaction, particularly theories of mind and social cognition, could play a role in the development of multi-agent systems and in human-agent systems? The overall goal of this chapter is to introduce selected theory and research in the area of social psychology to others who may not be familiar with the concepts and theory in this field. Thus, though portions of the chapter will review instances where social psychological concepts have been applied to actual systems, the focus will be on surveying concepts and ideas, not on the practical application of such ideas to system development.

The chapter will begin with a look at the question of what guides our social interactions with others, whether they are human or artificial. Dennett's (1978, 1989) concept of the intentional stance will be examined in some detail, and will be used as a basis for understanding interaction at a basic level. The search for relevant concepts and research findings that could be applied to deepen our understanding of agent interaction will continue with a review of selected concepts from the ethological and animal behavior literatures, including the concepts of fixed action pattern, imprinting, and imitation.

The next section will include a brief review of theories and evidence from social psychology that are applicable to multi-agent systems research. Social psychology represents a rich source of theory and insights into the nature of social interaction in multi-agent systems, and the review will include the areas of social perception and impression formation, selected portions of the interpersonal relationship and social exchange literatures, as well as examples of research in the agent-human literature that have built on these underlying ideas. The aim here is not to provide a comprehensive review of these research areas, but to point out their relevance as we go forward with research in the field of agent interaction, particularly agent-human interaction.

Affective components have played a guiding role in research in the area of human-agent interaction, as exemplified in the work of Rosalind Picard and her group at MIT. Thus, Picard's work and its application to the area of social interaction will be discussed, along with that of Cynthia Breazeal and her efforts to build interactive robots.

The final section of the chapter will include a brief survey of the work in agent-based modeling, as well as a look into the future of this research. Of particular interest is the potential contribution this research can make to our overall understanding of social interaction. For example, can it provide confirming evidence for models of social behavior emerging from the human experimental social and developmental laboratories, as well as ethnographic and field research? Also, what types of interactive systems will emerge from this research and how will they change the way we use computing technology?

ISSUES, CHALLENGES, PROBLEMS

Social Interaction Between Agents, Both Human and Artificial

What is it that seems to guide our interactions with other agents? Whether these agents are people, animals, or machines? We will turn to a variety of disciplines for insight into this question, among them social psychology, philosophy and computer science.

Among philosophers, Dennett (1978) has used the term "intentional system" to describe "…a system whose behavior can be – at least sometimes – explained and predicted by relying on ascriptions to the system of beliefs and desires" (Dennett, 1978). He is careful to note that in using the terms 'beliefs' and 'desires,' he is not suggesting that the entity *has* beliefs and desires, only that we behave towards the entity *as if* it possessed such things. An entity is an intentional system only in the case where someone is seeking to explain and predict its behavior.

To further clarify these points, Dennett uses the example of someone seeking to predict the next move of a chess-playing computer. There are three 'stances' one can take in attempting to predict the computer's behavior. First, if one knows exactly how the computer is designed – including the hardware and software, then if the computer functions as it was intended, one can predict its behavior in response to any given move. This is referred to as the *design stance*. Second, one takes a *physical stance* if one knows the actual physical state of the entity at any moment in time. For instance, with a human chess opponent, this would require knowledge of (among other things) the firing patterns of all the neurons in the brain, or in the case of the chess playing computer, the physical state of all the electrical circuitry in the processor and all connected components. From this knowledge, one could predict the system's physical state in response to a particular move. Of course, because of the complexity of the chess-playing computer system (or a chess playing human), a person could never have the kind of detailed knowledge required by the design and physical stances. Therefore, one's best strategy for predicting the computer's next chess move is to assume that it will make the most *rational* move, given that its design is optimal and that it is not currently malfunctioning. This last strategy, assuming that one is dealing with a rational entity, whether animal, human or machine, is referred to as the *intentional stance.* The implication of this stance, according to Dennett, is that we ascribe to the system the possession of certain information (beliefs), and suppose it to be directed by certain goals (desires) (Though, it should be stressed again, that Dennett is not implying that the intentional system *has* beliefs and desires). When we take an intentional stance toward a person, an animal, or a machine, we are using a *theory of behavior* in order to explain or predict the behavior of the other entity, one involving the implied rationality of the entity.

Turning to our interactions with artificial agents, the question of how humans think about the technologies that they interact with on a daily basis was investigated in a series of studies by Reeves and Nass. Their research suggests that we tend to interact with computers as if they were people (Reeves and Nass, 1996). Using such methods as brainwave monitoring, home video, and questionnaires to measure peoples' responses to media in all its forms, they found that people tended to interact with computers and other media technology in a fundamentally social and natural way, and may not even have realized that they were doing so. For example, people tend to evaluate the performance of other people more favorably when the evaluation is given to the other person face to face, as opposed to giving the evaluation of the same performance to a third party. Reeves and Nass obtained the same finding when a computer's performance was being evaluated instead of another person. The theory they proposed to explain these findings suggests that for most of our history, humans only responded both socially and naturally to other humans (and perhaps animals), so no mechanism other than a human social response for dealing with artificial entities has ever developed.

Major Types of Interactive Systems

Conversational agents. The Turing test provides a model for human-machine interaction (Turing, 1950). Turing used a parlor game as an interaction model, designed originally as a response to the question of whether machines can think. The 'imitation' game involves two unseen people, a male and a female, along with a group of interrogators. The interrogators attempt to decide which person is the male, and which is the female based on written responses alone. The male tries to convince the interrogators that he is the female, while the female attempts to convince the interrogators that she is the female and that the other person is the male. In the revised version, a computer and a human take the place of the male and female, and the decision to be made is which is the human and which is the computer, based again on written responses to questions alone. The object of the machine is to try to cause the questioner to mistakenly conclude that the machine is the other person; the object of the other person is to try to help the questioner correctly identify the machine. Turing (1950) described his hopes for the test this way:

I believe that in about fifty years' time it will be possible to programme computers, with a storage capacity of about 10^9, to make them play the imitation game so well that an average interrogator will not have more than 70 percent chance of making the right identification after five minutes of questioning. … I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted. (Turing, 1950, p. 436).

Most observers believe that Turing would be disappointed at the performance of computers in this test today, judged by performance in the Loebner Prize Competition—an annual event in which computer programs are submitted to the Turing Test. Turing's test has nonetheless provided a kind of model for the development and evaluation of programs designed to provide an interactive component for their human users. Perhaps the best-known example of a conversational agent of the type suggested by Turing is Weizenbaum's ELIZA (Weizenbaum, 1966). The program was developed using the model (Weizenbaum suggested the term parody) of a non-directive psychotherapist. Rather than offer interpretations of a client's behavior, the non-directive therapist is trained to reflect the client's statements, in order to draw out their underlying emotional components (Rogers, 1951). A typical conversation would proceed as in the following; ELIZA's responses are capitalized (from Weizenbaum, 1966):

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Men are all alike.
IN WHAT WAY?
They're always bugging us about
something or other.
CAN YOU THINK OF A SPECIFIC EX-
AMPLE?
Well, my boyfriend made me come
here.
YOUR BOYFRIEND MADE YOU COME
HERE
He says I'm depressed much of
the time.
I AM SORRY TO HEAR YOU ARE DE-
PRESSED
It's true. I am unhappy
DO YOU THINK COMING HERE WILL
HELP YOU NOT TO BE UNHAPPY
I need some help, that much
seems certain.
WHAT WOULD IT MEAN TO YOU IF YOU
GOT SOME HELP
Perhaps I could learn to get
along with my mother.
TELL ME MORE ABOUT YOUR FAMILY
My mother takes care of me.
WHO ELSE IN YOUR FAMILY TAKES
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CARE OF YOU
My father.
YOUR FATHER
You are like my father in some
ways.
WHAT RESEMBLANCE DO YOU SEE
You are not very aggressive but
I think you don't want me to no-
tice that.
…and so on.
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At the time, many people who interacted with ELIZA became quite quickly and emotionally involved with the program, in part motivating Weizenbaum to write *Computer Power and Human Reason: From Judgment to Calculation*, in which he explained the limitations of computers, and argued against the anthropomorphic views people had of the system he created (Weizenbaum, 1976). Web-based implementations of ELIZA can be found in several places, so one can experience the interaction for oneself.

Robots and interactive virtual graphic characters. With interactive conversational agents, as in the Turing test, the social context – social cues such as facial expressions and gestures, etc. - is taken away, so that the only information one has is the answer to a question displayed on a computer screen. The need to create software agents and robots that can interact with humans in a credible way has motivated more recent research, which has concentrated on building creature-like machines designed to provoke social responses on the part of humans (Bickmore & Picard, 2005; Breazeal, 2002a, 2003). These two types of agent-human systems will be discussed in more detail below, in the context of their use of social psychological theory.

The Place of Social Psychological Theory in the Development of Agent-Based Interaction

Social psychology can be defined as the scientific study of the way in which people's thoughts, feelings, and behaviors are influenced by the real or imagined presence of other people (Allport, 1985). This group of social scientists has had a great deal to say about human to human agent interaction, and their work could potentially make a contribution to the area of human to software/robot agent interaction. This review will not cover the whole of social psychology, as there are some areas of the field that would not provide as great a contribution as others at the present time. For example, there is a great deal of interest in the study of self-perception and self-understanding, including the mechanisms of self-awareness (Carver & Scheier, 1981; Duval & Wicklund, 1972). There are no claims on the part of any researcher in the field of robotics or software agents that these entities have any consciousness or awareness. In addition, although aggression and altruism are also important research areas within social psychology, they will also not be included in this review. We will instead concentrate on the social behavior of animals, the process of social perception, and social exchange theory and interpersonal relations. Following this section we will review work involving the use of social psychological theory in the development if interactive artificial agents.

Social Behavior in Animals

Behavior in lower species provide an interesting analog for understanding the behavior in artificial agents, whether software agents or robots. There has already been a great deal of work in the area of what has come to be called swarm intelligence (Bonabeau, et al., 1999). In this research, social insects, such as ants and bees, are viewed as collective problem solvers, where, although composed of simple interacting organisms, they are collectively able to solve complex problems. Their intelligence lies in the networks of interactions among individuals and between individuals and the environment. This analog has been translated into systems where software agents, acting according to simple rules in a virtual environment exhibit complex collective behavior, attempt to solve complex organizational problems (Bonabeau, 2002). This research has been largely concerned with the operation of population-level mechanisms.

Lower species also conduct social interactions at the individual level as well, and perhaps this level can provide some insights to researchers in the areas of robotics and other embodied (yet virtual) agents. Ethologists (Lorenz, Tinbergen, Hinde, and others) have studied animal social behavior both in the laboratory and the field for many years. Three major concepts are important for the purposes of the present chapter: *fixed action patterns, imprinting and imitation*.

A *fixed action pattern* is a response, thought to be innate, that occurs reliably in the presence of identifiable stimuli (called sign stimuli or releasing stimuli). These responses are distinguished from other types of behavior in that, unlike reflexes, they involve numerous muscles and parts of the body; and unlike purposive behavior, the responses are inflexible and run off in a mechanical way (Tinbergen, 1951). A classic example of a fixed action pattern is the aggressive response on the part of a male stickleback fish to the entry of another stickleback into his territory, caused by the sight of the threat posture of the encroaching stickleback. Tinbergen (1951) carried out numerous studies of this behavior and determined that the red belly in the proper orientation, even on an artificial model of a fish, was enough to trigger the response. Thus the red belly is a sign stimulus or releaser for the fixed action pattern of the aggressive response.

The remaining two concepts from ethology are part of the process of learning, particularly in young animals. Learning to distinguish your species from other, potentially harmful species is an important achievement. This can be accomplished in several ways. In some species it is attained during a very brief period in life called a *critical period.* During this early period, certain species of birds engage in a 'following-response' towards the mother. That is, they simply follow behind her because she possesses or exhibits a particular pattern of *releasers* that serves to trigger the behavior, much as the sign stimulus triggers the fixed action pattern. The releaser is composed of several attributes that the species has in common; for example an odor, shape or size, or, in the case of the greylag goose, the movement of the mother, that then triggers a response. Ethologists refer to this process as *imprinting* or the triggering of specific behaviors in the face of a pattern of releasers (Lorenz, 1961). In this case, imprinting has been explained as a primitive form of learning in which an individual finds out about the characteristics of their social group. In humans, the process of imprinting involves a strong emotional response to the mother that is referred to as *attachment.* This process is believed by some researchers to be irreversible, and important for the socialization of the child (Brown, 1965). A fictional portrayal of this process involving artificial agents was portrayed in the film "Artificial Intelligence," when the parents of the eternal child/robot "David" were given specific instructions on how to cause him to begin to perceive and behave toward the female human as "Mother." Though there is currently no actual analog for this process between humans and artificial creatures, Breazeal (2003), in developing Kismet, a sociable robot, used the idea of 'releasers' to encode and mediate the information from the robot's internal and external environments, and to generate an emotional response towards its human partner based on this information.

The final concept from ethology and the study of animal behavior that is relevant to work in agent interaction is *imitation,* which is also considered a primitive form of social learning. Though the topic remains controversial in ethology (Miklosi, 1999), there is a great deal of evidence for the role of imitation in human social learning and cognition in infants (Bandura, 1986). The evidence suggests that infants are able to model novel behaviors that they are physically capable of expressing. Meltzoff and Moore (1989) have demonstrated imitation of facial gestures in infants as young as 42 minutes.

In robotic applications such as household cleaning, building, and elderly care, which involve social interaction, robots will need to be able to coordinate their actions with their human partners. Thus, robots need to be able to recognize the actions of their human partners in order to understand the goals of the actions, and they will need to imitate their behavior as a method for learning new skills. Breazeal and Scassellati (2002) discuss the problems associated with building robots capable of imitation. Unlike studies of imitation in animal behavior or in infants, where the main goals most often are descriptive or involve the discovery of the mechanisms responsible for producing the behavior, in robotics the goal is to create or generate a behavior with minimal underlying capabilities. Two major issues in the development of robots that are capable of imitation that are currently far from being solved involve: (1) the perception of movement or "how does a robot know *what* to imitate, and (2) representing motor movements, or "how does a robot know *how* to imitate." Although there are differences in methods and goals, Breazeal and Scassellati nonetheless believe that animal research can contribute to work in interactive robotics and vice versa, and that greater understanding of robot imitation and social learning will contribute to our understanding of robot social cognition (Breazeal & Scassellati, 2002).

Interpersonal Behavior

Theories of interpersonal behavior are perhaps the most relevant for current work in artificial agent-human interaction. Social exchange theory forms the basis for later work in this area. The basic idea behind exchange theory is that humans are rational, utility maximizing creatures. Thus, we seek to maximize the social rewards a relationship with another person can provide. Given these assumptions, social exchange theory suggests that how we feel about our relationships is a function of the perception of the rewards we receive and the costs we incur, along with our feelings about what kind of relationship we deserve and the probability of obtaining a better one (Brehm, 1992; Kelley & Thibaut, 1978). When we find ourselves in a relationship with another person (or an artificial agent?) then, we evaluate the costs and benefits of that relationship to ourselves, and if the costs outweigh the benefits we seek to dissolve the relationship.

Even though there is empirical support for social exchange theory, some have criticized its view that people are simply out to get the most reward from a relationship at the least cost. Later versions of social exchange theory have incorporated the concept of equity in a relationship; in other words, we seek fairness in the amount of reward we offer the other person in a relationship and in the costs we incur. Thus, we want to be treated equally, and to the degree that the relationship is perceived as inequitable, we will seek to end it (Walster, Walster, & Berscheid, 1978; Berscheid & Reis, 1998).

Social exchange theory can help us understand what happens after a relationship begins, but what attracts us to other people to begin with? Here the major focus of the work has been on the examination of variables that determine attraction. Among the more important variables are (Berscheid & Reis, 1998):

- **Proximity:** We are more likely to develop relationships with the people who we are physically near.
- **Physical attractiveness:** Although we tend to pair up with those who are most similar to us in attractiveness.

- **Similarity:** We are more likely to be attracted to others who share our attitudes and values.

It is clear that applications that are meant to provide assistance to people, particularly the kind of live-in robotic assistants for the elderly that are envisioned, will be a part of a person's living space for extended periods of time. It thus becomes important to understand the process of developing a long-term relationship with an artificial agent. Research conducted by Bickmore and Picard (2005) is perhaps the best example of the use of concepts from social psychology to understand the interaction between humans and artificial agents. These researchers were interested in the development of long-term relationships with an artificial 'relational' agent. They developed an interactive embodied virtual character (Laura) that would interact with and help to motivate people as they engaged in a month-long exercise program. During the study, participants interacted with the agent on a daily basis over a 30-day period for at least a few minutes, in order to encourage the development of a basic level of relationship. While interaction took place via a kind of interactive chat, the animated character also used body language and facial expression to provide additional social cues. In a 'relational' condition, additional strategies were implemented in the design of the agent to encourage a relationship. For example, in a strategy involving *meta-relational communication,* the agent would periodically ask how things were going and would offer to make changes if needed. Periodically checking on the status of the relationship would then demonstrate concern and caring for the user (Bickmore & Picard, 2005). In a 'non-relationship' condition, these additional relationship-encouraging strategies were left off.

The results of the experiment suggested that even though there were few statistically significant differences between the experimental groups in their participation in the exercise program, the 'relational' group 'liked' the agent better, felt they had a 'good' relationship (approached statistical significance), showed an interest in continuing the relationship, and, when given the option of giving 'Laura' a sentimental farewell at the end of the program, chose to do this more often than the 'non-relational' group. In interviews conducted after the study, participants' impressions of the agent were very favorable; and they found interacting with 'Laura' very natural (Bickmore & Picard, 2005).

This study represents one of the first attempts to use concepts from the social psychological literature in the design of an artificial agent. Based on the finding of significant effects on relationship measures for the experimental condition in which these (and other) concepts were used, researchers and designers of such systems should begin to apply these techniques more widely. As we continue to explore the nature of the relationship between humans and artificial agents, perhaps the concepts from the social exchange literature might also be useful. Finally, as Bickmore and Picard suggest, agents that function in the role of 'helper' have a special obligation to develop a sense of trust in their human partners. Thus, going forward, research into the development of trust in these types of relationships will be particularly important.

Social Perception

This area of social psychology is concerned with how we form impressions of and make judgments about other people. For instance, what kinds of nonverbal cues are used in our attempts to understand another person's behavior? In addition, social perception concerns how we understand and attribute causes to another person's behavior.

Nonverbal communication. Impression formation will be important for the development of long-term relationships between humans and artificial agents. Part of our impression of another person is based, of course, on what they say to us, but an awful lot of information is derived from nonverbal channels. Work on nonverbal communication, and particularly the communication of emotion via facial expression has been an important focus for research in the area of social perception and impression formation (Ekman, 1965). Nonverbal communication refers to the way in which people communicate, intentionally or unintentionally, without words, including using facial expressions, tone of voice, and body position, among others. The most important of these, for the purposes of this chapter, is the use of facial expressions to communicate emotion. Charles Darwin (1872) is credited with beginning the work in this area with his contention that facial expressions served as a means of communicating information to others in the social group. For example, an expression of disgust may signal that the food I am eating doesn't taste very good; an angry expression may be followed by aggression, etc. Darwin believed that expressions for the so-called primary emotions (anger, happiness, surprise, fear, disgust, and sadness) were universal, that is, anyone, anywhere in the world should be capable of understanding and displaying these expressions. This view has received support, based on a great deal of cross-cultural research over a number of years conducted by Paul Ekman and his colleagues (e.g., Ekman & Friesen, 1975; Ekman, Friesen, & Ellsworth, 1982). Because of the importance of the face for communication of information about the internal state of the organism, designers of interactive systems, including robots, are taking these research findings to heart as they build new systems.

Emotion. In order to develop a complete understanding of how the mind works, most cognitive scientists and some artificial intelligence workers (e.g., Minsky, 2006) believe that it is necessary to understand emotion. In evolutionary terms, emotion may play a critical role in the allocation of cognitive and other resources to areas needed to solve environmental problems (Izard, 1977). Some theorists believe that negative emotions (anger, sadness, etc.) are a signal that some action needs to be taken to bring the organism back into a balanced state, while positive emotions (happiness) signal a more or less balanced, satisfactory state (Frijda, 1994; Plutchik, 1991). The emotion process unfolds as cognitive appraisal systems evaluate environmental conditions, and recruit resources (motor, respiratory, hormonal and other systems) to respond to the environmental appraisals. Facial expressions are also thought to perform a communicative function, giving others in the social group information on the internal state of the organism, providing input on how best to respond. The purpose of this brief explanation is not to provide the reader with a comprehensive understanding of emotion theory, but to emphasize its importance in the creation of interactive agents, and to provide context for the discussion of affective computing.

There are two threads of work in the area of human-agent interaction related to the topic of social perception with particular relevance to the expression and communication of emotion. One is Rosalind Picard's work on *affective computing* (Picard, 1997), which is concerned with the development of computing technologies that are capable of understanding and expressing emotion. Of course, whether computers *have* emotions, or whether they *truly* feel empathy for their human partners is beyond the scope of this research. The major technological difficulties involve developing systems that can understand and express emotion computationally.

Recognizing emotion. The ability on the part of an artificial agent to automatically recognize the emotion of a human agent will be critical to the development of interactive applications. Picard presents a scenario for such an application in this way:

Imagine you are seated with your computer tutor, and suppose that it not only reads your gestural input, musical timing and phrasing, but that it can also read your emotional state. In other words, it not only interprets your musical expression, *but also your facial expression, and perhaps other physical changes corresponding to your emotional feelings-maybe heart rate, breathing, blood pressure, muscular tightness, and posture… Given affect recognition, the computer tutor might gauge if it is maintaining your interest during the lesson, before you quit out of frustration and it is too late to try something different. "Am I holding your interest?" it would consider. In the affirmative, it might nudge you with more challenging exercises. If it detects you are frustrated…, then it might slow things down and proffer encouraging feedback. (Picard, 1997, p. 16)*

Recognizing emotion will require a variety of skills on the part of the system, each of which present technical challenges to the developers of such a system. Among these requirements are those involving vision and hearing for gathering information about facial expressions, gestures and vocal intonations, but in addition, once the sensory information has been gathered, an interpretation must be made based on knowledge about the situation and knowledge about emotion generation (Picard, 1997). Research suggests that computers are capable of recognizing videotaped actor portrayals of facial expressions of emotion with greater than chance accuracy (e.g., Cohen, et al., 2003), and in more complicated tests involving multimodal systems (Kapoor & Picard, 2005). In the latter study, the goal was to extract, process and interpret naturally occurring non-verbal behavior during natural learning situations, in order to provide personalized assistance to children engaged in learning tasks, a much greater challenge for the system. The researchers obtained data on facial features and head gestures, as well as data from a posture-sensing chair, which were then fed into feature extraction processes and the data classified as to whether interest was being expressed. The system achieved an overall accuracy rate of 86%, which was significantly better than using the individual sensory modalities alone. The challenge for this research area continues to be, as the Kapoor and Picard study suggests, being able to interpret multi-modal data in real time, in naturalistic settings, for ongoing emotional states involving constantly changing expressive states; and while an 86% accuracy rate is significantly better than chance, is it good enough for applications that seek to provide accurate and timely feedback to their human partners?

Expression of emotion. Picard (1997) has similarly developed criteria that need to be met in order for computers to be said to express emotion. These include *input,* in which the computer receives instructions about which emotion to express; *feedback*, which concerns the fact that, in humans, affective expressions can influence an ongoing affective state, as demonstrated in several laboratory experiments (Laird & Bresler, 1992). Other criteria proposed by Picard include *social display rules* or what are the relevant social norms that determine when, where, and how emotions are expressed; and the *output from the expressive process*, including changing facial expressions, posture or gait, or vocal signals. Each of these present enormously complicated technical challenges, let alone in combination, which is why, to date we have seen few examples of such systems. One exception to this is the work of Cynthia Breazeal, and her group's work on the development of socially engaging robots. She is also greatly interested in the development of emotion sensing and expressive systems for use in the service of humans.[1*]

The Sociable Machines Project at MIT is responsible for building Kismet, an expressive, anthropomorphic robot, capable of interacting in a social way with humans (Breazeal, 2003). In a nutshell (and greatly oversimplifying the entire process), the robot is capable of expressing emotions based on a complex system of sensors, drives (e.g., being over or under stimulated by an interacting human partner), and a perceptual system that keeps track of external and internal events. There is an emotion system comprised of an appraisal subsystem, which takes the results of the perceptual system and computes a value which it then hands to an emotion activation subsystem to make a decision about which emotion would be most appropriate, based on the value handed off from the appraisal subsystem. Finally, the motor system takes the result from the emotion system and generates the appropriate facial expression and posture. The robot is capable of conducting an ongoing interaction with a human partner in real time, in which the behavior of the human influences the emotional state of the robot and where the goal of the partner is to keep the robot's *drives* satisfied. This basically takes the form of keeping the robot awake and stimulated, but not overly stimulated, in which case the robot perceives threat and responds accordingly through appropriate facial expression and posture.

Breazeal and her colleagues also conducted a series of studies in which they examined the degree to which people categorized Kismet's facial expressions into one of seven categories of emotional expression. Whether they observed the expressions on a still photograph or saw Kismet model these expressions via videotape, the participants (which consisted of a group of 12 year old children and a group of adults) were able to correctly categorize the expressions significantly more often than by chance. Further, while "scolding" the robot during interactive sessions, the robot's sad face and body posture caused some participants to report that they felt 'terrible' or 'guilty,' perhaps evidence for the human partner experiencing a sense of empathy with the robot (Breazeal, 2003).

Taken as a whole, the work of Picard and Breazeal shows a great deal of promise for the development of systems that are capable of interacting with humans in a credible way. One example of a system that would have a great deal of practical value is a Furby-like creature that could serve as a companion for elderly people. Of course, such a system would have to be extremely easy to use as well as reliable; a person would need to be able to get it up and running easily, and it should not need a team of computer scientists and mechanical engineers to keep it running. Much more likely in the near future are learning technologies of the sort discussed above, combining multi-modal feedback from the learner to the system with the ability to tailor lessons to a learner on the fly based on this feedback. The acquisition of this feedback is a problem at present, requiring special headsets and, if physiological data is required, straps and sensors that provide ways of measuring processes like blood pressure and heart rate.

Attribution theory. Attribution theory is concerned with how we attribute cause to a person's behavior. People engage in this process as they attempt to understand the relationship between social situations and behavior, and predict future outcomes based on past occurrences of behavior. For instance, when we consider why a person stole another person's wallet, are we likely to place more weight on the person as causal agent, that is, to make a *dispositional* attribution? Or are we more likely to place greater weight on the environment, which would constitute a *situational* attribution? Such questions have intrigued social psychologists for years, beginning with Heider (1958), who developed most of the basic ideas and vocabulary. Once again, rather than attempt a comprehensive review of research and theory in this area, we will survey some of the major theoretical and empirical contributions, and then, because there has been no direct application of these ideas, we will speculate on their relevance to agent interaction.

Jones and Davis developed *correspondent inference theory* to understand the way in which we make internal (dispositional) attributions, or how we *infer* dispositions from *corresponding* behaviors (Jones, 1990; Jones & Davis, 1965). The theory is concerned with how we narrow down our choices for the dispositions that we think might have caused a particular behavior to occur. To do this, we look for what Jones and Davis call *non-common effects*, that is, effects or consequences of a particular behavior that could not be produced by another behavior or course of action. For example, suppose a friend decides to take a job at an investment bank in San Francisco. If we want to understand why this person chose this particular job we need some way of narrowing down our choices for an explanation. Correspondent inference theory suggests that we look for other choices our friend could have made, and examine the effects of the second choice. If the second choice produces effects that the first cannot, for instance, if we learn that our friend turned down a job working at a non-profit agency in rural Oklahoma, there would seem to be little overlap between the effects of the first choice and the second. In other words, there would be a large number of non-common effects. If this were the case, it would be more difficult for us to determine what caused the choice of jobs. If, on the other hand, we find out that our friend turned down a job at a consulting firm in San Francisco before accepting the job at the bank, we can narrow down the causal factors more easily, because there is more overlap between the effects. In this case there would be few non-common effects.

While correspondent inference theory focuses only on dispositional attributions, Harold Kelley's *covariation model* dealt with how people initially decide whether to make an internal (dispositional) or external (situational) attribution (Kelley, 1967). Kelley assumes that when we are in the process of forming judgments about another person, we gather information with which we can test hypotheses. We then look at the pieces of information that *covary* with other pieces, as if we are conducting a statistical test, and base our judgment on these pieces of information. Where does the information come from? There are three sources: first we call on our knowledge of or guess about the way a person has acted in similar situations (distinctiveness data), second, the way a person has acted in the same situation in the past (consistency data), and third, the way other people have acted in the same situation (consistency data). For example, in trying to decide why Jeff liked a particular movie, we consider how Jeff and others who have seen the film respond to it, and how they have responded to films like it in the past. If Jeff basically raves about all films of this type, or if others who have seen it are not enthusiastic, we are likely to attribute dispositional causes to Jeff's behavior. If Jeff rarely raves about films of this type or any other type, or if others also rave about it, we are inclined to make a situational attribution, that there was something about the film that caused his behavior. As with correspondent inference theory, there is a great deal of empirical support for Kelley's model (Ross & Nisbett, 1991).

Much of the research in social psychology tends to take place in a controlled laboratory environment, and while the theories discussed above have been confirmed in these types of settings, some interesting, somewhat contradictory findings have also emerged. Whenever you tend to find a character in a movie so compelling that you suspend disbelief and feel sadness at their misfortune for instance, you are making a mistake in judgment about this person. In reality, this person was an actor whose situation dictated that she behave in a certain way, yet we seem unable to view the person's behavior in an objective light. Though this may seem like an extreme example, results from laboratory experiments suggest that our judgment, in some cases is biased by our readiness to attribute the behavior of others to their dispositions. This tendency is referred to as the *fundamental attribution error.* In a classic experiment on this concept, groups of college students were asked to read an essay written by a fellow student that either supported or opposed the rule of Fidel Castro in Cuba. Half the participants were told that the writer had freely chosen their position before writing the paper, while the other half were told that the students had been assigned the topic beforehand. The participants were then asked to what degree the writer actually supported the position she wrote about. Logically, the participants should have concluded that being assigned the topic would not indicate actual support for the position; instead, the participants concluded that the authors actually supported their positions, whether they had freely chosen the topic or not (Jones & Harris, 1967). Thus, in general we tend to underestimate the role of the situation when making attributions about another's behavior, however, when judging the causes of our own behavior, we tend to be biased in the other direction, towards seeing situational components as the major cause. This is referred to by social psychologists as the *actor/observer bias* (Ross & Nisbett, 1991).

It is unclear just how the findings of attribution theory will be applied to the design of agent-human interactions. Breazeal (2003) has suggested that one of the next steps in the evolution of socially interactive robots like Kismet is that they be capable of acquiring mental models of other people. Scassellati (2000) has taken an important first step in this direction by examining the processes involved in shared attention. Going beyond this level, should designers build in the same reasoning biases that humans have, like the fundamental attribution error, into the systems they build? This would presumably cause the system to make the same errors in judgment as a human. Would these errors make the system seem more human? Or would it cause a human observer to feel more negatively towards the system ("Stupid robot!"), and thus be less likely to trust it? After all, aren't computers supposed to be logical? Or would we view the system as more unfeeling if it did not occasionally make mistakes? The answer would seem to be that it depends on the purpose for which the system was constructed. For a conversational system or one designed as a companion it would seem better to have the system appear as human-like as possible. In the interpersonal attraction literature this is known as the *similarity* effect; the more similar we are, the more I may like you (Berscheid & Reis, 1998). On the other hand, for a system designed for use in dangerous environments with a human partner, biased reasoning processes when it comes to making judgments about other people or the environment could be dangerous, and so should not be built in. In short, the ability to reason about the interpersonal environment would seem to be of some importance in the design of interactive systems if what we are interested in is the construction of artificial minds.

Agent-Based Modeling and Social Psychological Theory

There are two distinct strands in the agent literature that have utilized social psychological theory. One strand in this effort has used theory and research findings to develop new technologies, so their primary purpose has been on the engineering side. We have talked at great length in this chapter about this research. Representative of this approach is the work of Bickmore and Picard (2005), discussed above, and their use of the literature on human interpersonal relationships in the development of a software agent. Also representative of the engineering approach is the work of Breazeal and her colleagues, who have utilized work on the display and communication of emotion to develop socially engaging robots, and Rosalind Picard, who has pioneered the work on machine detection of affective states in human partners.

The second strand in the agent literature, which will only be briefly described here, uses agent-based modeling methods in the study of social psychological processes. In this research, the focus has been on the emergence of patterns relevant to social phenomena from the interaction of a group of autonomous software agents, programmed with a few simple rules. The approach has been referred to as *generative* in that, a phenomenon is explained by postulating underlying mechanisms that, through their interaction, generate the phenomenon. The phenomenon is said to emerge as a result of the interaction of the underlying mechanisms (Epstein, 1999; Smith & Conrey, 2007).

The use of simulation to develop and test theories in the social sciences has a long history

(Abelson, 1963). In contrast to the generative approach to theory building discussed above, these programs embody a particular theory of social and/or cognitive process. Robert Abelson (1963) was one of the first social psychologists to develop computer simulations of social cognition. One of his first efforts was the development of a program that simulated Heider's Balance Theory (Heider, 1958), which suggests that if a person holds contradictory thoughts, the person must rationalize the contradiction, or change one of the thoughts in order to bring the process into balance. For example, the statement "my simulation produced silly results" contains a thought that is positively valued in the person's belief system (my simulation) and a thought that is negatively valued (silly results). According to Heider, holding these contradictory thoughts causes discomfort until the person is able to somehow balance the values by somehow rationalizing the negatively valued thought. Abelson's program took statements that were out of balance and attempted to bring the statement into balance so that it would fit into a pre-determined simulation of a belief system.

One of the first social scientists to use a generative approach was Thomas Schelling (1978). He explored the question of whether segregation can arise from a group of agents who do not explicitly desire segregation. His program used the simple rule that if the population with your 'color' fell below a certain percentage in your neighborhood, move to an empty space on a virtual grid. The pattern that emerged upon running the simulation to completion was that the populations appeared completely segregated. Thus, the motive to not be in a minority in one's neighborhood, not a desire to be segregated appeared to cause this pattern.

Following Schelling, Robert Axelrod, a political scientist at the University of Michigan designed a series of computer tournaments, which would have the effect of evaluating strategies for winning an iterated Prisoner's Dilemma. However, he also used these results to try to answer the 'generative' question: can cooperation *emerge* from the interactions of rational self-interested individuals (Axelrod, 1984). Axelrod has continued to generate interesting research on these questions, which have some applicability to real world issues such as conflict resolution (Axelrod, 1997).

The agents in Axelrod's research represent entities stripped of everything psychological except self-interest; thus, these agents provide social scientists with tremendous control over extraneous variables like emotion, feelings of empathy, or other relationship-oriented variables that human beings possess. They represent the process of social exchange at its most fundamental level. Thus game theory is often used in this type of research because it contains simplifying assumptions about social behavior (basically that we are rational, self-interested creatures) that are appropriate for modeling the interaction between two or more human agents or between computational agents.

For those seeking more information about the generative approach in social science, Smith & Conrey (2007) have written an excellent article in which they provide a justification for the use of an agent-based approach to the development and testing of theory in social psychology. They also provide a review of the use of the generative approach in social psychology and the social sciences in general, and a comprehensive bibliography which should serve as a guide for the interested reader.

CONCLUSION

We have reviewed theories and research in social psychology that may be of interest to researchers and those engaged in the design of interactive technologies. Beginning with a detour into the philosophical literature and a summary of Dennett's concept of the intentional system, the chapter subsequently examined the Turing test, as well as conversational systems that utilize written verbal means of communication only, such as

ELIZA. The contribution of social psychological (including animal social behavior) concepts was then surveyed, as well as the application of these concepts to research in agent-human interaction. We reviewed selected theories in interpersonal relations, along with their application to an understanding of long-term relations between humans and artificial agents in the work of Bickmore and Picard. The survey also included concepts from social perception, with special attention to the use of emotion as a method of communicating the state of an organism, along with applications from the work of Picard and Breazeal to artificial agents. Attribution theory, the study of how we draw conclusions about the causes of an agent's behavior - are they inside the agent (personality) or outside (environment)? – was discussed, and though there have been no direct applications of this particular set of theories to agent-human interaction to date, if agents are to seem life-like, should they be subject to the same attribution biases as a human? A different strand of research, in which artificial agents are used to simulate social processes was then examined. This area has received renewed interest from social scientists, in part because of the computational power of modern personal computing platforms, and the availability of simulation software. Smith and Conrey (2007) have surveyed the major contributions to the literature and argued for the use of agent-based modeling in the development and testing of theory in social psychology. Finally, though the issues of whether artificial agents are truly intelligent, or are really capable of having feelings, or attaining consciousness, though important issues, may never have a final resolution. Philosophers and scientists will continue to debate these questions, but until we have a better grasp on what it means for a *human* to be conscious, or intelligent, or have emotions, it is premature to speculate about how these processes manifest themselves in an artificial being.

It is hoped that the present chapter inspires researchers and designers concerned with researching and developing interactive technologies to investigate the literature in the field of social psychology more closely. In a review such as this, one can only scratch the surface of the concepts and issues in this field, knowing that most of the ideas that have inspired researchers for many years cannot be given the space that they deserve. The field of human-computer interaction encompasses many researchers from many different backgrounds, who have come together to solve some of the most complex problems in computer science, engineering, and psychology. It behooves researchers from these areas to learn as much as they can from each other (and from fields like ethology and animal behavior, anthropology, and linguistics), because it is only as a truly interdisciplinary field that these problems can be solved. The applications resulting from this collaboration: live-in companions who can provide a psychological dimension to their interaction, workers who are able to learn new skills from their human counterparts, tutors who are genuinely able to enrich the learning experience for both children and adults, can be a great benefit to humans.

FUTURE RESEARCH DIRECTIONS

The future for the topic of this chapter, the contribution of social psychological theory to understanding and developing systems that engage in social interactions, looks very bright. The history of research efforts along these lines lies mainly in two unrelated bodies of work; first, there is the research that has sought to develop and test social theory using agent simulation (Abelson, 1965; Axelrod, 1984, 1997; Axtell & Epstein, 1999). These efforts represent a viable alternative and a complement to the current use of laboratory, ethnographic, and survey methods, characterized by Smith and Conrey (2007) as *Variable Based Modeling* as opposed to *Agent Based Modeling*. One of the advantages of such an approach for social scientists is that they are not limited in the scope of their research. That is, one is not constrained to conduct analyses at the level of the 'individual' actor, as most social psychological research is. One can create individual agents that act as nodes in a connectionist cognitive network, or agents that simulate the social networks within a large organization; the choice is up to the ingenuity of the researcher.

For researchers and designers of interactive systems the challenges include incorporating mechanisms whereby the agents are able to learn from their human partners. The interaction between human and artificial agent is most often represented as a parent-infant form of relationship. Thus, the development of systems that are capable of some form of imitation, which is thought to be one of the more primitive forms of social learning, is an important goal of this area of research and development. In addition, the ability of an agent to begin to take an intentional stance toward their human partners, in other words, to begin to reason about the behavior of their partners, as discussed in the section on attribution theory, would be a significant milestone towards the development of artificial agents who are able to reason in a social way.

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ENDNOTE

1. Of course, there are many other individuals in artificial intelligence and robotics engaged in the same types of research or closely related research; however, Breazeal's work is an excellent representative for the collective efforts in this field.

This work was previously published in Handbook of Research on Agent-Based Societies: Social and Cultural Interactions, edited by G. Trajkovski; S. Collins, pp. 35-50, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.8
Cyber-Identities and Social Life in Cyberspace

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ABSTRACT

Information and communication technology gradually transform virtual communities to active meeting places for sharing information and for supporting human actions, feelings and needs. In this chapter the authors examine the conceptual definition of virtual community as found in the traditional cyberliterature and extend it to accommodate latest cybertrends. Similar to the ways that previous social and mass media dissolved social boundaries related to time and space, cyber-communities and social software seem to also dissolve the boundaries of identity. This, in turn, questions the trust, privacy and confidentiality of interaction. The authors present a way of classifying and viewing self-presentation regarding cyber-identity management in virtual communities. It is based on the characteristics that cyber-surfers prefer to attribute to themselves and accordingly present themselves to others. In so doing, the authors coin the terms for five distinct phenomena, namely nonymity, anonymity, eponymity, pseudonymity and polynymity. They subsequently compare and contrast these terms, summarising information from their investigation, and outlining emerging questions and issues for a future research agenda.

DOI: 10.4018/978-1-60566-208-4.ch003

INTRODUCTION

Cyberspace and virtual communities are often described by features such as structure, setting or formation. From the view point of the user more important than the features are the social qualities. One of the important social features is the sense of community. Sense of community is often described as a set of subjective experiences of belonging, mutual respect, and commitment that can be gained only through participation (McMillan & Chavis, 1986). It is not just the space but the people with their collective experiences. Furthermore, human empowerment in designing for sociability and usability for socially acceptable information and communication technology has become a research and development issue of increasing importance (Preece, 2000; Earnshaw et al., 2001; Berki et al., 2003). Online communities cannot merely be built, only facilitated in order to provide platforms for people to come and form a community of their choice. This emphasises the human factor within design and research of cyberspaces.

Cyberspace does not have physical borders but social life within cyberspace does have expression boundaries as well as norms and rules for behaviour. These boundaries for social actions and behaviour are either inherited by the structure of a certain e-space or different social software, i.e. discussion forums and work spaces, or imposed by the designers and users of e-spaces. In order to succeed, online communities, e-spaces and other electronic congregations need regular users. Cyberspace does not exist without electronic inhabitants; otherwise it is a deserted cyber place. Recent studies show that the degree of success and functionality of virtual communities is incorporated and built through trustworthy group interaction (Werry & Mowbray, 2001). The rise of social software technologies and online social networks impose new challenges for law, security and trust, identity and interaction (Kollock, 1999; Kimppa, 2007; Berki et al., 2007). The challenges go sometimes so far as to raise questions related to democracy and citizens' degree of participation in private or public virtual communities (Wilhelm, 2000). The existence of cyberplaces also challenges the definition of membership since within digital worlds inclusivity and exclusivity have totally new semantics or terms of definitions with different applications and tools to facilitate membership management.

Boundless digital spaces also challenge the ways of participation. Entering cyberspace concerns issues of identity and identification. The possibility to participate in online communities anonymously may ease the entrance to digital worlds. Some participants, however, may dislike anonymous people and they, instead, gravitate towards digitally eponymous people welcoming them in an electronically-mediated social environment. To some extent identity, both in real life and cyber life, can be seen as composed of similar qualities. Notwithstanding, questions of security, safety and trustworthiness are often associated with cyberpartcipants and their identities. In real life, however, identities are not that often questioned, authenticated or even doubted.

Understanding cyberspace requires exploring the meaning of individual and group (collective) identities, in particular how they are built and how they affect interaction and participation (Renninger & Shumar, 2002; Georgiadou et al., 2004). Arguably, the identity shared by the cyber-societies participants should be empowering to facilitate participation and support communication. An overpowering group identity might block communication and create difficulties in promoting innovative ways of thinking and functioning. A shared, cohesive identity, used by eponymous or anonymous people facilitates the development of mutual trust among the participants and balances communication within a group. On the other hand, a pseudonym or plenty of names may decrease certainty and control in interaction but still increase the willingness to communicate. Technology-mediated-communication is often seen as faceless and task-oriented. However, it seems that communication in cyberspace may speed up initial interaction as well as self-disclosure, which, in turn, may facilitate interpersonal connections and building of relationships (Walther, 1994; Walther and Burgoon, 1992). Without doubt, anonymity, pseudonymity and eponymity affect trustworthiness, credibility and security of e-transactions and e-interactions (Jäkälä & Berki, 2004).

There is a multiplicity of people in e-spaces: e-learners, visitors of different chat rooms, participants of electronic interest groups, and members of support groups and e-communities, all with different needs and different aims (see e.g. Werry & Mowbray, 2001; Jäkälä & Mikkola, 2001; Renninger & Shumar, 2002). In cyberspace, group and community formation as well as identity building, testing and maintenance comprise the social, cultural and psychological aspects of behaviour with communication technologies (Jäkälä & Berki, 2004). Social behaviour online aims at facilitating a trustful communication environment providing acceptable and credible interaction (see Li et al, 2007).

In this chapter, the authors identify and discuss rules that govern interaction in cyberspace. Furthermore, the traditional definition of virtual community (see Rheingold, 1993) is scrutinised and extended. The authors aim at describing and distinguishing different types of identity that are presented or represented in the cyberspace, and associate their research findings to the cyber surfer's identity formation in the context of various virtual communities or e-spaces. Configuring the transformation of individual and collective identity to online identity, the chapter, simultaneously, provides a classification on the pitfalls and certain expectations from five different types of cyber-identity, namely *eponymity*, *nonymity, anonymity, pseudonymity* and *polynymity*. The authors coin these five terms here for the first time in order to describe five different phenomena in cyber communication that are associated with five different types of cyber-identity. These, though being common phenomena in everyday life on the screen (see e.g. Turkle, 1997, Papadimitriou, 2003), have remained undefined and unclassified while their positive or negative consequences influence online communication but remain largely unnoticed. There is a need to investigate these phenomena especially since online presence compromises the privacy of the interaction. An improved understanding of the relations between online identity building, online identity types and e-activities could contribute to the design of e-spaces, where people's activation and participation increase. For instance, this new information might lead towards the design of e-learning communities that could increase learners' participation in the e-learning process. Similarly this new knowledge could contribute to open new ways for social inclusion by overcoming biases and digital divides.

Internet is a relatively new means for interaction, where identity and identity formation have recently been paid attention especially from the technical point of view, e. g. authentication, privacy and identity theft. Other scientific domains such as communication and social psychology (see e.g. Bosma et al., 1994; Wallace, 1999; Wood & Smith, 2001) have paid more attention to these concepts. The main investigation approach is examining the recent research findings in the combined domains of cyberspace and identity. In the examination, theories and principles from other scientific domains are combined and utilised for the online identities comprehension. In the discussion and comparison the chapter also draws knowledge from personal experiences in e-learning, e-instruction and cyberspace usage through years of action research in the domain of cyber education, cyber communication and cyber culture.

CONCEPTUALIZING VIRTUALITY AND COMMUNITY

Originating from the Internet and expanding rapidly due to advances of Information and Communication Technology (ICT), virtual communities (VCs) nowadays pervade the public and private life. Within this context, the role of ICT as a facilitator for human interaction becomes gradually a resource of special significance and research study (Wallace, 1999; Earnshaw et al., 2001; Renninger & Shumar, 2002). Recent studies (Earnshaw et al., 2001; Kisielniki, 2002; Werry & Mowbray, 2001) concentrate on the commercial exploitation of leisure and the use of Internet as a means for controlling personal and collective identity (Wallace, 1999; Jäkälä & Berki, 2004). An equally important number of current research scholars concentrate on the growth of and the benefits from online support for a number of needs and every day activities (Jäkälä & Mikkola, 2001; Berki & Cobb-Payton, 2005).

Being part of a community or group fulfils one of the basic human needs, that of belonging (see e.g. Maslow 1987). In our era the use of ICT to build different interest-based and self-identified communities evidently stresses that communities do not necessarily need to interact face-to-face. The development of the Internet resulted in the increase of online communities since ICT enabled geographically dispersed groups to communicate with the aid of different technological solutions. According to Rheinghold (1993, 5), *"virtual communities are social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace."* Starting from short message exchanges and advancing to more demanding forms of e-discussion and e-interaction, humans express their sympathy, empathy, concern and demonstrate their needs to communicate and ability to support other humans. (Preece, 2000.)

Research-wise, the scientific domain of research in virtual communities includes themes that have recently raised the interest of sociologists, psychologists, anthropologists, computer scientists, communication scholars and information technology professionals. Many opinions have been exchanged in an attempt to coin a successful definition. However, there is not yet a single accepted definition, except agreement to a few certain elements that should exist in VCs. *"Nearly everybody agrees on certain elements. One of these is inclusivity"* (Werry & Mowbray, 2001), meaning that everybody should be able to participate. Thus, it is challenging to re-define the term online community. One of the very important reasons is that similar or different definitions have been coined and co-exist in an attempt to define e-group, e-environment, e-space, digital space, virtual environment, virtual space, online community, cyberspace, cyberplace, cybercommunity, to name just a few. These terms are often used interchangeably but there might be variations in their use, based on the context.

Internet as such is a large online community. However, quite often the term online community refers to a particular web-based subgroup within the Internet. Furthermore these online communities have labels such as special interest groups, support groups and other. Above all the authors suggest that online communities are technology-supported web-based *contexts* that provide *contact* for individuals and groups, upon specific *content*. Online social aggregations, such as families, groups of friends, distance mode learners, players of online games, and members of political discussion forums are gathered to socialize, discuss, exchange their thoughts, or seek support for their emotional needs. The content of these online communities ranges from entertainment and leisure, e-learning and education or edutainment, to political agenda setting, e-governance, e-democracy and e-health matters.

Inevitably, the Internet has been one way to build communities and promote relationships between individuals and within groups. Wood and Smith (2001) state that the essence of virtual community is more than just a group of people communicating online. Community is based on the feeling of belonging. According to Jones (1997) there are qualities that characterize online communities: i) a minimum level of interactivity among the participants; ii) a variety of communicators for conversation and contribution; iii) a common public space that identifies virtual communities from cyberspace with cyberplace; and iv) a minimum level of sustained membership that maintain and develop the community. These characteristics stress the human factor of online communities and communication.

Inhabitants of virtual worlds and communities might create an alternative identity for themselves that they use exclusively online, or several identities to be used during different online forums or simultaneously within one forum. Some or all of these *identities-on-line* may be complemented with embodiment of the user's image, picture, photo or live video. There are various applications of shared work spaces that equip task-oriented groups such as tele-working teams and virtual organizations. Even when using solely text-based technologies, it is possible to perceive interpretations of personal characteristics and relationships between the communicators. The strength of these interpretations probably varies between individuals. This affects both the notion of telepresence as well as immersion.

Virtual communities are not simply a diminishment or enlargement of personal life. When the real life communities are threatened, virtual communities may provide a shelter needed. In many cases, these communities are based on relationships and feelings. They replicate common and communal features of real life, or, if needed, they may create an environment that is beyond the limits of real life. As observed in real life communities, personal relations whose main objective is sociability, informed by loyalty and authenticity, become as much as part of the social situations of modernity as the encompassing institutions of time-space distanciation (Giddens, 1990). But can they offer commitment or merely a pseudo-community, where commitment could only be virtual? (see e.g. Wilbur, 2001).

Access to cyberspace does not necessarily imply inclusion in any virtual community. Similarly, participation in cyberspace does not automatically imply inclusion in virtual communities. There are different levels of authorisation while permissions are granted after identification and authentication take place. Membership in a certain virtual community does not guarantee access to other exclusive virtual communities; there are always boundaries to cross. However, the feelings of belonging and self-awareness are strongly bound to our group memberships (see e. g. Tajfel, 1982). When privacy is needed the only place to find it might be an exclusive virtual community that identifies and to some degree authenticates its users to guarantee their privacy. This is largely facilitated with the interaction tools that are available and with the cyber-surfers' choice of the cyber-identity that want (or not) others to perceive. Social software may or may not facilitate inclusion and privacy.

TRANSFORMING IDENTITY TO CYBER-IDENTITY

Even though the word 'identity' is often used in diverse scientific domains, it is also considered as an unclear word to be used as a scientific term. It also refers to an increasing number of concepts from personality traits to authenticating computer networks (Camp, 2004). However, the concept of identity has a long history – as long as human beings have been using different types of masks (both material and abstract) to cover their faces and identity (see, Wiszniewski & Coyne, 2002). There are different definitions for identity depending on the context of its use. Identity is often defined as the combination of essential qualities, which characterize and differentiate a person from others. The concept of identity describes the continuum between sameness and differentiation. A person can objectively be identified by physical characteristics: name, date of birth, biographical description; as well as objectively assessed by cognitive and psychological characteristics: Intelligent Quotient, attitudes or personal traits. Subjective identity, then, refers to the person's mental presentation of these objective identifiers and an awareness of being distinct from the others. (Bosma et al, 1994.). Depending on the time and context, a distinctive identity can be seen as a way to be separated from uniformity; albeit in some cases, it may be seen as social stigma or spoiled identity, as described by Goffman (1986).

People use different sides of their personality and different roles in various situations: e.g. communicating with colleagues, family members, friends, acquaintances or strangers. Identity includes individual's considerations of 'who am I?', 'how do I want to be perceived by others?', and 'how am I actually perceived by others?' Others perceive identity of a certain person as a set of identifiers that distinguish this person from other persons. The meaning of identity in its social context is often viewed in social psychology in relation to the person's or group's inclusion and exclusion from the society, and affects the personal or group considerations about self and groupness, respectively. The transition from the concept of identity in its traditional context to the meaning of identity in a post-modern sense is attempted below, considering the semantics of individual and collective identity as viewed in the post-technological era.

Management of self-presentation takes place when people enter e-spaces. By picking up the username, nickname or alias and selecting or creating personal information that they want to share with others, they simultaneously decide how they wish to be perceived by the other members of the community they are entering. This also emphasizes the relationship between community and identity (Jäkälä & Berki, 2004). The reflection of/on one's identity needs the others, and cyberspace communities help their members to identify and being identified both on the level of personal and collective identities. Real life and virtual communities offer guidelines for becoming 'one of us', distinguishing simultaneously their members from others, outsiders of the community. From the viewpoint of social technology, technology does not only provide structures and tools for online communities. In addition to that, technology provides tools for social construction of reality and the outcomes depend on how these tools are being used. Same technology can be used to gain access to community membership and e-space with shared ideas and interaction or space to manifest individuality to all passerby or selected audience. Technology can also be used to block interaction and increase protection. Technology can be the gatekeeper between different users or groups of users. One way of using social technology is to self-manage identity - either personal identity or shared identity of a certain group. In the following paragraphs we will describe and discuss different possibilities for e-identity.

The next five sections refer to, classify and analyse five distinct phenomena that are observed in online communication. We name them: eponymity, nonymity, anonymity, pseudonymity and polynymity. Different context, contact and content of online interaction require different self-presentation rules, and the following types of identity offer opportunities and borders to human participation, inclusion and exclusion from virtual communities.

Eponymity

Eponymity is the state of being identified and recognised by name (eponym) and other distinctive individual features. Being eponymous implies having a set of known, distinctive characteristics, such as name, title and affiliation, used for identification, and to some degree for authentication.

One way of participating in cyber-activities is by being eponymous, when the identity of the communicator is then apparent. Interacting eponymously has often been considered as the way to grant authorization in technology-based communications. Eponymity does not challenge the protection of privacy and declares the responsibility and credibility of the activities. The online group and role formation that is based on *real* identities range from the very traditional roles of educators and learners in virtual learning environments (Putz & Arnold, 2001) to modern research and development collaboration teams for promoting innovation. New cyber-activities that include eponymous interaction are minority groups in society, who seek for re-inventing their roots by creating their own cultural and national identity (Bakker, 1999; Nocera, 1998). For some ethnic minorities or socially suppressed groups, eponymity in cyberspace serves as a step to openness and further recognition (Berki & Cobb-Payton, 2005).

Eponymity may be associated with official communication. For example, in teaching, guidance and customer services real face needs to be seen instead of artificial replica. Being able to transfer the notion of familiarity from virtual world to real world -and vice versa- may also increase trustworthiness. But could artificial and virtual identity be more believable, credible and attractive than the real one?

Nonymity

Nonymity, or rather nonappearance, is the state of not being identified by any name nor any other distinctive individual features. Being at the state of nonymity implies not having a set of known, distinctive characteristics, such as name, title and affiliation, used for identification and/or authentication. Actually, nonymity refers to identity that avoids detection consciously or unconsciously. Nonymity is a stealth mode of identity. Nobody knows whether a person exists when is not apparent while participating. Out of sight, out of mind. No technological means could possibly determine the appearance.

Nonymity is silent, non-observable and no public identity. It is even a non-communicative and non-interactive with other participants, state of identity, where participation and sharing is unidirectional, based on the choice and control of the nonymous person. No-one is aware of the online presence, sometimes not even of the actions of a person with no identity. For instance, these actions might be malicious in case of stealing others' identities to use them later or gathering useful information for malfunctions. A nonymous person could also benefit in an e-learning virtual community or in an instruction and learning forum, by accessing confidential examination and assessment in online forms of exams. On the other hand, nonymity could also offer protection and safety for the real person behind, in situations where real life communities, persons or identities are threatened.

A nonymous person can hardly ever be distinguished or identified. He or she is a silent participant, whose online silence is different from the silence of the users of other types of identity because no-one else knows or is aware of this silent participation.

Anonymity

Anonymity is the state of not being known by any name. Anonymity is defined as freedom from identification and implies lack of distinctiveness. An unnamed person is someone, who is unacknowledged as the doer of something because of a lack of distinctive features. Sometimes anonymity can be seen as a negative identity. For example within discussion forums the anonymous participant may lurk others - follow their actions without own participation. Online communities have often built-in tools that make other participants visible by adding a feature of awareness of the situation in the online environment. Therefore, other e-participants are aware of the online presence of anonymous persons even without their direct participation, while in the case of nonymous persons are not. Anonymous participants are not necessarily silent, like the nonymous persons. Their participation in a forum, however, can or cannot be identified, while they can be visible or not. Anonymity has been implicated, among other, in research on social facilitation and crowd behaviour. Yet its conceptual status and the processes by which anonymity achieves its effects are still far from clear (Lea et al. 2001).

One way of entering cyberplaces is by strategically choosing anonymity that is the state at which the identity of the communicator is not apparent. Interacting anonymously has often been considered as a questionable identity in technology-mediated communication; it challenges the protection of privacy as well as the responsibility and credibility of the activities (Li et al. 2007). On the other hand, anonymity may facilitate citizens' rights, democratization of processes, consensus participation, and in some cases it may encourage interaction and provide support (Jäkälä & Berki, 2004). While it might be easier to discuss delicate issues anonymously, there might also be doubts about the trustworthiness of other communicators and about security and safety of shared interaction and information. It should also be easier to break up anonymous interaction than interaction with a known other.

Pseudonymity

Pseudonymity is the state of being identified by a pseudonym, that is by a name, which is not somebody's real, correct name. Furthermore, being pseudonymous in virtual communities means bearing a set of false distinctive characteristics, such as name and title that are used for identification and to some degree for interaction of the person concerned. Even though pseudonymity is often addressed with suspicion, it is not always used to mislead others as frequently believed. Sometimes eponymity can be too challenging or the option of anonymity is not available. Sometimes pseudonymity evolves to eponymity, since many cyberspacers are recognised or traced by their nicks or aliases which may lay there to be addressed as their eponyms.

Pseudonymity can offer safety needed when entering virtual communities that otherwise might stay unvisited. For some people, the only option to join a virtual group is by pseudonymity, which provides possibilities to veil under false name or nickname. Pseudonymity offers possibilities to decide on the type of personal information that a person wants to provide, whether real or artificial. While eponymity could be as a desirable property for functioning, and a requirement for inclusivity in reality and in a technological sense (see e.g. Berki & Cobb-Payton, 2005), it is the pseudonymity and its misuse that has raised many questions regarding abuse of language and misbehaviour of humans on the net (see Wallace, 1999).

Pseudonymity could, for instance, enhance self-presentation management for online students and online courses instructors in order to facilitate e-participation, overcome digital divide and increase social inclusion.

Polynymity

Polynymity is the property of having and presenting oneself with many different names. Thus, it is also associated to the state of being identified by several pseudonyms. Having multiple names as identifiers in cyberspace's communities, means possessing and using a mix of real or artificial distinctive names and characteristics, which are presented in interaction with different persons or groups. While communicating with the aid of technology, the management of self-presentation has totally new expression tools. People can have multiple simultaneous roles, each of which is actualised within certain communities (see Papadimitriou, 2003). These roles can totally differ from each other. One person can also participate in the same event with several parallel identities (Turkle, 1997). Nowadays this seems to be the most often used identity in cyberspace. However, that might also be the main reason why some people do not consider virtual communities as a space for *real* interaction.

In case of polynymity, online communication is sometimes seen as loaded with mistrust, since the source of communication cannot always be verified. Sometimes, online participants choose polynymity for fun, but in some cases the user does not have the possibility for choice. At some cases the community guides the community members to polynymity. For example, academic scholars participate in electronic learning environments with their students by using an eponym, while they participate in chat rooms or tutor support groups using a pseudonym; and anonymously evaluate eponymously written but anonymously presented paper proposals for a conference.

Table 1. Identity types and interaction prerequisites

Identity type / interaction prerequisites	Eponymity	Nonymity	Anonymity	Pseudonymity	Polynymity
Awareness	yes	no	yes	yes	yes
Visibility	yes	no	limited	yes	yes
Identification	yes	no	limited	limited	limited
Approachability	yes	no	limited	limited	limited
Authentication	limited	no	no	no	limited

THE EMPHASIS FROM CYBERSPACE TO CYBERPLACE

The previous subsections provided a taxonomy of the most frequent types of e-identity formation as phenomena observed in cyberspace and partially described in cyber literature in a limited fashion. Furthermore, the authors provided meaningful names considering the semantics and pragmatics of these cyber-identity types. The five distinct types of identity discussed here, namely eponymity, nonymity, anonymity, pseudonymity and polynymity are subsequently compared and contrasted providing a tabular representation of their features regarding their interaction prerequisites in e-spaces. The following table summarises the information presented above regarding online awareness, visibility, identification, approachability and authentication.

Table 1 itself is a broad summary of the information currently gathered, analysed and classified by the authors. While it depicts significant knowledge on cyber-identities, it is by no means an exhaustive source of what are the advantages and disadvantages of every type of identity or what are the pitfalls and limitations of each one in online communication. It rather comprises issues that set a future research agenda for the technologist, communicator scholar and for the cyber culture scepticism followers. The entries of the table underline the need to get more information about the potential importance of cyberspace to political liberties and established human rights and the ways virtuality is likely to change our experience of the society and e-society in a comparative way. Technological means in the form of social software for achieving this transformation should also be viewed critically since there might be potential pitfalls when mixing technology and human relationships for the sake of communication (or non-communication).

During the last ten years the cyberspace has turned into a populated cyberplace. Before it had merely been an abstract space to present and publish context. Nowadays, it is increasingly becoming a common public place where the virtual communities' users themselves are empowered to produce the content for other users. Cyberspace has been established as an everyday medium for communication, where sociability is increased with the enrichment of personal expression (e.g. applications of social media). It is, thus, important to know which forms of identity might or not facilitate approachability, visibility and authentication (see Table 1).

The number of e-groups in which people participate seems to go on increasing, since pursue of effectiveness is achieved by encouraging people to form different groups, teams and communities. Participation in virtual communities shows a range of diverse interests, different roles and different work tasks. Leisure time and hobbies are more often also net-based which increases the use of different e-spaces also after and during working hours.

One significant aspect of online communication is management of identity. In general, identity formation and self-presentation become significant when there is a desire to regulate the functions and functionality of the virtual community. Apart from regulation, self-expression and self-presentation issues are connected to ease of access to the e-space where all are linked to the content that is provided within a particular context. Table 1 presents a non-definite list of cyber-identity types, which, again, should not be viewed as final and isolated forms of self-expression and presentation. In fact, the entries of table 1, especially those attributed to pseudonymity and polynymity, indicate that identity in cyberspace is not and sometimes cannot be a constant attribute of someone's online presence. It rather is a fluid concept, which evolves during time, enriched or simplified according to the communication needs of the cyber surfer. A significant issue of the future research agenda is the observation of identity changes and the study of the conditions and events that trigger these changes.

SUMMARY AND FUTURE RESEARCH

Online communities can be divided into *permanent* infrastructures, which co-exist with the physical community or can perform as *temporary* virtual environments in order to support the timely functions of real life within a virtual space (Jäkälä & Berki, 2004). For instance, permanent cyber-communities could be perceived as free public networks, public access media and advisory boards, educational collaborations, independent or private media and internet cafes. Cyber-communities of temporary online nature could be the web-based support provided for conferences and symposia, technology centres, governmental and organisational programs. The latter can be online, supporting by social software, especially when in need to support community activism and research initiatives, or merely for completing a work task. Due to the evolution of technology, the emphasis can not be on the technology as such but on the use of it to support social actions and behaviour online.

The development of the virtual life increased the demands for trust in interpersonal communication. Building, testing and maintaining identity might lead to pretensions and precautions. When referring to nonymity or pseudonymity nontrustable interaction comes to mind, while anonymity and eponymity are associated to domination but also liberation. Liberation and simultaneously deception are terms that are inevitably linked to polynymity, as well as self-expression and creativity. Likewise, the demands for anonymity, eponymity and pseudonymity in different virtual groups have to be approached from the point of view, that best-fitted technological solutions are best-fitted for humans, too. Technology should cater for ethical competition, privacy and transparency in marketing, security in e-sales, individual and intellectual freedom of expression.

The expansion of virtual communities indicated many emerging themes that have not yet been attributed as research objects to a well-formed discipline with a sound scientific and theoretical background. They are, though, promising research areas because onlineness is explored as the possibility for wider participation. Virtuality opens boundaries for new forms of communication and sociability. The concept of identity as a trust-based interaction in online worlds can be realized by considering the power and suitability of technology to create identity assets such as security, integrity and safety for the adequate provision of trust. At the same time, there is a need to combine the principles and capabilities of other disciplines in order to establish cohesive understanding of real people in virtual communities. Real people both in reality and virtuality have different roles and identities. Cyberspace does not demand more out of those, only makes them more visible.

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KEY TERMS AND DEFINITIONS

Anonymity: Anonymity is the state of not being known by any name. Anonymity is defined as freedom from identification and implies lack of distinctiveness. An unnamed person is someone, who is unacknowledged as the doer of something because of a lack of distinctive features.

Eponymity: Eponymity is the state of being identified and recognised by name (eponym) and other distinctive individual features. Being eponymous implies having a set of known, distinctive characteristics, such as name, title and affiliation, used for identification, and to some degree for authentication.

Nonymity: Nonymity, or rather non-appearance, is the state of not being identified by any name nor any other distinctive individual features. Being at the state of nonymity implies not having a set of known, distinctive characteristics, such as name, title and affiliation, used for identification and/or authentication. Actually, nonymity refers to identity that avoids detection consciously or unconsciously.

Polynymity: Polynymity is the property of having and presenting oneself with many different names. Thus, it is also associated to the state of being identified by several pseudonyms. Having multiple names as identifiers in cyberspace's communities, means possessing and using a mix of real or artificial distinctive names and characteristics, which are presented in interaction with different persons or groups.

Pseudonymity: Pseudonymity is the state of being identified by a pseudonym, that is by a name, which is not somebody's real, correct name. Furthermore, being pseudonymous in virtual communities means bearing a set of false distinctive characteristics, such as name and title that are used for identification and to some degree for interaction of the person concerned.

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 27-39, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.9
Establishing the Credibility of Social Web Applications

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INTRODUCTION

In recent years, there has been a steady shift in the *nature* of Web applications. The vehicle of this transition of Web applications is *us*, the people. The ability to post photographs or videos, exchange music snippets with peers, and annotate a piece of information, are but a few exemplars of this phenomenon. Indeed, the pseudonym Web 2.0 (O'Reilly, 2005) has been used to describe the apparent "socialization" of the Web.

In spite of the significant prospects offered by human-centric Web applications, the mere fact that virtually *anyone* can set up such applications claiming to sell products and services or upload/post unscrutinized information on a topic as being "definitive," raises the issues of credibility from a consumers' viewpoint. Therefore, establishing credibility is essential for an organization's reputation and for building consumers' trust.

The rest of the article is organized as follows. We first provide the background necessary for later discussion. This is followed by the introduction of a framework within which different types of credibility in the context of human-centric Web applications can be systematically addressed and thereby improved. Next, challenges and directions for future research are outlined. Finally, concluding remarks are given.

BACKGROUND

In this section, we present the fundamental concepts underlying credibility and present the motivation and related work for addressing credibility within the context of Web applications.

Basic Concepts of Credibility of Web Applications

For the purposes of this article, we will consider credibility to be synonymous to (and therefore interchangeable with) believability (Fogg & Tseng, 1999).

The concept of credibility can be classified based upon the types of user interactions with a Web application. A user could consider a Web application to be credible based upon direct interaction with the application (*active credibility*), or consider it to be credible in absence of any direct interaction but based on certain pre-determined notions (*passive credibility*). There can be two types of *active credibility*, namely *surface credibility*, which describes how much the user believes the Web application based on simple inspection, and *experienced credibility*, which describes how much the user believes the Web application based on first-hand experience in the past. There can be two types of *passive credibility*, namely *presumed credibility*, which describes how much the user believes the Web application because of general assumptions that the user holds, and *reputed credibility*, which describes how much the user believes the Web application because of a reference from a third party.

Related Work on Credibility of Web Applications

The issue of the credibility of Web applications has garnered attention in recent years from diverse viewpoints and this has lead to theoretical (Fogg, 2003; Metzger, 2005) and empirical (Consumer Reports WebWatch, 2005) studies pertaining to the credibility of both commercial and non-commercial Web applications.

There have been some partial efforts in addressing the credibility of Web applications. A set of guidelines for improving the credibility of Web applications have been presented (Fogg, 2003). However, these guidelines are stated in such a fashion that they can be open to broad interpretation, do not always present the relationships among them, and are stated at such a high-level that they may not always be practical or may be difficult to realize by a novice user.

A general framework for addressing the credibility of Web applications has been proposed previously (Kamthan, 2007; Kamthan, 2008). This article presents an adaptation as well as a modest extension of these works.

A SYSTEMATIC APPROACH TOWARDS THE CREDIBILITY OF WEB APPLICATIONS

In this section, we consider approaches for understanding and improving active and passive credibility.

Stakeholders and Credibility of Web Applications

We identify two broad classes of stakeholders with respect to their *roles* in relationship to a Web application: a *producer* (such as the provider or an engineer) is the one who owns, finances, develops, deploys, or maintains the Web application, and a *consumer* (such as a novice or expert user) is the one who uses the Web application for some purpose.

We then assert that credibility is a *perceived* quality attribute with respect to the stakeholders of a Web application. Indeed, we view credibility as a *contract* between a producer and a consumer. This contract can have ethical, legal, and/or moral implications.

Addressing Active Credibility of Web Applications

We consider a Web application to be an interactive information system and adopt semiotics (Shanks, 1999; Stamper, 1992) as the theoretical basis for communication of information. The active credibility of Web applications is viewed as a qualitative aspect and is addressed indirectly from the perspective of semiotics (Table 1).

We now discuss each of the components of Table 1 in detail.

Identification of Semiotic Levels

The first column of Table 1 addresses semiotic levels. We are particularly interested in the communicative properties of the representations of a Web application, which in semiotics we can view on six interrelated levels: physical, empirical, syntactic, semantic, pragmatic, and social.

We focus only on the quality concerns at the last two levels: at the *pragmatic level* the interest is in the utility of the representations to its stakeholders, while at the *social level* the interest is in the manifestations of social interaction among stakeholders with respect to the representations.

Decomposition of Semiotic Levels and Assignment of Quality Attributes

The second column of Table 1 draws the relationship between semiotic levels and corresponding quality attributes.

Since each semiotic level is rather high to be tackled directly, we decompose it further into quality attributes that are widely-known and relevant. Not all attributes corresponding to a semiotic level are on the same echelon, and therefore they are placed at different tiers. We contend that the quality attributes included are necessary but make no claim of their sufficiency. Also, the quality attributes are not necessarily mutually exclusive, and this dependency can be either favorable or unfavorable (Wiegers, 2003). We note that some of the quality attributes are classical and relevant in a desktop environment but they get amplified, and in certain cases exacerbated, in a networked environment.

Specifically, credibility belongs to the social level and depends on the layers beneath it. The quality attributes aesthetics (presentation), legality, privacy, security, and transparency (of the producer) also at the social level depend upon the quality attributes accessibility and usability at the pragmatic level, which in turn depend upon the quality attributes comprehensibility, interoperability, performance, readability, reliability, and robustness also at the pragmatic level.

We discuss only the entries in the social level in some detail. The sensitivity part of visual perception is strongly related to aesthetics as it is close to human senses. The artistic expression plays an important role in making a Web application "attractive" to its customers beyond simply the functionality it provides. It is critical that the Web application be legal (for example, is legal in the jurisdiction it operates and all components it makes use of are legal); takes steps to respect user's privacy (for example, does not abuse or share user-supplied information without permission); takes steps to secure itself (for example, in situations where financial transactions are made). The provider must take all steps to be transparent with respect to the user (for example, not include misleading information such as the features of products or services offered, clearly label promotional content, make available their contact information including physical address,

Table 1. A semiotic framework for active credibility of Web applications

<table>
<tr><th>Semiotic Level</th><th>Quality Attributes</th><th colspan="2">Means for Assurance and Evaluation</th><th>Decision Support</th></tr>
<tr><td rowspan="2">Social</td><td>Credibility</td><td rowspan="4">Process-Oriented: Inspections, Testing

Product-Oriented: Training, Guidance</td><td rowspan="4">Tools</td><td rowspan="4">Feasibility</td></tr>
<tr><td>Aesthetics, Legality, Privacy, Security, Transparency</td></tr>
<tr><td rowspan="2">Pragmatic</td><td>Accessibility, Usability</td></tr>
<tr><td>Comprehensibility, Interoperability, Performance, Readability, Reliability, Robustness</td></tr>
</table>

policies regarding returning/exchanging products, and so on).

Next, we separate the semiotic quality attributes and the means for addressing those.

Means for Active Credibility Assurance and Evaluation

The third column of Table 1 lists the means for assuring and evaluating active credibility. We note that the mapping between the aforementioned pragmatic and social quality attributes and the means for addressing them is many-to-many.

We now briefly discuss two product-oriented means, namely training and guidance for assuring the active credibility of a Web application.

Training

Often, the courses related to the Web offered at institutions tend to focus primarily on the manipulations of the "popular" (and moving target) client- and/or server-side technologies-of-the-day. The result is that the students tend to learn more about "technology hacks" rather than the fundamentals of analysis and design necessary towards a *systematic* approach to the large-scale development of Web applications.

Apart from an exposure to a comprehensive technical background in Web engineering (Mendes & Mosley, 2006), the toolbox of a prospective professional Web engineer should include several other aspects: means of precisely identifying user classes, user preferences, and their needs; understanding of quality attributes specific to the domain of the Web application and their social manifestations; appropriate use of standards for both the process and the product; ability of journalistic writing, including the ability of balancing information with other types of media (related to marketing such as advertisements); training in informed and balanced decision making in order to analyze the trade-offs and decide amongst different design approaches, or between the use of early and established technologies; basic knowledge of issues related to legal issues such as those related to intellectual property rights (IPR) and licensing; and basic knowledge of financial issues (such as those related to merchant accounts and payment systems) in the lieu of support for commercial transactions.

Guidance

We consider guidelines and patterns as two "bodies of knowledge" based on past experience and expertise that can serve as aids for structured guidance.

The guidelines encourage the use of conventions and good practice. They could serve as a checklist with respect to which an application could be heuristically and, to certain extent, automatically evaluated. There are guidelines available for addressing accessibility (Chisholm, Vanderheiden, & Jacobs, 1999) and usability (Nielsen, 2000) of Web applications. However, guidelines suffer from certain limitations: they may seem rather general at times, often do not discuss trade-offs as a consequence of their application or relationships among them, and tend to assume a certain level of knowledge of the domain and therefore are more suitable for an expert than for a novice.

A pattern provides a conceptually reusable and proven solution to a recurring problem in a given context. It has been pointed out (Friedman, 2005) that identifying patterns for the design of Web applications could be useful towards improving the credibility of these applications. Indeed, patterns for Web applications have begun to appear (Van Duyne, Landay, & Hong, 2003), and a judicious use of patterns can tackle many of the pragmatic and social quality attributes in Table 1. However, there are certain caveats in the adoption of patterns: there is an evident cost involved in adaptation of patterns to new contexts; since the mapping between patterns and quality attributes is many-to-many, their selection may not be trivial; and there is always a distinct possibility that for a given problem, there simply may not be any suitable pattern available.

We next briefly discuss two process-oriented means, namely inspections and testing for evaluating the active credibility of a Web application.

Inspections

Inspections are a rigorous form of auditing based upon peer review that, when practiced well, can help evaluating some of the quality attributes at both pragmatic and social levels in Web applications. These are aesthetics, comprehensibility, legality, privacy, readability, and transparency. Inspections could, for example, assess if the presentation of information appears "professional", determine "sufficiency" of contact information, or decide what information is/is not considered "promotional."

Since inspections is a means for *static* verification, it can evaluate in rather limited form (if at all) the quality attributes that by necessity require some form of "dynamism" or real-world use. These include accessibility, interoperability, performance, reliability, robustness, security, and usability.

In spite of the usefulness of inspections in early defect detection, adoption can depend on the level of organizational process maturity, their effectiveness lies strongly on the reading technique deployed, and entail an initial cost overhead of training each participant in the structured review process followed by the logistics of checklists, forms, and reports involved.

Testing

Testing is a means for *dynamic* verification and is usually supported by most Web application development processes. The attributes of accessibility, interoperability, performance, reliability, robustness, security, and usability can to a large extent be tested (semi-)automatically using tools or with the help of actual users.

However, not all quality attributes at either pragmatic or social levels in a Web application can be tested automatically. For example, it is not possible to completely test a Web application for aesthetics, comprehensibility, legality, privacy, readability, or transparency (like producer's intent) using tools; human inspection would be necessary for checking and determining the level of support of these quality attributes. Thus, inspections and testing do not replace but *complement* each other.

Tools

There are various tools that can help improve quality concerns at technical and social levels, manually, semi-automatically, or automatically. For example, they can help us detect security breaches, inform us of absence of privacy metadata, report violations of accessibility guidelines, or suggest image sizes favorable to the performance on the Web.

However, state-of-the-art tools can be expensive, although this situation is changing with the rise of open source software (OSS). They also may not always be applicable.

Decision Support

The last column of Table 1 acknowledges that the activities of assurance and/or evaluation must be realizable in practice.

The providers of Web applications take into account organizational constraints of time and resources (personnel, infrastructure, budget, and so on) and external forces (market value, competitors, and so on), which compels them to make quality related decisions that, apart from being sensitive to credibility, must also be feasible. For example, an a priori guarantee that a Web application will be credible to *all* users at *all* times in situations that they can find themselves in, is simply impractical.

The feasibility analysis is evidently related to decision making and could be a part of the overall Web application project planning activity. Further discussion of this aspect is beyond the scope of this article.

Addressing Passive Credibility of Web Applications

In this section, we briefly look into the case of passive credibility, specifically reputed credibility.

Like in the real-world contexts, Web applications could be audited for quality in general and credibility in particular. Indeed, WebTrust and TRUSTe are two relevant initiatives in the direction of addressing reputed credibility.

We acknowledge that the perceptions related to presumed credibility may be one of the most difficult to tackle. There are no absolute guarantees but the following could be helpful for presumed credibility assurance of a Web application: personalizing the application to user context, making organizational policies explicit, and appropriately labeling the nature of content as per the requirements of the Internet Content Rating Association (ICRA).

Scope of Credibility of Web Applications

We note that credibility is not a "universal" concern. The credibility of a Web application is a concern to a user if there is an associated cost (say, in terms of lost time, effort, or money) that is outright unacceptable to the user.

That the credibility of a Web application is a concern may also depend on the purpose of the interaction and the role played by the user. For example, credibility may be a lesser concern to a user if (s)he is casually browsing a gossip column on a movie artist than if (s)he is filling out an annual tax return form.

We also note that credibility is *not* a quality attribute that is absolute with respect to users or with respect to the Web application itself. We contend that for a Web application to be labeled as non-credible there must exist at least a part of it that is labeled non-credible based on the aforementioned classification by at least one user at some point in time. For example, a user may question the credibility of information on a specific product displayed on a specific "Web page" within a Web application.

FUTURE TRENDS

The work presented in this article can be extended in a few different directions, which we now briefly discuss.

It is known that, when applied judiciously, standards can contribute towards quality improvement. Indeed, credibility has recently been a topic of interest in standards for Web applications such as the IEEE Standard 2001-2002. However, awareness and broad use of these standards among engineers is yet to be seen.

Due to the unique nature of Web applications, any initiative towards addressing the credibility of Web applications should take place within the auspices of a development process that is that is sufficiently *agile*. This would require that the current agile methodologies for the development of Web applications evolve to provide support for credibility in general and for pragmatic and social quality attributes discussed in this article in particular.

The semantic Web has recently emerged as an extension of the current Web that adds technological infrastructure for better knowledge representation, interpretation, and reasoning (Hendler, Lassila, & Berners-Lee, 2001). At the highest level of this infrastructure is the issue of trust. For example, ontologies are central to the semantic Web and their development and subsequent use is based on mutual trust among the stakeholders. For the sustainability of the Web architecture, it is critical that the social Web and the semantic Web co-exist and evolve harmoniously. However, the "human" aspects of the semantic Web remain largely unaddressed. A natural extension of the discussion on credibility of the preceding section could be within the context of semantic Web applications.

CONCLUSION

By shifting from a collective of computers towards a community of people, the Web is becoming a symbiotic means of contribution, participation, and collaboration. The consumer concerns of credibility and the extent to which they are addressed will remain a key determinant towards the success of this paradigm.

Although there have been many advances towards enabling the technological infrastructure of the Web in the past decade, there is much to be done in addressing the social challenges, including user perceptions and expectations.

In conclusion, if credibility is important to an organization, it needs to be considered as a *first-class* concern, rather than an afterthought, from inception to conclusion of a Web application development process. Addressing the credibility in a systematic and feasible manner is one step in that direction.

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KEY TERMS

Credibility Engineering: The discipline of ensuring that a system will be perceived as credible by its stakeholders, and doing so throughout the life cycle of the system.

Delivery Context: A set of attributes that characterizes the capabilities of the access mechanism, the preferences of the user, and other aspects of the context into which a resource is to be delivered.

Quality: The totality of features and characteristics of a product or a service that bear on its ability to satisfy stated or implied needs.

Quality Model: A set of characteristics and the relationships between them that provide the basis for specifying quality requirements and evaluating quality of an entity.

Semantic Web: An extension of the current Web that adds technological infrastructure for better knowledge representation, interpretation, and reasoning.

Semiotics: The field of study of signs and the communicative properties of their representations.

Web Application: A specific to a domain Web site that behaves more like an interactive software system rather than a catalog: it will in general require programmatic ability on the server-side and may integrate/deploy additional software for some purpose (such as dynamic delivery of resources).

Web Engineering: A discipline concerned with the establishment and use of sound scientific, engineering and management principles and systematic approaches to the successful development, deployment, and maintenance of high-quality Web applications.

This work was previously published in Encyclopedia of Information Science and Technology, Second Edition, edited by M. Khosrow-Pour, pp. 1432-1437, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.10
The Evolution and Influence of Social Presence Theory on Online Learning

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ABSTRACT

The theory of social presence is perhaps the most popular construct used to describe and understand how people socially interact in online learning environments. However, despite its intuitive appeal, researchers and practitioners alike often define and conceptualize this popular construct differently. In fact, it is often hard to distinguish between whether someone is talking about social interaction, immediacy, intimacy, emotion, and/or connectedness when they talk about social presence. Therefore, this chapter outlines the evolution of the construct of social presence in an effort to understand better its relationship to online learning.

INTRODUCTION

People are social creatures (Brown & Duguid, 2002; Read & Miller, 1995). They learn and work in groups (Read & Miller, 1995). The Internet evolved out of an effort to connect computers and information and therefore people. Since its early days, the Internet has grown exponentially (Madden, 2006). However, unlike the early days when only scientists used it, people use the Internet today in a variety of different ways, including communicating with friends, family, and co-workers. In addition to connecting with current friends and family, people also use the Internet to form new relationships (Madden & Lenhart, 2006). As a result, some researchers have begun to describe the Internet as a social medium (Baym, Zhang, & Lin, 2004; Walther & Parks, 2002).

However, just as the Internet can bring people together and be described as "social," it can separate people and be described as isolating and impersonal (Kraut, et al., 1998; Morahan-Martin & Schumacher, 2003; Nie, 2001). Some researchers have reported cases of Internet addiction and dependence (Hiltz & Turoff, 1993), and others (Nie & Erbring, 2002) have found that the more time that people spend on the Internet, the less time they spend with people in face-to-face social situations. Further, van Dijk (2006) determined that the Internet invites certain types of people to withdraw into the computer. Whether the Internet is a social medium, therefore,

DOI: 10.4018/978-1-60566-830-7.ch010

remains a heated debate in many ways (Kraut et al., 1998; Nie, Hillygus, & Erbring, 2002). As states like Michigan begin to require high school students to take online courses to graduate (Watson, 2006), and online enrollments at the college level continue to grow (Allen & Seaman, 2006), the sociability—or isolation—of the Internet remains a nationwide concern.

The theory of social presence is perhaps the most popular construct used to describe and understand how people socially interact in online learning environments. However, despite its intuitive appeal, researchers and practitioners alike often define and conceptualize this popular construct differently. In fact, it is often hard to distinguish between whether someone is talking about social interaction, immediacy, intimacy, emotion, and/or connectedness when they talk about social presence. Therefore, the focus of this chapter is on outlining the evolution of the construct of social presence in an effort to understand better its relationship to online learning.

BACKGROUND

In the late 1980s and early 1990s, researchers began to study the effects of computer-mediated communication (CMC). Some concluded that CMC was inherently antisocial and impersonal (Walther, 1996; Walther, Anderson, & Park, 1994). While Hiltz & Turoff (1993) acknowledged that interpersonal relationships might be fostered through CMC, early research suggested—and convinced others—that CMC was better at task-oriented communication (Walther & Parks, 2002). These early CMC researchers turned to social presence theory to make sense of their findings.

Social Presence Theory

Short, Williams, and Christie (1976) originally developed the theory of social presence to explain the effect telecommunications media can have on communication. They defined social presence as the degree of salience (i.e., quality or state of being there) between two communicators using a communication medium. They posited that communication media differ in their degree of social presence and that these differences play an important role in how people interact (p. 65). They conceptualized social presence primarily as a quality of a communication medium that can determine the way people interact and communicate. From their perspective, people perceive some media as having a higher degree of social presence (e.g., video) and other media as having a lower degree of social presence (e.g., audio). More importantly, they believed that a medium with a high degree of social presence is seen as being sociable, warm, and personal, whereas a medium with a low degree of social presence is seen as less personal. CMC researchers later used this to theory to explain that CMC was inherently impersonal because nonverbal and relational cues—common in face-to-face communication—are filtered out of CMC (Walther & Parks, 2002).

The Role of Context and Setting

Early researchers, though, studied CMC primarily in organizational or business settings; that is, early on, they conducted very little research on CMC in educational settings. Educational settings—specifically classroom settings—have different dynamics that researchers consider when studying CMC because no such thing as a typical CMC message exists (Herring, 2007). Much of the meaning and significance of CMC depends on its surrounding discourse (Herring, 2007), and the surrounding discourse in educational settings—specifically online educational settings—is very different from that in business settings (Gee, 2007).

Education is a social practice (Lafey, Lin, & Lin, 2006; Shea, Frederickson, Pickett, & Swan, 2001); consequently, any formal learning environment must be able to support the social practice and process of learning (Shea et al., 2001). Earlier on though, people criticized online education because they believed that the absence of social cues would interfere with teaching and learning (Berge & Collins, 1995). Despite this criticism, online education continues to grow as access to the Internet increases; in fact, enrollments in online education continue to grow each year (Allen & Seaman, 2006; Tallent-Runnels et al., 2006).

However, despite occasional reports of loneliness and isolation (Grubb & Hines, 2000; Robinson, 2000), proponents and practitioners of online education argue that online education and CMC can support the social practice of learning. Even though nonverbal and relational cues are filtered out, these researchers have argued that CMC can still be very social and interpersonal (Gunawardena, 1995; Gunawardena & Zittle, 1997) and at times even hyperpersonal (Walther, 1996). Further, as researchers (Gunawardena, 1995; Tu, 2000) began examining the sociability of online education, these new researchers began to question the degree to which the attributes of a communication medium—in this case the cues filtered out of CMC systems—determine how people socially interact and are perceived as "being there" when communicating online (Danchak, Walther, & Swan, 2001; Gunawardena, 1995; Gunawardena & Zittle, 1997; Richardson & Swan, 2003; Tu, 2000).

The Evolution of Social Presence Theory

As a result, these researchers began questioning and further developing the theory of social presence developed by Short et al. (1976). They argued, based on their experience and research, that participants in online discussions, using text alone, are able to project their personalities into online discussions and create social presence (Swan, 2003; Swan & Shih, 2005). They found that online learners are able to present themselves as being "real" as well as "connect" with others when communicating in online learning environments by doing such things as using emoticons, telling stories, and even using humor (Rourke et al., 2001; Swan, 2003). Thus, a user's personal perceptions of social presence and the behaviors used to make up for the cues that are filtered out matter just as much, if not more, than a medium's supposed capabilities. This new line of research sparked a renewed interest in the sociability of online learning, social presence, and CMC as evidenced in the increased amount of literature focused on social presence.

Social presence is now a central concept in online learning. For instance, social presence has been listed as a key component in theoretical frameworks for learning networks (Benbunan-Fich, Hiltz, & Harasim, 2005) and distance education (Vrasidas & Glass, 2002). Researchers have shown—in varying degrees—a relationship between social presence and student satisfaction (Gunawardena, 1995; Gunawardena & Zittle, 1997; Richardson & Swan, 2003), social presence and the development of a community of learners (Rourke, Anderson, Garrison, & Archer, 2001; Rovai, 2002), and social presence and perceived learning (Richardson & Swan, 2003). Just as earlier researchers of CMC (Kiesler, 1986; Kiesler, Siegel, McGuire, 1984) used social presence theory to explain why CMC was inherently impersonal, later researchers (Gunawardena, 1995; Tu, 2000) reconceptualized social presence theory—focusing less on the medium and more on people—to explain how CMC in online learning environments can be very personal and social.

SOCIAL PRESENCE AND ONLINE LEARNING

Social presence theory has a complex history. To understand better how this complex history has evolved over the years, it is important to look at influential and related research on social presence, competing theories of social presence, and finally some ways that contemporary researchers define, operationalize, and study social presence.

Influential and Related Research on Social Presence

Short et al. were members of the Communications Studies Group (CSG) at the University College in London. The CSG consisted of roughly 30 researchers conducting experiments in the 1970s on communication media (Pye & Williams, 1977). Interestingly, *The Social Psychology of Telecommunications* appears to be the only joint publication of Short et al. Despite this, each of them conducted a number of studies on the effects of communication media during the 1970s (e.g., Short, 1974; Christie & Holloway, 1975; Christie & Kingan, 1977; Williams, 1975; Williams, 1977; Wilson & Williams, 1977).[1] Their research focused on comparing people's attitudes toward different communication media (e.g., face-to-face, audio, video). The following paragraphs will briefly summarize a few key findings from this early research that later influenced the development of and people's understandings of social presence theory.

The majority of their early research focused on the assumed importance of the visual channel of communication. Short (1974), Christie (1974), and Williams (1975) initially found that communication media were strengthened by the addition of a visual channel. Christie (1974) reported from one study that,

> *visual media were ... more useful for complex group discussions, private conversations and non-private dyadic conversations. Thus, the presence of visual channel appears to be perceived as an important advantage of a communications medium. (p. 367)*

However, as more research was conducted (e.g., Christie & Kingan, 1977; Williams, 1975), it became apparent that the value of a visual channel was more situational than originally thought. For instance, research began to show that the importance of a communication medium depended largely on the task at hand. In fact, according to Christie (1974), "it is clearly misleading to conceptualize different media as lying along a single dimension of acceptability or usefulness. Their perceived usefulness varies according to the application considered" (p. 368). People might want a less intimate or immediate communication medium for certain tasks (Williams, 1975). For instance, Williams (1975) suggested "that with tasks of very high intimacy—perhaps very embarrassing, personal or conflictual ones—the least immediate medium, the telephone, would lead to more favorable evaluations than either or the more immediate media" (p. 128). Further, Williams (1978a) showed that tasks that are low on interpersonal involvement and cooperative in nature can easily be accomplished by audio or video conferencing; however, tasks that are higher on interpersonal involvement "are sensitive to the substitution of telecommunications for face-to-face interaction" (p. 127).

For the most part, these early communication researchers were not concerned with the role the visual channel of communication had on educational or instructional tasks. Williams (1978a) though argued that "tele-education seems especially promising since educational activities are primarily for cooperative problem-solving and the transmission of information—activities which have been shown to be almost unaffected by the medium of communication used" (p. 129). Williams (1978a) intelligently pointed out though in the very same article that our knowledge about the role of mediated communication is far from complete—as was our understanding of how people learned in the late 1970s.

Their later research, among other things, showed that while visual cues are helpful, they are not necessary for people to communicate effectively (Christie & Kingan, 1977, p. 272). Also, contrary to previous theories, Williams (1978b) found that physical presence may be even more important for people communicating than visual communication (p. 101). Results like these began to call for a more complex explanation for the role of visual cues in the communication process, which Williams (1978b) thought might be found in social presence theory.

Competing Theories of Social Presence

The theory of social presence developed by Short et al. (1976) was only one of a number of theories used to explain the influence communication media have on communication. Three popular competing theories of social presence—especially during the 1980s—were *Cuelessness Theory* developed by Rutter (1984, 1987), *Media Richness Theory* developed by Daft & Lengel (1984, 1986; Daft, Lengel, & Trevino, 1987), and *Social Information Processing Theory* developed by Walther (1996; Walther & Parks, 2002). The first two theories (like Social Present theory) have been described as deficit models because they focus on the cues that are filtered out while idealizing face-to-face communication as the gold standard of communication (Thurlow, Lengel, & Tomic, 2004). Each of these competing theories will be addressed briefly in the following sections in an effort to illustrate the zeitgeist of the 1980s and early 1990s—a time that led to the reconceptualization of Short et al.'s theory of social presence.

Cuelessness. Working from a similar theoretical framework as Short et al. (1976), Rutter (1984, 1987; Rutter, Pennington, Dewey, & Swain, 1984; Kemp & Rutter, 1986) developed the cuelessness model. Rutter was concerned with the over-emphasis placed on the importance of eye- contact when two people communicate. As a result, he and his colleagues (1984) set forth to challenge the intimacy model developed by Argyle and Dean (1965) and later Argyle and Cook (1976). They argued that previous research had focused too much on looking and eye-gaze and not enough on the mutual gazing back and forth. Like Williams before, Rutter et al. (1986) found that what matters when communicating is visual access to the entire person rather than simply access to another's eyes. Rutter et al. argued that it was the combined social cues—from vision and other senses—that mattered more than simply eye-contact.

The cuelessness model essentially claims that the fewer the number of social cues, the greater the psychological distance between two communicators (Rutter et al., 1984). Further, Rutter and his colleagues argued that the greater the psychological distance between two people the more likely communication will be task oriented and depersonalized (Kemp & Rutter, 1986; Rutter, 1984; Rutter et al., 1986). In fact, Rutter (1989) and colleagues found that the number of social cues—that is, both visual and physical presence cues—decreased when people used a closed-circuit television (i.e., visual cues), versus a curtain and wooden screen (i.e., no visual cues), versus audio (i.e., neither visual or physical cues) to communicate with each other.

Media Richness. Another competing theory that emerged during the 1980s is the theory of media richness. Daft and Lengel (1984, 1986) developed the theory of media richness. Whereas Rutter and colleagues were aware of the work of Short et al., Daft and Lengel never explicitly acknowledge the work of Short et al. (1976). Daft and Lengel (1984) were focused primarily on information processing behaviors in organizations. More specifically, they were interested in a concept they called information richness

Richness is defined as the potential information-carrying capacity of data. If the communication of an item of data, such as a wink, provides substantial new understanding, it would be considered rich. If the datum provides little understanding, it would be low in richness. (p. 196)

They posited that communication media can determine the richness of information (Daft & Lengel, 1986). They argued that face-to-face communication has the highest richness whereas numeric communication (e.g., spread sheet with numbers) has the lowest. According to Daft and Lengel (1986), a "medium's capacity for immediate feedback, the number of cues and channels utilized, personalization, and language variety" (p. 560) all influence its degree of information richness.

Social Information Processing. The last of the three competing models is the social information processing model developed by Walther (1992, 1994, 1996). Walther developed his model in response to the previous "deficit" theories. Whereas previous researchers were interested in media effects across various communication media, Walther focused primarily on CMC. He criticized previous research, like that addressed earlier in this chapter, for a number of reasons. First, the majority of the early research was conducted in experimental settings that failed to mirror how people communicate with different media in the real world (1992). Second, these early studies and researchers assumed that the absence of visual cues led to an absence of sociability. Third, they assumed that task-oriented communication lacked relational and social communication. And fourth, they failed to acknowledge that just as cues are filtered out, other cues are filtered into CMC and therefore CMC has some affordances that face-to-face communication does not (Walther, 1996; Walther & Parks, 2002).

Walther (1992) argued that human's social nature is the same in CMC and face-to-face environments. Given enough time, he believed that people will finds ways to compensate for any cues that are filtered out in CMC. The social information processing model essentially posits that given enough time, CMC can be very personal and even hyperpersonal (Walther, 1992, 1996). Previous research tended to put time restrictions that Walther believes diminished the possibility of interpersonal and relational communication. Walther also found that previous interaction between communicators influenced how people communicated online. Further, Walther (1994) found that the possibility of future interaction influenced the degree to which people socially interacted online. Finally, he found that the way users used emoticons also influenced interpersonal communication online. In summation, Walther's social information processing model argued that "given the same investment of time and commitment, relational quality in CMC will be the same as face-to-face communication" (Thurlow, Lengel, & Tomic, 2004, p. 249)

These competing theories, as illustrated in Figure 1, help illustrate the way that thinking about a medium's effect on communication—especially interpersonal and social communication—changed over time. Research on social presence and online learning, that began with the work of Gunawardena (1995; Gunawardena & Zittle, 1997)—which I consider the third phase of social presence research (see Table 1)—was influenced by this previous research and theories, especially that of Walther. Rather than conceptualizing social presence as Short et al. (1976) did, Gunawardena and those that followed her (most notably is Garrison, Anderson, and Archer, 1999) began reconceptualizing social presence theory—moving away from a technological deterministic conceptualization of mediated communication.

Defining Social Presence

Given the evolution of social presence theory, it is probably not surprising that there is not a clear, agreed upon, definition of social presence (Rettie, 2003; Tu, 2002b). In fact, nearly everyone who writes about social presence seems to define it just a little differently. To complicate matters, related terms such as presence, copresence, and telepresence are used to describe similar things (and sometimes even the same thing) as social presence.

Figure 1. Timeline of competing theories of social presence

Presence is a key theoretical construct used in a variety of disciplines besides communication and online learning—most notably virtual reality (see Biocca, 1997). In fact, Lombard and Ditton (1997) identified six interrelated (and cross-disciplinary) but distinct ways people understand "presence": (a) presence as social richness, (b) presence as realism, (c) presence as transportation, (d) presence as immersion, (e) presence as social actor within medium, and (f) presence as medium as social actor. They even attempted to create one *all* encompassing definition of presence. According to Lombard and Ditto, the following definition takes into consideration all six ways presence is understood; presence is "the perceptual illusion of nonmediation" (presence explicated section). To date, though, Lombard and Ditto's all encompassing definition has not received wide spread adoption—especially by researchers of online learning. Lombard and Ditton, though, were not alone; Biocca, Harms, and Burgoon (2003) also recognized the different ways researchers across different fields defined presence. They also created an all-encompassing definition of social presence; they defined social presence as simply the "'sense of being with another'" (p. 456) whether that other is human or artificial.

Despite attempts by Lombard and Ditto (1997) and Biocca et al. (2003) to develop some conceptual clarity about presence in general or social presence in particular, researchers of social presence and CMC in educational environments continue to redefine and categorize social presence (Picciano, 2002). For Gunawardena (1995),

Table 1. Phases of social presence research

Phase	Period	Key Figures	Focus of Research
Phase 1	1970s	Short et al.	Focused on Telecommunications
Phase 2	1980s-early1990s	Rutter Daft & Lengel Kiesler Walther	Focused on CMC
Phase 3	Early/mid 1990s-Present	Gunawardena Rourke et al. Tu Swan	Focused on Online Learning

social presence was "the degree to which a person is perceived as a 'real person' in mediated communication" (p. 151). Garrison et al. (2000), on the other hand, defined social presence "as the ability of participants in a community of inquiry to project themselves socially and emotionally, as 'real' people (i.e., their full personality), through the medium of communication being used" (p. 94). Tu and McIsaac (2002) defined social presence as "the degree of feeling, perception, and reaction of being connected by CMC to another intellectual entity through a text-based encounter" (p. 140). Finally, for Picciano (2002), social presence in an online course "refers to a student's sense of being in and belonging in a course and the ability to interact with other students and an instructor" (p. 22).

Definitions of social presence, at least for researchers of social presence and online learning, tend to fall on a continuum. At one end of the continuum, researchers tend to conceptualize social presence as the degree to which a person is perceived as being "real" and being "there." These definitions tend to focus on whether someone is able to project him or herself as being "real" in an online environment and whether others perceived this person as being there and being real. In fact, Williams (1978a) defined social presence in this way when he defined social presence as "the feeling of contact obtained…" across various communication media (p. 127). At the other end of the continuum, researchers tend to go beyond whether someone is perceived as being "present"—that is, simply "there" or "real"—but focus on whether there is an interpersonal emotional connection between communicators. It is important to note, though, that on this end of the continuum, there tends to be an assumption that the interpersonal and emotional connection that communicators establish when there is social presence is a positive connection (Wise, Chang, Duffy, & Del Valle, 2004). Finally, like most continuums, the majority of researchers find themselves somewhere in the middle—placing a little bit of emphasis on an emotional connection—rather than on the ends of the continuums.

Operationalizing and Measuring Social Presence

The differences in how researchers define social presence might seem minor but they end up having significant consequences on how people conceptualize social presence. For instance, Garrison et al. focused on students (or instructors) ability to project themselves as "real" whereas Picciano focused more on student's sense of belonging to a community. Issues of definition are important because the way researchers define social presence influences how they measure social presence and the conclusions they draw.

After all the theorizing, researchers need to be able to identify, measure, and test their theories about social presence. As researchers of CMC and online learning began to reconceptualize social presence, rather than use the techniques developed and utilized by past researchers—perhaps in part because of Walther's critique of these techniques—they began to look for new ways to study social presence. Gunawardena and Zittle (1997), Rourke et al. (2001), and Tu (2002b) have each been very influential in developing ways to study social presence. But just like in the mid-1970s—when researchers either studied social presence by observing user behavior or examining users attitudes (Christie, 1974)—researchers in this third wave of social presence research have tended to either focus on user's attitudes or behaviors online. For instance, Gunawardena and Zittle as well as Tu focused primarily on studying user's attitudes whereas Rourke et al. focused on studying user's behaviors. Regardless of their focus, these researchers have heavily influenced most of the studies on social presence and CMC. Therefore, in the following paragraphs, I briefly summarize how each of these researchers studied social presence.

Social Presence Scale. Gunawardena (1995; Gunawardena & Zittle, 1997) conducted some of the earliest studies on social presence and CMC in an education setting. In her first article, Gunawardena (1995) had student's rank 17 bi-polar scales on a 5-point likert-type scale (from negative to positive). For instance, she asked students whether CMC was more socialable or unsocialable or more warm or cold. The bi-polar scales she used appear to focus on user's perceptions of the medium more than the degree to which others are perceived as "real" or "there." In a later more influential article, Gunawardena and Zittle (1997) reported on additional data collected with an instrument called the Social Presence Scale. The Social Presence Scale was similar to the previous scale used by Gunawardena, but instead of responding to bi-polar scales (which were similar to the semantic differential technique used by Short et al.), students were asked to rank 14 questions on a scale of 1 to 5. For instance, one question asked students to rank, on a scale of 1 to 5, to what degree they agree or disagree that, CMC is an excellent medium for social interaction. The Social Presence Scale was tested for internal consistency (Alpha = .88); Gunawardena and Zittle concluded that it investigated the construct of social presence more directly than the previous scale.

Social Presence Indicators. Unlike Gunawardena and Zittle who measured social presence through a self-report questionnaire, Rourke et al. (2001) sought to measure social presence through analyzing online discussions. Rourke et al. identified three different categories of social presence: affective responses, interactive responses, and cohesive responses. They then developed twelve indicators that researchers could use to analyze transcripts of CMC (primarily through content analysis). For instance, the indicators of affective responses are the expression of emotions, use of humor, and self-disclosure. Rourke et al. developed these categories and indicators based on their previous work (Garrison, Anderson, & Archer, 1999; Rourke, Anderson, Garrison, & Archer, 2001), other literature in the field, and finally their experience reading online transcripts.

Rourke et al. tested and measured the "efficacy and reliability" of their categories and indicators by using them with participants in two graduate education online courses. Other than latent variables (e.g., expression of emotion and use of humor), they had high interrater reliability. However, Rourke et al. cautioned readers about generalizing their results because their main purpose was to "develop and test the efficacy of a tool for analyzing the social presence component of educational computer conferences" (Discussion section) rather than to draw conclusions specifically about the samples in question. They also acknowledged that they were still unclear whether all 12 indicators should be weighted equally—which later researchers have questioned (Hughes, Ventura, and Dando (2007)—as well as whether or not there is an optimal level of social presence. In fact, Garrison mentioned in a round table presentation at the 2008 annual meeting of the American Educational Research Association (AERA) that these indicators might need to be revisited to ensure that they do not need to be revised (Arbaugh, et al., 2008).

Social Presence and Privacy Questionnaire. Tu (2002b) criticized early research on social presence that used the same semantic differential technique as Short et al. (1976) (e.g., Gunawardena, 1995). Tu argued that this technique is not an adequate measure one's perception of social presence when it comes to CMC. He also argued that the Social Presence Scale developed by Gunawardena and Zittle (1997) failed to take into consideration different variables cited in the research (e.g., recipients, topics, privacy, task, social relationships, communication styles). As a result, Tu (2002b) developed The Social Presence and Privacy Questionnaire (SPPQ).[2] Tu developed the SPQQ by using parts of Steinfield's (1986, as cited in Tu, 2002b) CMC attitude instrument and Witmer's (1997, as cited in Tu, 2002b) perceived privacy instrument.

Tu tested the content validity and the construct validity of his instrument. Five factors emerged from the factor analysis: social context, online communication, interactivity, system privacy, and feelings of privacy; these five factors accounted for 82.33% of the variance with Cronbach's alpha values ranging from .74 to .85. While Tu acknowledged that online privacy had a weak correlation and therefore might need to be removed as a dimension of social presence, he continued to use online privacy as a dimension of social presence in later studies (Tu & Corry, 2004; Tu & McIsaac, 2002). Despite the strengths of his survey, Tu and McIsaac (2002) later determined as the result of a mixed method study, using the SPPQ and a dramaturgy participant observation qualitative approach, that there are "more variables that contribute to social presence" than previously thought. Therefore, Tu and McIsaac concluded that social presence was more complicated than past research suggested. Specifically, they found that the social context played a larger role than previously thought.

These three examples are evidence that there is still little agreement on how to measure social presence (Lin, 2004; Stein & Wanstreet, 2003). Just as Tu criticizes how Gunawardena measured social presence, others have criticized and modified Tu's work (Henninger & Viswanathan, 2004). Also, while social presence has been presented as a perceptual construct, Hostetter and Busch (2006) point out that relying solely on questionnaires (i.e., self-report data) can cause problems because "respondents may be providing socially desirable answers" (p. 9). Further, Kramer, Oh, and Fussell (2006) point out that self-report data "are retroactive and insensitive to changes in presence over the course of an interaction [or semester]" (p. 1). But at the same time, even the scale created by Rourke et al. (2001a) has been modified by Swan (2003) and later by Hughes, Ventura, and Dando (2007); moreover, Hughes et al. also questioned the usefulness of "reducing social presence to an overall number" (p. 27) as Rourke et al. did.

Researchers need "a multifaceted presence instrument, one that examines presence more than single items and addresses the construct more by evaluating specific behaviors rather than a global effect" (Russo & Benson, 2005, p. 60). However, it is likely that any multifaceted instrument would be influenced by the work of Gunawardena and Zittle (1997), Rouret et al. (2001), and/or Tu (2002b) because most researchers continue to use (or adapt) the instruments created by these researchers. Therefore, any study of social presence should at least acknowledge how its methodology has been influenced by these early pioneers.

FUTURE TRENDS

Despite failing to meet initial estimates of growth (Shank & Sitze, 2004), enrollments in online courses and programs continue to grow dramatically each year (Allen & Seaman, 2006; Tallent-Runnels et al., 2006). This growth, coupled with the people's concerns with the Internet, will nearly ensure that researchers, policy makers, and practitioners will continue to debate the sociability of the Internet and the role that online learning should play in our future (Wray, Lowenthal, Bates, & Stevens, 2008). The third wave of research on social presence will likely give birth to a fourth wave of research on social presence. During the fourth wave, it is likely that researchers will begin to employ multiple and mixed method approaches (e.g., like the work of Swan and Shih, 2005) of studying social presence that focus on, among other things, the socially situated and contextual nature of social presence. Further, researchers and practitioners alike will have to consider a new host of things related to social presence with the continued blurring of boundaries between classroom and fully online courses as well as between course bound communication tools (e.g., discussion forums) and non-course bound tools (e.g., Facebook and Twitter) (Dunlap & Lowenthal, 2009; Lowenthal, 2009a; Lowenthal & Dunlap, 2007;).

CONCLUSION

Despite initial concerns about the sociability of the Internet, researchers of social presence and CMC have demonstrated that indeed online learners can project themselves online and be perceived as being there and being real (Lowenthal, 2009b). However, given the history and evolution of social presence theory, coupled with the multitude of ways that researchers define and operationalize social presence, researchers as well as practitioners must begin to question what we know and do not know about social presence. Regardless of one's perspective, one thing is clear, researchers need to continue to study social presence using multiple and mixed methods as well as how it manifests and changes in different contexts.

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ENDNOTES

[1] They each appeared to have taken part in and written a number of studies with the Communication Studies Group. See Williams (1977), Pye & Williams (1977), and Johansen (1977) for a summary of the results of some of the unpublished research conducted by Short et al.

[2] In a different article, Tu (2002a) refers to the SPPQ as the CMC Questionnaire; however, he tends to refer to it more often as the SPPQ and therefore SPPQ will be used to refer to this instrument.

This work was previously published in Online Education and Adult Learning: New Frontiers for Teaching Practices, edited by T. T. Kidd, pp. 124-139, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 1.11
Social Presence

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INTRODUCTION

Learning is a social process (Harasim, 2002; Swan & Shea, 2005; Tu, 2000). Discourse plays a key role in the social process of learning (Harasim, 2002). Therefore, it is extremely important that we understand how students and teachers socially interact in online courses where asynchronous computer-mediated communication (CMC) is the major form of discourse. Theories of social presence help explain how students and teachers interact and learn online.

BACKGROUND

Short, Williams, and Christie (1976) are credited with developing the initial theory of social presence. Short et al. developed their theory of social presence to explain the effects a communication medium can have on the way people communicate. Working from previous research in psychology and communication (i.e., Argyle and Dean's concept of intimacy and Wiener and Mehrabian's concept of immediacy), Short et al. defined social presence as the degree of salience (i.e., quality or state of being there) between two communicators using a communication medium. They conceptualized social presence as a critical attribute of a communication medium that can determine the way people interact and communicate. Further, they posited that people perceive some communication media as having a higher degree of social presence (e.g., video) than other communication media (e.g., audio).

In the late 1980s and early 1990s, as the popularity of CMC grew, communication researchers began to apply the theory of social presence developed by Short et al. to CMC. Many of these early researchers came to the conclusion that CMC was antisocial and impersonal because social context cues were filtered out (see Walther, 1992).

In the mid 1990s, researchers with experience using CMC for educational purposes began to question whether the attributes of a communication medium determined its social presence (Garrison, Anderson, & Archer, 2000; Gunawardena, 1995; Gunawardena & Zittle, 1997; Swan, 2003b; Walther, 1996). They argued that a user's personal

DOI: 10.4018/978-1-60566-198-5.ch280

perceptions of presence mattered more than the medium's capabilities. They also illustrated that contrary to previous research, CMC can be very social and personal (Gunawardena, 1995; Gunawardena & Zittle, 1997) and even hyperpersonal (Walther, 1996).

MAIN FOCUS: SOCIAL PRESENCE

Definitions of Social Presence

There is not a clear, agreed upon, definition of social presence (Rettie, 2003; Tu, 2002). Instead, researchers continue to redefine it (Picciano, 2002). For instance, Gunawardena (1995) defined social presence as the degree to which people are *perceived* as "real" in CMC. Garrison et al. (2000), on the other hand, defined social presence as the ability of students "to *project* themselves socially and emotionally, as 'real' people" (p. 94). Tu and McIsaac (2002) defined social presence as "the degree of feeling, perception, and reaction of being connected by CMC" to another person (p. 140). Finally, Picciano (2002) defined social presence as student's perceptions of being in and belonging in an online course. Nearly everyone who writes about social presence continues to define it just a little differently; therefore making it very difficult for both researchers and practitioners to come to any firm conclusions about the nature of social presence.

Measuring Social Presence

Just as social presence is difficult to define, it is even harder to measure. There is little agreement on how to measure social presence (Hughes, Ventura, & Dando, 2007; Lin, 2004; Stein & Wanstreet, 2003). In fact, very few researchers have operationalized social presence into observable and measurable parts. The surveys and coding schemes developed by Gunawardena (1995; Gunawardena & Zittle, 1997), Rourke et al. (2001), and Tu (2002b) have influenced the majority of research on social presence (e.g., Baskin & Henderson, 2005; Hostetter & Busch, 2006; Hughes, Ventura, & Dando, 2007; Lin, 2004; Lomicka & Lord, 2007; Na Ubon & Kimble, 2004; Richardson & Swan, 2003; So, 2005; So & Brush, 2007; Stacey, 2002; Swan, 2002, 2003a; Swan & Shih, 2005; Wise, Chang, Duffy, & Del Valle, 2004).

Gunawardena (1995; Gunawardena & Zittle, 1997) and Tu (2002) created surveys to measure social presence based on past literature in the field. Whereas Gunawardena (1995; Gunawardena & Zittle, 1997) and Tu (2002) focused primarily on surveying and interviewing students about their *perceptions* of CMC and social presence, Rourke et al. (2001) focused on identifying observable behaviors used by students to project themselves as "real" people. More specifically, Rourke et al. identified three categories and twelve indicators of social presence from their previous work, other literature in the field, and experience reading online transcripts (see Anderson, Rourke, Garrison, & Archer, 2001; Garrison, Anderson, & Archer, 2001; Rourke, Anderson, Garrison, & Archer, 2001); the categories and indicators of social presence are listed in Table 1.

Table 1. Categories and Indicators of Social Presence

Categories	Indicators
Affective	Expression of emotions Use of humor Self-Disclosure
Interactive	Continuing a thread Quoting from other messages Referring explicitly to other messages Asking questions Complimenting, expressing appreciation, expressing agreement
Cohesive	Vocatives Addresses or refers to the group using inclusive pronouns Phatics / Salutations

Note. Adapted from Rourke et al. (2001).

Tu and McIsaac (2002) later argued though—as the result of a mixed methods study they conducted—that social presence is more complicated than previously thought. As a result, they identified additional dimensions and variables of social presence (see Table 2).

Because of differences like these, Russo and Benson (2005) argue that there is a need for a multi-method approach and instrument to measure social presence. However, most researchers seem content to use (or adapt) the instruments and coding schemes created by Gunawardena and Zittle (1997), Rourke et al. (2001), or Tu (2002).

Effects of Social Presence

Despite the differences in definitions and methodology, researchers of social presence have come to similar conclusions about the nature of social presence in online learning environments. The following section highlights a few of the main findings.

Researchers have found a relationship between social presence and student satisfaction in online learning environments (Gunawardena, 1995; Gunawardena & Zittle, 1997; Hostetter & Busch, 2006; Richardson & Swan, 2003; Russo & Benson, 2005; Swan & Shih, 2005).

For instance, Richardson and Swan (2003) found that students who were identified as having high social presence online were highly satisfied with their instructor; further, Richardson and Swan found a link between student satisfaction with their instructor and perceived learning. While Russo and Benson (2005), like Richardson and Swan, found a relationship between student satisfaction with learning and instructor presence, they interestingly found a stronger relationship between student satisfaction and the perceived presence of other students. Therefore, suggesting that it is just as important for instructors and students to establish and maintain social presence in online learning environments.

Social presence has also been found to influence online interaction. Learner-to-learner interaction is motivating and stimulating for students (Moore & Kearsley, 2005) as well critical in learning (Richardson & Swan, 2003). Social presence is directly related to learner-to-learner interaction (Tu, 2000). That is, students need to interact with their peers to be perceived as being “there” and being “real.” Tu & McIsaac (2002)

Table 2. Dimensions and Variables of Social Presence

I. Social Context	II. Online Communication	III. Interactivity	IV. Privacy
Familiarity with recipients	Keyboarding and accuracy skills	Timely Response	Formats of CMC
Assertive / acquiescent	Use of emoticons and paralanguage	Communication Styles	Access and Location
Informal/formal relationship	Characteristics of real-time discussion	Length of Messages	Patterns of CMC
Trust relationships	Characteristics of discussion boards	Formal/Informal	
Social relationships (love and information)	Language skills (reading, writing)	Type of tasks (planning, creativity, social tasks)	
Psychological attitude toward technology		Size of Groups	
Access and location		Communication strategies	
User’s characeristics			

Note. From Tu and McIsaac (2002).

conducted a mixed methods study in which they found that social presence influences online interaction. However, they also found out that the quantity or frequency of participation online did not necessarily result in high social presence; rather, it is the quality of interactions online that make the difference.

Finally, researchers have investigated the relationship between social presence and student learning. Picciano (2002) found a strong relationship between "students' perceptions of their interaction … and their perceptions of the quality and quantity of their learning" (p.28). Focusing more on perceived learning, Richardson and Swan (2003) found a relationship between student satisfaction with their instructor and perceived learning. Finally, Russo and Benson (2005) found a statistically significant relationship between student perceptions of their own presence and the points they earned in a class. Research on social presence and online learning, though, is based on an assumption that social presence enhances learning. Therefore, despite these positive results, there is a need for additional research on the relationship between social presence and student learning (Swan & Shea, 2005).

Establishing and Maintaining Social Presence

Every member of an online learning community is responsible for establishing and maintaining social presence. However, an online instructor has some additional responsibility to help establish and maintain social presence in a course (Anderson, Rourke, Garrison, & Archer, 2001; Gunawardena, 1995); this added responsibility is often understood as teaching presence.

Garrison, Anderson, and Archer (2000) were the first to coin the term teaching presence as one of the three elements of their community of inquiry framework. They defined teaching presence as "the design, facilitation, and direction of cognitive and social process for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes" (Anderson, Rourke, Garrison, & Archer, 2001, p. 5).

Regardless of whether researchers of social presence fully adopt the community of inquiry framework (Garrison et al.) or the concept of teaching presence, most researchers seem to agree that it is the instructor's responsibility to create a space for social interaction and an opportunity for a learning community to form (Gunawardena, 1995; Stacey, 2002). Given the important role that both students and instructors play in developing and maintaining social presence, Aragon (2003) identified a number of strategies used to establish and maintain social presence (see Table 3). Aragon (2003) differentiated between course design strategies (e.g., limiting class size), instructor strategies (e.g., providing frequent feedback), and participant strategies (e.g., sharing personal stories). A number of the strategies identified for instructors and participants (i.e., online learners) are the same (e.g., contributing to the discussion boards, using humor, using emoticons). Therefore, instructors can model for student's effective ways to establish and maintain social presence in online learning environments—which can ultimately increase student satisfaction, learner-to-learner interaction, and possibly even student learning.

FUTURE TRENDS

The Internet is a social medium (Baym, Zhang, & Lin, 2004; Walther & Parks, 2002); it can bring people together but at the same time separate them (Morahan-Martin & Schumacher, 2003). Education is a social practice (Lafey, Lin, & Lin, 2006; Shea, Frederickson, Pickett, Pelz, & Swan, 2001); therefore, online learning environments must be able to support the social practice and process of learning (Shea et al., 2001). The construct of social presence, and research on social presence, help explain how the social practice and process of learning takes place online. Therefore, as

Table 3. Strategies to Establish and Maintain Social Presence

Course Design:	Instructors:	Participants:
• Develop welcome messages • Include student profiles • Incorporate audio • Limit class size • Structure collaborative learning activities	• Contribute to discussion boards • Promptly answer e-mail • Provide frequent feedback • Strike up a conversation • Share personal stories and experiences • Use humor • Use emoticons • Address students by name • Allow students options for addressing the instructor	• Contribute to discussion boards • Promptly answer e-mail • Strike up a conversation • Share personal stories and experiences • Use humor • Use emoticons • Use appropriate titles

Note. Adapted from Aragon (2003)

enrollments in online learning continue to grow each year, the construct of social presence will become even more important. As CMC continues to change and evolve with the development of new ways to communicate online (e.g., Twitter), practitioners will continue to find new ways to adapt how they communicate in order to project themselves as being "real" and to connect emotionally and socially with others.

CONCLUSION

Social presence is a complex construct initially developed to explain the effect a communication medium can have on how people communicate. Over time, though, research on social presence and CMC has shown that personal perceptions of social presence and adaptations people make with how they communicate matter more than the objective qualities of a communication medium. Further, research has shown that learner's perceptions of social presence are related to their satisfaction with the course, the instructor, and at times their learning.

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KEY TERMS AND DEFINITIONS

Computer-Mediated Communication: Asynchronous (e.g., email or threaded discussions) or synchronous communication (e.g., chatting) conducted via a computer.

Immediacy: Psychological distance between communicators.

Interaction: The combined or reciprocal action of two or more people or objects that have an effect on each other; in online learning environments, interaction is often understood as learner to content, learner to instructor (and instructor to learner), learner to learner, and learner to interface interactions.

Intimacy: A communication concept that explains how people will adjust their behavior—whether online or face-to-face—to maintain a sense of equilibrium.

Online Learning Community: Broadly defined as a group of people with shared interests who come together online to collaboratively learn together.

Social Presence: The degree to which a person is perceived as being real and being there in mediated communication.

Teaching Presence: The design, facilitation, and direction of cognitive and social process for educational purposes.

This work was previously published in Encyclopedia of Distance Learning, Second Edition, edited by P. Rogers; G. Berg; J. Boettcher; C. Howard; L. Justice; K. Schenk, pp. 1900-1906, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.12
Reconceptualising Information Literacy for the Web 2.0 Environment?

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ABSTRACT

This chapter questions whether the shift from the Web as a vehicle for storing and transmitting information to the new Web as a series of social networking environments, requires significant changes in how students interact with information when they are studying within a formal learning environment. It explores the origins and growth of the idea of information skills development, the translation of this work into frameworks and sequential models and the adaptation of these models to take account of changes in information storage and transmission brought about by the Internet. The chapter then examines the changing contexts and changes in learning being brought about by the Web 2.0 environment and questions whether adjustment of existing information literacy models is a sufficient response to deal with these changes. We conclude that although Web 2.0 developments are not fundamentally undermining the nature of teaching and learning they do provide important possibilities for more effective information literacy development work. A non-sequential framework is offered as a contribution to supporting HE students when seeking to obtain, store and exploit information simultaneously in the informal social world of Web 2.0 and in their formal academic discipline.

DOI: 10.4018/978-1-60566-208-4.ch022

THE RISE OF INFORMATION SKILLS

In the early 1980s a spate of books appeared in the UK containing a new term in the title: 'information skills'. This term was the brainchild of a working party concerned about school pupils' competence in *"using libraries, exploring references and making notes"* (Marland, 1981, p7) and arose out of the Schools Council's desire to explore what a curriculum for a changing world might comprise. The working party report asserted that *"Individuals today have an increasing need to be able to find things out…never before have our lives depended so much on our ability to handle information successfully"* (Marland, 1981, p9). Narrow concerns about library skills and user education were replaced by a focus on students' problems in finding and using information to tackle assignments and conduct their research within a formal learning environment. This intervention was due to the interest in these skills by educationalists, who, working alongside librarians, ensured wider adoption for information skills and a clearer place for the concept within the learning process.

However, despite this development and the appearance of a number of books exploring the place of information skills in learning (see, for example, Markless and Lincoln, 1986, and Wray, 1985) the concept of information skills was far more widely accepted by librarians than by teachers. This resulted in heavy emphasis on competence in resource use and on finding information.

Models of Information Skills

From the outset writers wanted to show the need for students to develop these 'new' information skills. The issue was presented as one of skills deficit and consequently led to a plethora of information skills frameworks and models, spelling out what students should be able to do. (Many of these models were later 'rounded up' and described by Loertscher and Woolls, 2002.) Model constructors conceived the requisite process as tying together distinct elements of information-related behaviour into a logical, sequential process which could then be taught (e.g. Marland, 1981; Brake, in Markless and Lincoln 1986).

An important retrospective review of these models and frameworks (Eisenberg and Brown, 1992) concluded that

"while each author may explain this process with different terms … all seem to agree on the overall scope and the general breakdown of the process … it appears that the various process models are more alike than different and it may be possible and desirable to begin speaking about a common process approach to library and information skills instruction." (p. 7)

The approach to information skills as a 'common process' to be applied to library research and information handling unfortunately tended to result in a disregard for the context of learning. Skills were perceived as generic; the sequential process outlined in the models was to be adopted at all ages and across different subjects. The process formed a 'curriculum' to be taught to students and applied by them whenever necessary. This view was hardly challenged in the early world of information skills although research on information behaviour in context and on critical thinking skills was calling into question the whole notion of easy transfer, which is also a well-established assumption in mainstream education (Perkins and Salomon, 1992).

Perhaps the most influential of these generic information skills models was advanced as the Big6. This model was created by Eisenberg and Berkowitz (1990); it was widely disseminated in book form and continues to be heavily promoted in the USA and internationally through their website and through an extensive programme of workshops. We will use this Big6 framework as the basis of our critique for the remainder of this chapter because it is one of the frameworks most widely used in USA and UK schools to support information skills teaching and because its authors were amongst the first to integrate ICT into information skills in a distinct and transparent manner.

The Big Six Skills™ Approach

The main elements of this model are outlined below:

1. Task Definition: (determine the purpose and need for information)

Define the problem
Define the information requirements of the problem

2. Information Seeking Strategies: (examining alternative approaches to acquiring the appropriate information to meet needs)

Determine the range of possible resources
Evaluate the different possible resources to determine priorities

3. Location and Access: (locating information sources and information within sources)

Locate sources (intellectually and physically)
Finding information within resources

4. Use of Information: (using a source to gain information)

Engage (e.g. read, hear, view) the information in a source
Extract information from a source

5. Synthesis: (integrating information drawn from a range of sources)

Organize information from multiple sources
Present information

6. Evaluation: (making judgements based on a set of criteria)

Judge the product (effectiveness)
Judge the information problem-solving process (efficiency)
Eisenberg and Berkowitz (1990)

It is not surprising that when the concept of information skills was new, and people sought to understand its scope, frameworks such as the Big6 were widely adopted. They provided a foundation on which to build learning activities and assessment. Would such frameworks survive intact into the 'information age' of ICT?

The Shift to Information Literacy: A Broader View?

With the advent of Worldwide Web and the extensive accompanying investment in ICT in educational institutions of all kinds, concerns about students' ability to find and use information grew exponentially and a new vocabulary began to emerge in formal education - that of information literacy. The notion of information literacy developed in the USA in the 1980s in response to a move towards more active learning in universities and the concomitant need to move away from terms implying passive instruction (Martin, 2006). Use of the term expanded considerably in the 1990s (Bawden, 2001) and has gained some worldwide influence, leading to a declaration by UNESCO (2003) stressing the global importance of information literacy within the information society. A parallel growth in the UK has seen the term widely adopted in academic libraries and national educational bodies (but with most school libraries until now still preferring to focus on information skills - Streatfield and Markless, 2007).

Did the new term signify any fundamental change in thinking or signal a new characterisation of the skills or processes previously called information skills? National Information Literacy Standards in Australia (CAUL, 2001) and the USA

(ACRL, 2000) echoed much of what was in the earlier process models, as did the information literacy model proposed in the UK by the Society of College, National and University Libraries (1999). Despite the fact that 'literacy' is a problematic and contested concept (it has been variously described as encompassing notions of functional competence and skills, of sets of wider cognitive abilities, and as part of a contextualised approach to learning in its social and economic context - Bowden, 2001), information literacy was usually reduced in presentation to a series of skills, procedures and technicalities. This inhibited approach attracted some criticism for being too mechanistic and some writers moved towards a conceptualization that includes attitudes, underpinning knowledge and meta-cognitive abilities (Kuhlthau, 1988; Bruce, 1997). Although Kuhlthau recognised the importance of student attitudes and emotions in her information process model, these elements have not been integrated into other process models - although the commentaries accompanying these models usually refer in some way to motivation and attitudes.

Information Skills and the Internet

In this phase of its development, the Internet was viewed primarily as a new information storage and delivery system for which existing information skills frameworks could simply be expanded or adapted to take account of the growth in access to information via the Internet. Eisenberg and Johnson (1996) exemplified this view when they explicitly integrated ICT into the Big6 Skills model, saying that

Students need to be able to use computers flexibly, creatively and purposefully… (they) should be able to use the computer as part of the process of accomplishing their task. (p. 2)

During the 1990s, the creators of the Big6 confidently extended the model to include student use of ICT when solving learning problems. They claimed that various computer and information technology skills were integral parts of the Big6 Skills. This claim was sustained as their model continued to be implemented in schools across the USA and the UK (Eisenberg and Berkowitz, 2000). Adherents of this and other process models confidently asserted that the basic principles of information seeking and use, derived from years of watching and helping students to interact with print-based information, remained unchallenged.

We have chosen to exemplify current process models by citing the Big6 when looking at whether the concept of information literacy needs to be repackaged or reconceptualised because:

- the model crystallizes the general process approach favoured until now and serves as an adequate exemplar of the model-driven approach
- it serves our purpose because it was the only model advanced until recently that systematically encompasses the ICT dimension
- It is still currently being used and promoted in that form.

The Big6 framework is useful for this purpose because it is a systematic and widely adopted model. Our comments should not be construed as an attack on this particular framework.

Examining the Process Models

What are the assumptions underpinning the Big6 and similar models and what are their main characteristics?

- A sequential view of the process of student research, conceived as a series of logical steps

- Use of prescriptive language to convey an 'ideal approach' to information-seeking and use (e.g. "After students determine their priorities for information-seeking they must locate information from a variety of sources"; "once the information problem has been formulated, the student must consider all possible information sources and develop a plan for searching"). This approach is commonplace in this period, despite the warning offered a decade earlier by Tabberer and Altman (1986) about the danger of idealising study behaviour and promoting 'the right way to …' They stressed that success came by diverse routes and as a result of different choices made in different situations. They warned that students did not always gain much by being confronted with 'the ideal' because there is a range of influences that prevent adoption of 'best behaviour'.
- The process models were designed to support information skills teaching (i.e. to provide a 'curriculum' for the teachers and a pathway to be followed by students when doing their research).
- A particular and limited conception of information-related behaviour is represented in these models, with much emphasis on information seeking, location and access. Use of information is reduced to determining relevance and extracting pertinent items of information (by taking notes or resorting to cut and paste). The words knowledge, understanding and making sense of, seldom occur in these models, nor does the idea of creating one's own viewpoint. The apparent assumptions are that this shortcoming will be addressed in the subject teaching or that the acts of extracting and organising relevant information will themselves stimulate the construction of meaning. What happens instead is frequently cut and paste activity leading to more or less unintentional plagiarism. In these models, synthesis is not about transforming information to encapsulate new knowledge
- Overall they present ways to support teaching ("innovative instructional methods") designed to provide a framework to guide teachers or librarians when preparing appropriate activities or tasks for their students.

These models reflected the main uses conceived for the Web in this period as a vehicle for storing and transmitting information.

Information Literacy and Web 2.0: Changing the Context, Changing the Learning?

The 'orthodoxy' of information skills within formal learning environments, as enshrined in the Big6 Model, is being increasingly challenged. Recent research into information literacy is moving away from technological processes and skills-based models, recognising the complexities inherent in finding and using information. A more experiential perspective that recognises the contextual and affective elements of information literacy is emerging (Williams and Wavell, 2007). Two complementary developments have influenced this shift in focus: greater interest amongst information literacy researchers and practitioners in the processes of learning (especially theory about variation in learning and constructivist approaches); and an electronic environment that is increasingly being shaped by its users.

Have traditional views of information literacy really been rendered obsolete? Does learning through Web 2.0 require different skills and abilities? Are a new range of cognitive and metacognitive strategies needed to learn effectively within the Web 2.0 environment? Or, does the Web 2.0 environment provide tools that enable teachers to engage students more effectively in well-established learning processes than could be achieved hitherto?

In our view, learning is not fundamentally different within Web 2.0, nor does the 'new' social software change the basic processes of learning. Where Web 2.0 has made a difference is in making it easier to engage with some aspects of learning that were previously difficult to address (for example, real collaboration and groupwork, peer critique, hearing students' authentic voices and construction of new knowledge). None of these important aspects of effective learning are new: all can be found in the education literature of the 20th Century, from Dewey to Ausubel, and from Vygotsky to Marton. However, despite their importance, few of these elements have found their way into information literacy models or practice.

When the Worldwide Web was primarily a vehicle for storing and delivering information it was easy to portray information literacy as an ordered sequence of skills to be ***transmitted*** to students, whilst ignoring other approaches to learning. Web 2.0 effortlessly undermines this approach with its disregard for authority, hierarchy and order and its focus on the voice of the individual and on ever changing constructed groups. Any contemporary approach to information literacy must consider how to engage more effectively with learners, by understanding these multiple aspects of how they can learn.

Before we examine in a little more detail some of these key elements of learning and their relationship to information literacy and social software, we need to note two other factors that may influence this relationship: the reluctance of individuals and institutions to change; and the ways in which the 'Google generation' of 'digital natives' may interact with information and learn in new and different ways. What are the key elements of learning as they relate to information literacy and social software? Some at least of these key elements are:

1. Reluctance to change (institutions and teachers)

Faced with the unfamiliar challenge of a new world of social networking, some education institutions have tended to react in a predictably conservative way by blocking access to elements such as Face book and Second Life. As a result of such embargos, as well as a reluctance by teachers to engage with this new world, students are frequently operating in different electronic environments during formal learning from those in their out of hours experience (especially in schools). This makes teaching of information literacy more problematic.

To somewhat over-dramatize the dilemmas created: as a teacher, how can you fully engage with students in helping them to exploit information if you don't have easy access to what may constitute their major sources of information? Or, from a student perspective, why should you bother to engage with all this 'information literacy stuff' if your perception is that all you have to do to get the information and help that you need, is to resort to your social networks? When you are away from the institution, if you can effortlessly manipulate multi-media information to build your own web pages, why jump through what might be seen as sterile and irrelevant information literacy hoops when you are in formal learning mode? Again, as the world of Web 2.0 becomes increasingly sophisticated, the version of ICT encountered in formal learning is likely to appear ever more limited and pedestrian.

2. Digital natives and others

" Future students in higher education belong to a generation that has grown up with a PC mouse in their hands, a TV remote control, a mobile phone, an i-pod, a PDA and other electronic devices for communication and entertainment … computer games, the Internet, MSN, wikis and blogs being an integral part of their lives" (Veen, 2007, p.1).

Prensky has labelled these young people 'digital natives' and has asserted that they now exhibit different characteristics from their forbears (the digital immigrants) due to the extent of their exposure to technology in all its forms.(Prensky, 2001). He claims that changes in activity during development may result in different neural wiring via processes of 'neuro-plasticity'; a view recently echoed by Martin Westwell of the Institute for the Future of the Mind (2007). Both advocates assert that current students have much better visual skills, do better at visual-spacial tests, are able to deal with lots of information at once, and can process this information and make decisions quickly. On the other hand, this generation of students may have shorter attention spans, be easily distracted, may not maintain focus well when interrupted and may have less ability to reflect on topics than the previous generation. Veen (2007) adds to this list of differences, talking about non-linear learning behaviour; clicking and zapping to deal with information overload; using exploratory approaches to new situations; and becoming experienced at problem solving at a young age. "We now have a new generation with a very different blend of cognitive skills than its predecessors – the digital natives." (Prensky, 2001)

As a result of Web 2.0 developments, we can also anticipate that 'digital natives' may have different social skills.. This is because the Internet is increasingly used for socialisation rather than just information-seeking, with even those seeking information often doing so via peer groups. Westwell claims that more people use Second Life and Facebook than use Google. Whether or not we believe all these claims, Oblinger and Oblinger (2005) have forecast that the next generation of students entering higher education will be digitally literate, highly Internet-familiar, connected via networked media, used to immediate responses, and preferring experiential learning. This generation will be highly social: they will prefer to work in teams and will crave interactivity in image-rich environments as distinct from text-intensive environments.

Where does this leave traditional information literacy, with its focus on using libraries and finding primary sources, its reliance on laborious sequential steps and its scant reference to collaboration or to multi-media resources? If Westwood and others are correct, their picture of our 'new' students implies that not only have they gained from their early digital experiences but they have also lost in terms of opportunities for reflection and 'slow-learning'. This picture of gains and losses calls into question the widespread claims that elements of Web 2.0 (wikis etc.) automatically help to develop meta-cognitive skills. However, it is also interesting to note that traditional information literacy frameworks do not emphasise reflection and its role throughout learning.

Web 2.0, Information Literacy and Formal Learning

Where do all these changes leave information literacy? How might traditional models of information literacy need to be altered to accommodate the experience and expectations of students within formal education? Where does Web 2.0 fit in?

- The sequential view of skills deployment is now being questioned. Learning tasks make a range of different demands on students, which call into question the notion of applying the same series of steps to meet all these demands. Observations of pupils from 5-18 in schools and students in further education colleges show that they seldom follow the prescribed sequence (Streatfield and Markless, 1994; Moore, 1997; Markless and Streatfield, 2000). Formal studies of information-seeking behaviour in universities again challenge this premise (Foster, 2006). To be fair, most of the process models that are set out in steps are accompanied by some form of caveat recognising or even advising that it is not necessary to follow the prescribed sequence. However, there is usually little help offered on how to use the model in a non-sequential way, with the result that the framework tends to be taught as a sequence. The desire to inflict sequences on students is remarkably resilient in the world of information literacy. Even writers who are responding to the Web 2.0 environment tend to present a sequence of processes to be learned in order to become 'information fluent' (e.g. the five-stage process of Jukes (2007): asking questions; accessing data; analysing and authenticating information; applying it to real-life problems; assessing product and process). This approach takes no account of the influence of context on any sequence, the influence of learners' cognitive styles, or the need to make sense of any information and transform it into knowledge.

In addition, a core characteristic of Web 2.0 tools is that they transfer power, ownership and authority to the participants. This inevitably gives people license to design their own routes through learning tasks in any way that suits them. Finding information is less likely to involve systematic information seeking than, for example, interest groups, peer web pages or social bookmarking.

These observations lead to the key question - can the Big6 or any similar information literacy model be adapted to take account of how students actually find and use information, especially in the Web 2.0 environment?

- Although the importance of learning as construction is recognised within the rhetoric of information skills pedagogy and "Information literacy is often seen as the school library version of constructivism" (Moore, 2005 p.3), much of the observed planning and practice[1] suggests heavy reliance on transmission, learner practice, and feedback, all heavily structured into manageable segments and strongly 'teacher' controlled (that is, the classic behaviourist approach). Early voices such as Kuhlthau's (1993), which present information-seeking as a process of seeking meaning, were at first largely ignored in practice. In recent years there have been intensified efforts to ensure that people who are teaching information literacy adopt constructivist approaches (e.g. Todd, 2001). Limberg (2007) asserts that to learn is not to receive knowledge and information, but is about changing the relationship between a person and the world. She claims that information-seeking is too often focussed on teaching technical procedures and on fact-finding rather than on students formulating authentic questions and constructing their own positions. The concept of authenticity is central to Limberg's ideas on information literacy. Contrived questions and tasks, designed solely to meet externally imposed assessment and with no other consequences for the student, will not engage and motivate students. Without a real and personal interest, students will be satisfied with the superficial answer, the first 'hit', or 'good enough' information. There is no incentive to go beyond using technical skills to collect facts.

Again, the latest outputs from the USA-based Center for International Scholarship in School Libraries (Kuhlthau and others, 2007) focus on the concept of 'guided inquiry' as the basis for teaching and learning of information skills. The main characteristics of guided inquiry are:

- active engagement by students in the learning process
- students building on what they already know
- high levels of reflection
- a recognition of the importance of social interaction and of students' different ways of learning (Kuhlthau and Todd 2007)

All these are recognisable characteristics of learning as construction (see, for example, Papert and Harel, 1991). There is little doubt that constructivist approaches are particularly suited to Web 2.0 tools. In this environment, students can construct artefacts such as video presentations, blog entries and wiki pages both individually and collaboratively. Teachers can join in with collaborative editing and can scaffold students' work. It seems likely that the constructivist approach to teaching and learning so well supported by Web 2.0 tools may finally lead to information literacy teaching becoming more attuned to how students learn.

If constructivist principles are used to inform and guide information literacy work, students will be required to develop a repertoire of strategies that are conspicuously absent from most information literacy models. This will involve:

- reflection: the ability to reflect constructively and to use that reflection in planning for their own development
- evaluation of the processes undertaken as well as of the products of their study
- making sense (deep understanding) of the information that they obtain, linked to the ability to transform the information to reflect their own emerging views

We do not think that these aspects of learning can simply be grafted onto existing frameworks or inserted after any particular element of a linear, sequential model. They are part of an iterative process of learning not well represented in existing information literacy frameworks.

The Importance of Context

The importance of context in relation to information behaviour is well established (e.g. Streatfield and Wilson, 1980; Dervin, 1992; Ingwersen and Jarvelin, 2005). Context in information-related behaviour is recognised as multi-dimensional: with different facets reflecting features of the task; characteristics of the learner; and features of the system. Louise Limberg observed in a conference presentation that "Influential studies have abandoned the idea of information literacy as a set of generic skills applied anywhere. Information literacy is not generic but should be seen as social practice …" (Limberg, 2007). Looking at secondary schools, Williams and Wavell (2007) warned that if we are trying to to develop pupils' information literacy we cannot ignore content in favour of technicalities and procedures - if we do so, we will get trivial learning outcomes. Nevertheless, as we have already noted, information literacy advocates have persisted in offering generic skills development frameworks that take little no account of context.

How can the importance of context be reflected in an information literacy framework? We believe that a different type of framework is needed; one that moves away from offering a list of abilities to be taught or applied in an unvarying sequence, irrespective of context.

Alongside the challenge of producing an appropriate information literacy framework we face another problem: how can we teach information literacy in ways that respect the influence of context? Current views on skills development (e.g. Luke, 2006; Williams and Wavell, 2006) assert that if students are to develop their information-related skills through assignments there is a need for:

- Authentic tasks that are recognised as relevant by the students (tasks that have

meaning to students on a personal or academic level; not contrived to allow them to practice particular skills)
- Immersion in authentic contexts (realistic environments, current information drawn from the real world, engagement with real world problems and concerns)
- High quality tasks related to current academic work (e.g. asking students to conduct critical evaluation of sources to construct a position for an essay, rather than offering general guidance on evaluating information)
- Learning embedded in the relationships, values and discourse of the learning community (inherently social)
- Timely teacher interventions in order to move learners on at transition points in their work

Web 2.0 can once again be a powerful support for increasing authenticity and enabling the deployment of information literacy strategies in a variety of meaningful contexts. The possibility of a public platform for their work may help students to take more seriously the underlying information literacy processes involved in producing that work.

Student Reflection

If we are to take context into account when deciding on information literacy strategies, this immediately introduces the concept of variation. Bowden and Marton (1998) argued that not only do students need to experience variation in order to learn, but they must also explore variation by comparing and analysing their experiences. To do this, students need to:

- actively engage in discussion and reflection about finding and using information in order to uncover variation in their conceptions
- confront variation in their own experience and in the experience of others. (Based on Bruce, 2007, pp. 51-52)

Since at least the 1970s, reflection has been seen as a mainstay of learning and this concept has found its way into many models of learning (e.g. Kolb, 1975; Schon, 1983).

Reflection is a particularly important element in developing the processes underpinning learning and is therefore potentially important in any systematic approach to information literacy. Reflection is taken for granted in most models of information literacy or placed at the very end of the process. This approach in not likely to enable the development of the meta-cognitive strategies necessary to perform problem-solving with information. It is likely to be difficult to integrate reflection into existing information literacy frameworks in any meaningful way (see the discussion about constructivism above). The possibilities for learning provided by Web 2.0 may provide a way forward. For example, peer critique and the collaborative production of artefacts may automatically stimulate reflection. If not, engagement in these processes should provide opportunities for a more formal emphasis on reflection as part of information literacy teaching.

Collaborative Learning

Collaborative learning has long been seen as a desirable process: for example, groupwork is a key element of training courses for teachers in all sectors. Web 2.0 tools have turned many students into sophisticated social networkers via YouTube, Facebook, blogs and discussion boards (Ipsos MORI, 2007). The same tools can also be used to facilitate collaboration in formal learning settings, whether the focus is on creating specific interest groups, building learning communities or enabling the collaborative production and editing of artefacts.

Collaborative learning requires many skills of communication and interaction, but does it make fundamentally different information literacy demands on learners than those made when individually finding and using information? There is little in recent research to indicate that this is the case (Williams and Wavell, 2007; Kuhlthau, 2007). The influence of context (subject, learner characteristics and teacher expectations) is not just about whether students are working individually or in groups to find and use information. At the same time, Web 2.0 can be seen as working counter to collaboration through increased personalisation of learning paths. Overall, this aspect of Web 2.0 raises important issues in the wider context of approaches to learning by providing increased scope for a variety of activities. It may offer valuable avenues for the teaching of information literacy but does not seem to fundamentally affect the information handling skills required.

Learners' Expectations of Information

Web 2.0 inevitably raises questions of ownership and authority of information. It is an environment in the course of creation by its participants. These participants individually and collaboratively generate content in a form, format and structure that best suits their own needs and preferences. This process works well when the primary focus is on participation in social networks or developing personal interests. However, it can create major difficulties when the same processes are applied in formal learning. Keen (2007) claims that we are diving headlong into an age of mass mediocrity because of the absence of gatekeeper expertise and the increase in user-created content. This view is echoed by Gorman in his Britannica Blog (2007) which identifies an erosion of traditional respect for authenticity and expertise in a world in which everyone is an expert "ignorant of the knowledge they will never acquire and the rich world of learning that search engines cannot currently deliver to them."

Most students should be able to operate both in the social world of web 2.0 and in more formal learning environments (even before we take account of the growing presence of academic interests and institutions on Web 2.0). However, to operate effectively in formal learning environments, student autonomy may have to give way to recognised academic authority. Students' preferred use of Wikipedia and social bookmarking, alongside their facility in creating new 'knowledge' through remixing text, image and audio, or through the collaborative creation and editing of web pages may come into conflict with the necessity to conform to academic norms of using externally-validated information. Students will not be able to simply replicate their social/leisure on-line behaviour when engaging in formal academic tasks. Information literacy should help in this arena: traditional information literacy models do focus on evaluating sources of information, on considering authority and credibility. Such an emphasis should raise students' awareness of the problems associated with following their own preferences and concentrating on their own perspectives. A new balance may need to be drawn between encouraging students to use the range of pathways to information that are open to them in Web 2.0 and ensuring that they have the ability to choose the most appropriate for academic study.

However, do we also need to respond more positively to students' expectations of information? Should the information literacy field legitimise elements of students' preferred information-related behaviour? For example, should we ensure that information literacy frameworks encompass such concepts as 'good enough' information, trial and error, and peer 'expertise' rather than focusing primarily on a set of competencies that appear to be designed to turn all learners into systematic researchers, regardless of the task context?

Does Finding Information Really Matter Any More?

One question likely to worry traditional information literacy proponents is whether there will be a continuing need for skills in information seeking, given an information world in which search engines are become increasingly sophisticated and in which Web 2.0 offers a range of enticing alternatives to systematic searching. According to Carol Kuhlthau (2007) what is important in the 21st century is the ability to use information for problem-solving ***not*** "the technology of finding."

Is a New Model of Information Literacy Needed to Meet the Challenge of Web 2.0?

We are not convinced that the Web 2.0 environment on its own necessitates the development of new sets of abilities for finding and using information. It does, however, move learning into new directions (e.g. increased collaboration, more authentic tasks, peer critique, non-linear aaproaches to information). In doing so, learning with Web 2.0 tools should put increasing pressure on proponents of information literacy to move in the direction of well recognised learning principles and practices. In particular, information literacy can be enhanced in a formal learning environment by exploiting some possibilities offered through Web 2.0 tools:

- Enhanced group work and shared tasks
- Cooperative creation of multi-media artefacts
- Collaborative editing and critiquing
- Searching for information (e.g. using social bookmarking and folksonomies)
- Organising information in new ways (e.g. using tagging)
- Increasing authenticity of work by presenting ideas to others in a more public space and using a wider range of media
- Providing 'just-in-time' scaffolding to support students
- Facilitating student reflection using records of individual and group processes and providing virtual contemplative spaces

None of these aspirations are new to formal education but some have been difficult to achieve hitherto without the benefits of advances in Web 2.0.

If the information literacy community is prepared to design materials, activities and support mechanisms based on the opportunities offered by Web 2.0, can they adapt existing information literacy frameworks to scaffold their work? Is a framework needed at all to enable information literacy development in formal education settings?

Any model or framework will be flawed because it cannot fully take account of the influence of context on information use or the problems inherent in producing any generic view of information literacy. However, whilst doing research and development work in many further and higher education institutions and schools, we have found that staff and students want to put some sort of framework in place. They want a public statement that clarifies what is encompassed by information literacy; a guide to support curriculum planning; and something that students can refer to when doing research and tackling academic tasks.

The following framework (Markless and Streatfield, 2007) was originally designed to address problems being encountered by the University of Hertfordshire. The University was trying to develop an institution-wide approach to supporting students when finding and using information in an electronic environment. At first it was thought that an existing framework could be used or adapted to meet the needs of staff and students. However, consideration of the issues explored in this chapter made the shortcomings of such an approach apparent. We concluded that many of the traditional information literacy models had been built on a series of assumptions about learning and information behaviour that were problematic and that the increasing use of Web 2.0 threw these assumptions into stark relief. We therefore needed to offer a different solution that is more in keeping with the changing learning environment.

The solution offered is essentially a framework to support student choice in learning rather than information literacy teaching. The framework is designed to enable students to get help where and from whom they need it rather than to usher them through a regimented programme of information skills development. Some of the individual elements of the framework hark back to those designed in the 1980s and 90s. The skills and strategies included are not all new, although we have moved away from a heavy emphasis on systematic searching. In addition this framework is designed to be approached and used differently from traditional frameworks such as the Big6. The drivers behind our approach are student choice and reflection to support effective learning rather than laying out a sequence of steps to be taught.

During three key stages (which do tend towards the sequential) students ***choose*** which strategy to adopt at different points in their research. Help and guidance is available for each of the key elements. Importantly, if one avenue fails students can go back to the big picture and choose another route; they are not trapped in a sequence that they are expected to follow. The framework is designed for students to construct their own problem-solving approaches to finding and using information, either individually or collaboratively. The impact of context on learning should lead students to make different choices about which strategies to employ and which skills to draw on depending upon the nature of the task they are addressing and the wider social context in which they are operating. The framework is designed to take advantage of technological developments that allow individuals to make choices, navigate between options and then save their search paths for future reflection.

Figure 1.

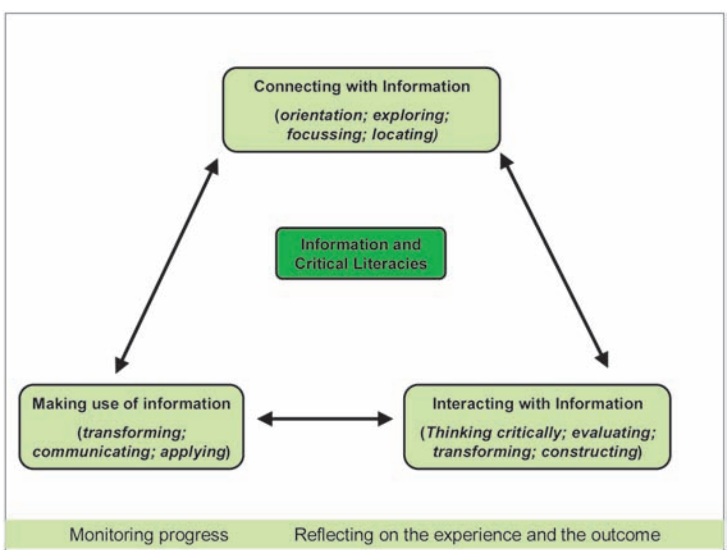
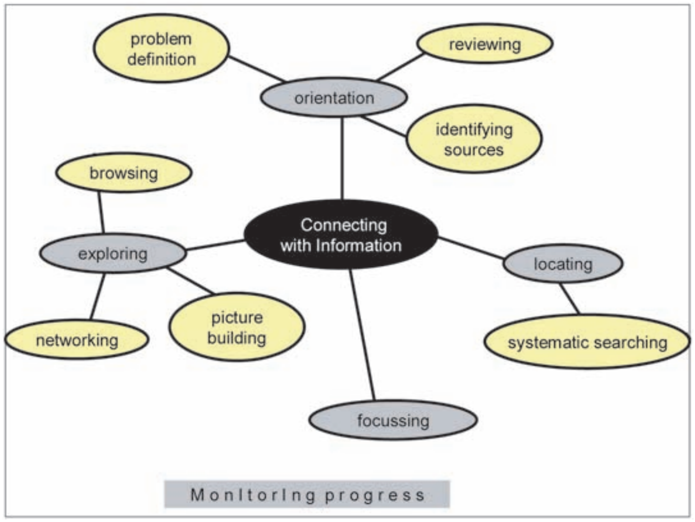


Figure 2.



The framework that we designed drew on two research-based published models, a non-linear model of information-seeking behaviour[2] devised by Allen Foster (2004; 2006) and a model of information and critical literacies offered by Ross Todd (2001). Foster worked with academics to show the fallacies inherent in the assumption that researchers looked for information using a fixed sequence of steps. Todd's overview of information literacy emphasised transformation and construction of knowledge because he wanted to encourage students to stop interpreting research tasks or assignments merely as processes of collecting information. Instead they are encouraged to think in terms of forming their own perspectives, creating new insights and presenting their own authentic voices.

Figure 3.

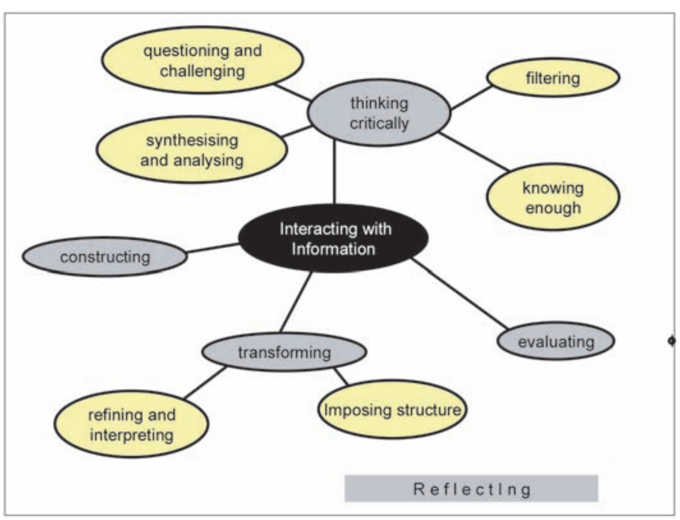
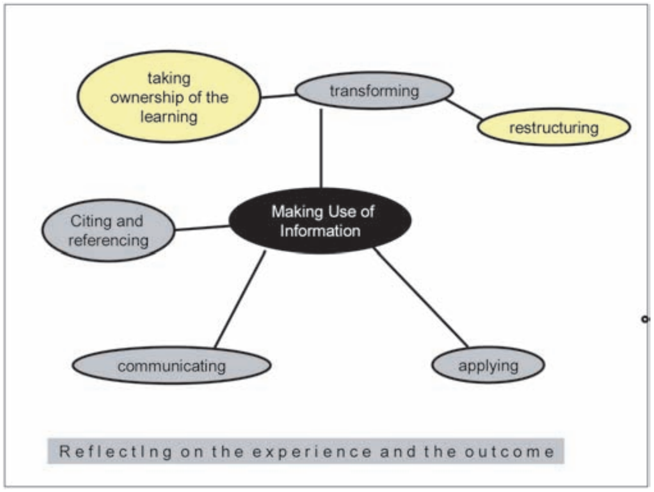


Figure 4.



Our new framework builds on these ideas as well as addressing some of the concerns discussed earlier in this chapter. It is presented below as a series of figures.

Figure 1 provides students with an overview of what is involved with finding and using information. It was important to avoid the trap of presenting information literacy as a series of steps (anything between 5 and 12 stages in many traditional frameworks. The Big6 actually contains 12 steps as there are two stages in each of the 6 main elements of the framework.) Students can choose to engage in any one of the 3 main elements depending on the nature of the academic task they are tackling.

Figures 2, 3 and 4 are what the students see when they click on the relevant box in figure one. There is no set path through any of these figures; if the student is at the beginning of a project they may look at figure two and decide that the best place to begin is with networking. If they click on networking they will get some ideas about who they might contact and how they might work with peers. Equally, a student might decide to begin with problem definition. Again, this element is populated with activities, ideas and advice about how to analyse a problem. Whatever path a student or group of students decides to take through this framework they are offered on-line support at the point of need. They are also encouraged to save their path so that they can see how they worked through a particular assignment - the choices they made. Students compare their chosen paths with those of their peers and consider which have been most effective. They can also review their approaches across a number of different tasks to see whether and how they have adapted their approach to the context. Encouraging reflection on the process of learning was an important element in our design of a non-sequential framework.

Where our framework is being used, each element is being populated with material designed by both academic staff and librarians. The framework itself has stimulated some useful collaborative work between staff interested in specific elements most relevant to their discipline. Their aim is to provide support for students who want to use a particular information skill or strategy in the course of their academic work without dictating a path through that work.

This framework is very much a work in progress. It is being tested at universities in the UK and Spain and is currently being translated into

Arabic. The real test for this framework will be if students do not see it as a straightjacket, constraining their normal interactions with information, but find it useful no matter what the information environment in which they are working.

Conclusion

The traditional information skills models (such as the Big6) that grew out of early interest in enhancing the use of libraries and text-based resources tended to be based on a simplistic view of learning and information behaviour. These models served a purpose in introducing students to the formal world of academic information and, as such, continued to be of use when responding to the arrival of the Internet in its original conception as an information storage and transmission vehicle. However, the shift in focus towards ever greater information access through the Internet combined with greater attention to teaching and learning of information literacy based on constructivist education principles, has led to the traditional information skills approaches being increasingly questioned.

The changes being brought about by the advent of Web 2.0 have served both to provide a further challenge to traditional approaches to information literacy and potential solutions to some of the inherent problems in traditional approaches. The value of teacher-led, text-focussed, sequential models must now be in question because they are based on very un-web 2.0 propositions. Instead, the social networking possibilities offered by Web 2.0 provide fresh opportunities for supporting social learning, including peer information seeking, evaluation, critique of strategies and capturing of processes when helping students to engage with information literacy development. Accordingly, a new framework is tentatively offered here as an alternative to the Big6 and similar models, with the intention of allowing students to construct and revisit their own paths to information discovery, organisation, sense-making and exploitation in the evolving world of Web 2.0.

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key terms

KEY TERMS AND DEFINITIONS

Constructivist Learning: Learning as an individual or social act of construction, leading to sense-making and the building of meaning.

Information Literacy: A set of abilities for seeking and using information in purposeful ways related to task, situation and context. (Limberg, 2007)

Information Skills: The sets of skills and competencies required to find and use information, usually in a formal education context.

ENDNOTES

1. This observation is based on our experience over twenty years of observing information skills/ literacy lessons and examining lesson plans.
2. Although Foster describes his model as non-linear, it may be more helpful to regard it as a non-sequential model

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 493-511, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.13
Social Networking

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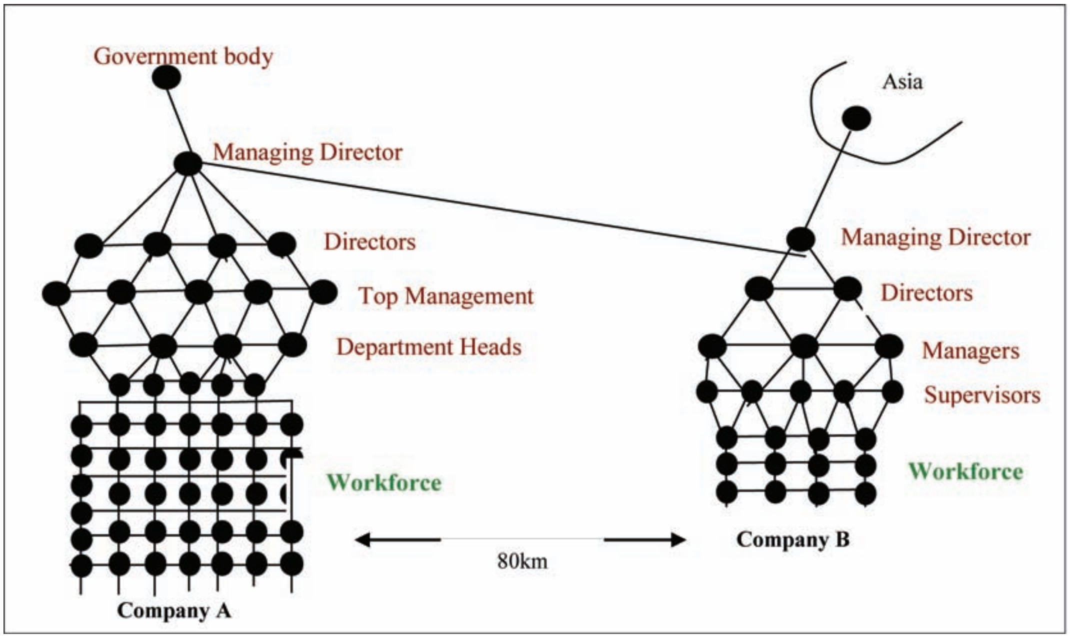
INTRODUCTION

It is in man's nature to form communities, and it is also in his nature to communicate. Psychologists hold that man is moved by instincts, desires which can only find full satisfaction in a community and by communication. Social networking (or network theory) is not an exact science and may reasonably be termed a social catalyst in discovering the method in which problems are solved; organisations are run to the degree in which individuals succeed in achieving goals (Freeman, 2004). In the network theory, social relationships are discussed in terms of *nodes* and *ties*: the former individual actors, the latter, relationships within networks frequently described diagrammatically where the *node* is a point, and the *ties*, lines of social connectivity (Scott, 2000).

Such social network diagrams can be used to measure the social capital of individual nodes/actors: a measurement, or determination of the usefulness of the network to the actors individually, as it is that measurement of usefulness to the individual which not only assesses the social capital of actors, but which by extension may shape and expose the very nature of the network as an entity. Loose connections (weak ties) reflect the greater possibility of openness in the network (Granovetter, 2003). This, in turn, is more likely to bring new ideas, new opportunities, and greater scope for innovation than close networks with many redundant ties. It is clear that "the friendly network" composed of friends already have common knowledge, common interests, and common opportunities. Better

DOI: 10.4018/978-1-60566-014-1.ch177

Figure 1. Social networking



still, it has access to wider social geographies. Again, the group with links to many networks has potentially greater access to other social arenas and a more extensive field of information, and thus the individuals, have links to a diversity of networks, as opposed to those within a single network, and can exercise more power and exact more influence by acting as brokers between their own and other networks not directly linked. This "polylinkage," or "filling social holes," places greater emphasis on the qualities or attributes of individuals. The ability of individuals to influence their success depends largely on the nature and structure of their network. Figure 1 illustrates a social network. Company A is a large fashion design house, a national company.

Company B imports and packs material for A's use, but so far, A has little interest in a take over bid because of continuing government financial enhancements and certain tax concessions. A has, thus far, also ignored the lure of outsourcing to Asia, where it could control material at the point of manufacture. Company B imports most of the material A requires, and supplies A at a mark up sufficient to meet all the transport costs. B is in "comfortable survival," for as a condition of title to financial enhancements in an area of high unemployment. This interaction when examined within the social network characterizes, not only interdependence that exists between the companies, but the *in-group* factor, and however "shocking" a statutory body for justifiable reasons, supports the "cosy" arrangement (Wellman & Berkowitz, 1988). That arrangement, in a very real sense, runs contrary to Sociometry, which attempts to quantify social relationships and which Granovetter explained in finding that, "Power within organisations" comes from an individual's power within a network rather than the post or the title he or she holds (Granovetter, 1990). In the relatively simple example of companies A and B, the power of each company is totally dependant on government legislation, which was arrived at as the result of a debate in the House and a vote in parliament. Self evidently, the individual within networks A and B have little to do with the present state of

Figure 2. Matrix of group relationships

	Ryan	Tara	Paul	Geraldine
Ryan	---	1	0	1
Tara	1	---	1	0
Paul	0	1	---	0
Geraldine	1	0	0	---

business. B depends on A and A on the legislation derived from a free vote in parliament.

However, in a strike or work to rule situation, it is the individual who holds the power. Granovetter, in the final analysis, appears to be correct, if and only if the cosy status quo continues. It is a basic law of Physics that, "Every action has an equal an opposite reaction," and that law appears, so far, to hold true in Social Networking. There are, however, those who would claim that Social Networking or Network Theory is all theory, yet not really theoretical on account of too much methodology (Scott, 2000). The core problem with this stems from an apparent inability to test hypothesis in a mathematical way, that is, using statistics as the data by its very nature negates the random sampling, which statistics demands. Here, even the computer and its resources do not appear as being capable of handling larger and larger databases, where networks expand. We present examples of social networking which integrate sociology and psychology within everyday life. In particular, we use examples relating to an organisation's internal structure, but this can also be extended further to university classes as well as the politics associated with any group in relation to sports teams and then with work and sport aside another example given to address this essay topic is the rise of social networking Web sites such as *bebo.com*. As an overview there will always be the so called in-groups and out-groups, and so there will be the inevitable group politics associated with the individuals involved. Social networking was first created in 1954 by "J.A. Barnes" (Barnes, 1954) where he talks about social circles relating to casual acquaintances or friends and these connections are important as they have a direct impact upon productivity and individual motivation. Here, we concentrate on social networking in relation to analysis. The examples presented show how groups behave and how group politics affects everyone involved, whether it be working in a job or studying at university (Alexander & Danowski, 1990).

SOCIAL NETWORKING

The amount of information needed to describe even the smallest of social networks can be quite big. Tools from mathematics are used to help all of the tasks of social network methods (Newman, 2003). To help with the manipulation of network data and the calculation of indexes describing networks, matrices are very useful for recording information. An example of a simple matrix is shown in Figure 2.

The above matrix shows the structure of a close friendship in a group of four people: Ryan, Tara, Paul and Geraldine. It describes a pattern of liking ties with a point-to-point matrix where the rows represent choices by each actor. We put a "1" if a person likes another, and a "0" if they don't. One reason for using mathematical and graphical techniques in social network analysis is to represent the descriptions of networks compactly and more efficiently. This also enables us to use computers to store and manipulate the information quickly and more accurately than we can by hand. The smaller, tighter networks are not as useful to their members as networks with lots of loose connections (weak ties) to individuals outside the main network. This is because networks with weak ties are more likely to introduce new ideas and opportunities to their members than closed networks. For example, people who do things only with each other already share the same knowledge and opportunities, whereas people with connections outside of each other are more likely to have access to a wider range of information. It is a lot more beneficial for individual success to have connections to a variety of networks rather than many connections with that of one network. Another advantage of having connections to a variety of networks is the use of filling social holes. This is when individuals can bridge two networks that are not directly linked to exercise influence or act as brokers within their social networks. Social network analysis (also known as network theory) has become a key technique in modern subjects such as:

- **Sociology:** The study of society and human social action, and includes the examination of the origins, institutions, organisation, and development of human life.
- **Anthropology:** The study of humanity. It is concerned with all humans at all times and with all dimensions of humanity.
- **Social psychology:** The study of how individuals perceive, influence, and relate to others. The study of how our thought and self-awareness is social in origin.
- **Organisational studies:** Organisational behaviour, a distinct field of academic study which exams organisation through using the methods of economics, sociology, political science, anthropology, and psychology.

Social networks operate on many levels and play an important role in solving problems and how organisations are run, and it helps individuals succeed in achieving their targets and goals. In Social Network Theory, the attributes of individuals are less important than their relationships and ties with other points within the network (Newman, 2004). This approach both has its advantages and disadvantages. The advantage of this approach is that it is useful for explaining many real-world phenomena. The disadvantage, however, of this approach is that it leaves less room for individual agency, and the ability for individuals to influence their success because so much of it rests within the structure of the network. Social networks are also used to examine how companies interact with each other, as well as between individual employees at different companies. These networks provide ways for companies to: gather information, reduce competition, and cooperate with rival companies for their mutual benefit in setting prices and policies. Social networking can refer to a category of Internet applications to help connect friends, business partners, or other individuals together using a variety of tools. These applications are known as online social networks and are becoming increasingly popular (Watts, 2004). Online social networks are a special network service. It is social software specifically focusing on the building and verifying of social networks for whatever purpose. Social networks play a major role in hiring, in business success for firms, and in job performance. Social network theory in the social sciences began with the urbanisation studies of the "Manchester School." A genuine social network is limited to about 150 members (Cross & Parker, 2004). This is sometimes known as the Dunbar number, which measures the cognitive limit to the number of individuals with whom any one person can maintain stable relationships. It is theorised in evolutionary psychology that the number may be some kind of limit of average human ability to recognize members and track emotional facts about all members of a group. The need to track "free riders" is important, as larger groups tend to more freely allow cheats and liars to succeed. Free Riders are points who use more than their fair share of resources, or shoulder less than a fair share of the costs of its production. To connect two random people anywhere in the world through a chain of social acquaintances is generally short. This idea gave rise to the famous phrase six degrees of separation, which is a theory that anyone on earth can be connected to any other person through a chain of acquaintances that has no more than four intermediaries. Research has shown that about five to seven degrees of separation are sufficient for connecting any two people through the Internet (Hill & Dunbar, 2002).

In 1995, the first social networking Web site was set up called *Classmates.com*. It was not until 2001 that Web sites using the Circle of Friends social networks started appearing, and the popularity of these is still growing today. The most recent social networking site is *bebo.com*. It currently has over 20 million members world-wide and is a free service. Through *Bebo.com* you can search for friends, browse member homepages, learn more about people you see every day, write and draw on other people's white boards, join "Clubs," see events and parties on the calendar, keep in contact with friends at other schools and colleges, share photos privately or publicly, create quizzes about yourself, and blog. These social networks start out by an initial set of founders sending out a message inviting members of their own personal networks to join the site. The new members then repeat this process, growing the total number of members and links in the network. These sites then offer different features like viewable profiles, chat, and so forth. Social connections can also be used for business connections. Blended networking is an approach to social networking that combines both off-line elements (face-to-face events) and online elements. Social computing is the use of social software, which is based on creating or recreating social conversations and social contexts online through the use of software and technology. An example of social computing is the use of e-mail for maintaining social relationships (Carrington, Scott, & Wasserman, 2005). There are some indices for social network analysis, which are as follows:

- **Betweeness:** Measures the extent to which a particular point lies "between" the various other points in the graph. It is the most complex of the measures of point centrality to calculate. It is the number of people who a person is connected to indirectly through their direct links.
- **Closeness:** The shortest distances between each individual and every other person in the network. The people who have the shortest paths have the best visibility into what is happening in the network.
- **Degree:** The amount of ties to other points in the network. It measures network activity for a node by using the concept of degrees.
- **Eigenvector centrality:** Measures the importance of a node in the network. It assigns relative scores to all nodes in the network.
- **Clustering coefficient:** Measures the likelihood that two associates of a node are associates themselves. Clustering coefficient graphs measure to determine if a graph is a small-world network (a class of random graphs where most nodes are also neighbours of one another) or not.
- **Cohesion:** Measures how well the lines of source code within a module work together to provide a specific piece of functionality. It is expressed as either higher cohesion or low cohesion. The advantages of high cohesion are robustness, reliability, reusability, and understandability. The disadvantages of low cohesion are difficult to maintain, difficult to test, difficult to reuse, and difficult to understand.
- **Density:** Individual-level density is the degree a respondents' ties know one another. Network/global-level density is the number of ties in a network to the amount possible.
- **Integration:** Measures of group dispersion or how network links focus on specific nodes.

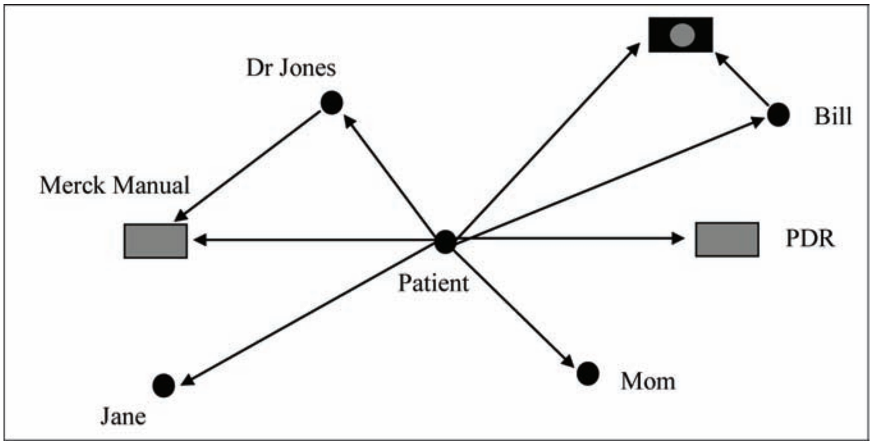
- **Radiality:** The degree in which a person's network reaches out into the network and provides new information and influence.
- **Reach:** The manner which any member of a network can reach other members of the network.
- **Structural equivalence:** The extent to which nodes have a common set of linkages to other nodes in the system. The nodes do not need to have any linkages with each other to be structurally equivalent.
- **Structural hole:** These can be filled by connecting one or more links to link together other nodes. Structural Hole is linking to ideas of social capital, for example, if you link two people who are not linked you can control their communication.

A social pyramid is a model of social relationships. Social intimacy is based on what layer of the pyramid you are on. The person with the least amount of social intimacy is placed at the foundation of the pyramid and the individual at the top of the pyramid has the highest amount of social intimacy. So on each successive layer going down, the individual has less and less intimacy. For example, a random person you interact with on the street is at the base of the pyramid, but your next of kin would be very close to the top. The philosophy of Social pyramids holds that the energy a person puts into the base of the pyramid is magnified at the top. For example, if a person gives positive energy to the people with whom they are at the base of their pyramid, it will be reflected in their personal life. Vice versa, the same can be said for the negative energy. Another type of social network is a sexual network, which is defined by the sexual relationships within a set of individuals. They can be formally studied using the mathematics of graph theory (Valente, 1996). Epidemiological studies (scientific study of factors affecting the health and illness of individuals and populations) have researched into sexual networks, and have discovered that the statistical properties of sexual networks are crucial to the spread of sexually-transmitted diseases (STDs). Social contract is a political theory that explains the basis and purpose of the state and of human rights. Within a society, all its members are assumed to agree to the terms and conditions of the social contract by their choice to stay within the society without violating the contract. The social safety net is a term used to describe a collection of services provided by the state (e.g., welfare, homeless shelters, etc.). They help prevent anyone from falling into poverty beyond a certain level. An example of how the safety net works would be a single mother unable to work. She will receive benefits to the support the child so the child will have a better chance at becoming a successful member of society. Mathematical sociology is the usage of mathematics to draw up social theories. In sociology, the connection between mathematics and sociology is limited to problems of data analysis. In mathematical sociology, the phrase "constructing a mathematical sociology" is used. This means making relevant assumptions about some mathematical objects and providing practical evaluations for ideas. It can also mean detecting properties of the model and comparing these with the relevant practical data.

NETWORK ANALYSIS

There are two kinds of Social networking analyses offering two kinds of network data. These are Ego network analysis and complete network analysis. Ego network analysis questions respondents in the form of social survey, wherein each is asked about people they interact with and relationships within and between them (see Figure 3). Clearly, random sampling would be used, that is, from a large population, and thus Ego network analysis looks at and assesses the quality of each respondent's network (size, income, age, etc). This type of network analysis lends itself to random sampling, where statistics can be used to test the hypothesis.

Figure 3. Ego network



Complete network analysis deals with a set of respondents, for example, all employees in a given company, and the relationships between them such as friendships and socialising (see Figure 4). The majority of research in Social network analysis is into complete networks, where centrality by way of subgroup examination is central and the only valid one.

Social networking involves the linked measurement of relationships between people and the product of their intellectual effort—knowledge/information. That knowledge must be seen as a "surrogate" who reflects the information released from the minds and made available for retrieval, or simply viewing as the circumstances require. This is truer than in our relationship with the computer, as an electro mechanical device which affords access to and retrieval of desired information. The computer and its operator may correctly be deemed a single node, one part active and capable of directing, the other, the computer, capable of obedience. Obedience in this context is its capacity to respond to the primary nodes' will, for example, read the work of others, study the nature and function of organisations, or to analyse a computer network and its topology. In the simplest of terms, the operator uses the computer to access particular information, or to contact a person or persons in order to gain information: a reciprocal operation (Carley & Newell, 1994).

People are used to find content, and content is used to find people, which is a reciprocal relationship, as illustrated in Figure 5.

Figure 4. Complete network

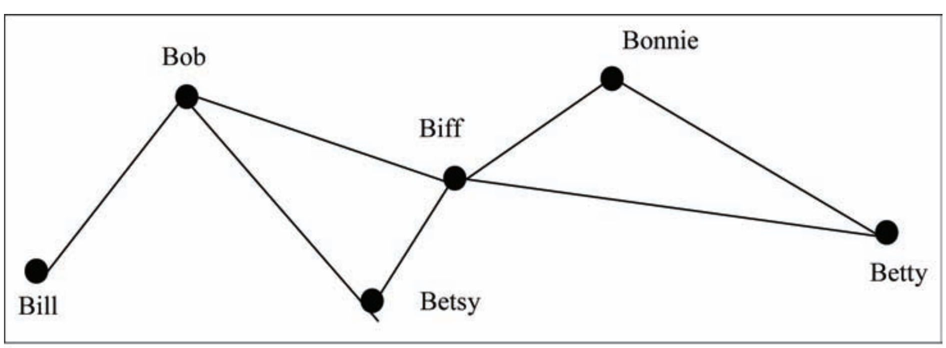
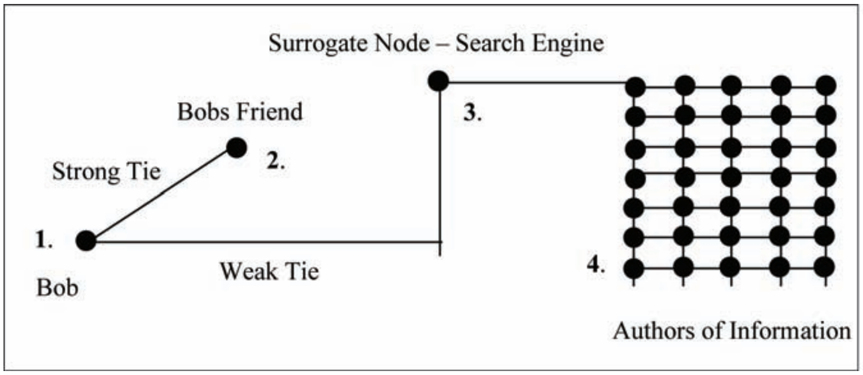


Figure 5. Relationship between people and content



a. Bob (1.) asks his friend (2.) for information (strong tie but limited in information).
b. (2.) directs (1.) to search engine (3.) (again, a strong tie).
c. The information found here has been provided by others, the authors (4.) of the information (weak ties with unlimited information).

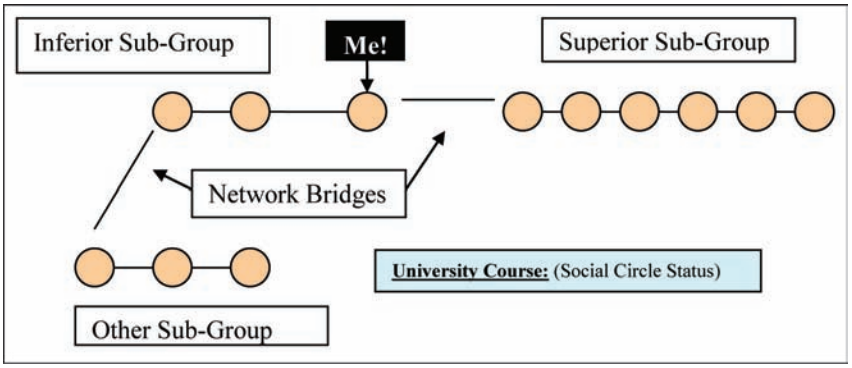
This situation reinforces network theory in that weak ties provide most information and strong ties provide limited information. Often the industrial application of social networking depends on "feedback" via hierarchical route and occasionally by way of random surveys. There have been instances when large corporations have altered policy, or procedures, or created innovations gathered from the minds of employees without those persons contribution being acknowledged. Such surveys have often produced new ideas to boast profits, or form the basic idea for a new product, capable of being produced more cheaply. So far, the computer/node links to information has been used as a simple social network example. There are, however, within computing in general and as a specialism, specific social networks where data is processed into a format useful to people and feeding "the information society," groups of people who both generate and depend on information (Wasserman, 1994). The single node/sole user consists of the combination of an animate and an inanimate node: the former the user, the latter the computer. At their interface exists almost infinite access to information and presuming the link with the ISP, the potential to become part of the network of networks, the Internet. If the operators, the animate node goes "online," and are consciously or unconsciously engaging in the social anthropology of their own environment, their own social network, and that of the "global village." In the context of networking, the node/operator has the choice of selecting strong ties with family and friends, but these limit diversity and the exploration of weak ties to the ever expanding realm of information. This node/operator, perhaps unwittingly, may enter the new world of "face to face" experiences of varied interaction (social computing), and while such social networking tends to recruit members from members, it is probable that the operator node will cooperate and enlarge the social site by inviting others from within a social network. These "introduction services" and similar social connections may be organised to include business connections. The attraction of these social sites lies in features offered, such as automatic address book updates, viewable updates, displayed feedback, and their introduction services with the potential to expand from sparse to dense social networks. It is a logical assertion that social networks are prerequisite to the creation of valuable economics and computer linked communities, and because it is in our nature to socialise, maybe its time we demonstrated this in the systems we design, for the success or failure of societies may well depend on the patterns of those social networking systems. Perhaps a good point at which to begin would be to fully study, and having fully learned, try to achieve that level of social networking which already exists in nature's lower orders: ants, dolphins, and whales (all "wireless" of course).

SOCIAL NETWORKING EXAMPLES

Social networking analysis, according to *Wikipedia.com,* is defined as "The mapping and measuring of relationships and flows between people, groups, organisations, animals, computers or other information/knowledge processing entities." This in effect means that it relates to any network of people who are known as nodes. These nodes are connected to others via associations or connections. These nodes or people connections have seven status types, which are as follows:

- **Degree centrality:** Social networking nodes relate to the degree concept. This is the number of node or people connections. This in English means the number of people that one individual knows within, say, a company or classroom or sports club. These connections can be significant and hence the following phrase of – "Having friends in higher places."
- **Betweeness centrality:** This terminology relates to the node/ individual with a bridge role between two or more subgroups. Hence, there is communication flow between the subgroups through the runner, so to speak, and this has its advantages and disadvantages.
- **Closeness centrality:** Individuals with this label in the network are in a good position as they are in the loop in relation to information flow through a network. These people know individuals and subgroup's both high and low, and because of there closeness with everyone involved they get to see what is actually going on. (Hence Manager and Supervisor team).
- **Network centralisation:** This refers to the location of certain nodes within the network and relates to the network structure or hierarchy/chain of command and shows who reports to whom.
- **Network reach:** The reach here refers to the direct and indirect connection or contacts between different networks or social circles. For instance, in the case of two networks, these are linked via the individual or nodes using direct and indirect links either directly between two individuals or subgroups linked through bridge nodes across the network.
- **Peripheral players:** These people are simply the dark horses within the network. Although these nodes are not directly connected to others, they still play a significant role in which a company would not exist without them. The classic example is a supplier of resources needed to create the overall product. The supplier works external to the organisation, but they are still valued by the company, as both must coexist to enable customer satisfaction through a high quality product being manufactured.
- **Boundary spanners:** These individuals are the key connectors to other subgroups and so these people integrate many people together and allow information transfer to flow better through more people within the network. These people are in a good position because their social circles are large, which enables them to swap ideas, and this information can be channelled effectively into quality goods and services.

Figure 6. University social network



Social Networking Example

Figure 6 illustrates a model (based on a real-life experience by one of the article authors) of a university course where there are many subgroups, including the inferior subgroup and the superior subgroup, along with another subgroup that was indirectly connected to the inferior Subgroup.

- **Degree centrality:** The total number of connections within the "Inferior Subgroup" is 3, which is the same as the "Other Subgroup" that had a total of 3 connections also. But the "Superior Subgroup" has the most connections, with a total of 6.
- **Betweeness centrality:** There are 2 nodes that act as "Bridge Individuals" and they have the role as connectors of Subgroups. Hence, the "Superior Subgroup" was connected to the "Inferior Subgroup" through me, while the "Other Subgroup" was linked to the "Inferior Subgroup" through other nodes or "Bridge Individuals."
- **Closeness centrality:** Although 2/3 of the subgroups appeared to be stable from the outside in, the "Inferior Subgroup" that consisted of a trio had barriers because 2/3 members were already friends and so they are known as "Clicks," and therefore have a closer association compared to someone whose association with them is merely as a social acquaintance. These, however, are the "Bridge Individuals" that connect subgroups together so information flow can pass throughout the entire network of people.
- **Network centralisation:** There is no chain of command structure as such, but in relation to class hierarchy the Superior Subgroup" has the most numbers in there alliance, and so they monopolise the entire network because there is strength or power in numbers. Hence, they are positioned at the top end of the network, while the other subgroups are inferior and so lower down because it is the "Superior Subgroup" that has the best information flow between its larger alliance, and so they hold the most power within the network.
- **Network reach:** The "Superior Subgroup" is connected to the "Inferior Subgroup" through the nodes that act as "Bridge Individuals." Also, the "Other Subgroup" is connected to the "Inferior Subgroup" through the "Bridge Individuals," and so it is these bridge nodes that allow for Network Reach as they connect up the different Subgroups and enable information to be passed through the network.
- **Peripheral players:** There are none in this social network because "Peripheral Players" refers to suppliers whose network is external to a company, although if any

Sub-Group individual had connections with computer students higher up in the university, they could use these contacts to there advantage by seeking help from advanced students and this information flow could benefit any Subgroup, but this is beyond the scope of this article.

- **Boundary Spanners:** This basically relates to nodes that connect other Subgroups together to allow the passing of information between the networks, and hence the class network diagram has four Boundary Spanners or the two pairs of "Bridge Individuals."

Here, we see that initially the number of students was large enough to fill a lecture theater. However, as the course progressed, more and more students left, and as the numbers decreased, the social circles became more evident. Therefore, in subsequent years, the competition was even fiercer because the numbers were so small that every subgroup knew who each other was. With the smokescreen gone, the social politics were more serious, for the numbers were whittled down to the elite, those who really wanted to be there. Now that there were subgroups formed by individual students, these groups would have their own status between the in-group. For example, when it comes to a group assignment, if the numbers are inadequate, then any individual may take the initiative to find someone to make up the numbers, but this is not always in the control of the group, for the lecturer may intervene to make up the numbers for an assignment, and if new subgroups are not formed, then existing groups are added, and these groups expand via the new individual who joins the subgroup, but the status battle continues. Thus, the ability for the group to gel as a whole may determine the outcome of the group assignment, for personality clashes may affect the team to work together as a whole, and so the big question is whether or not any new members get along with the established subgroup or not. The level of success or failure may go down to the balance of power within the group, and the best way to explain this is by the common phrase of the word "Cliques," for if members in a group are friends, then they are likely to stick together, and if they are in the majority they can control group activity to there own favor at the cost of minority individuals.

CONCLUSION

Social networks are social structures made up of nodes and ties. They indicate the relationships between individuals or organisations and how they are connected through social familiarities. They are very useful for visualising patterns. The use of mathematical and graphical techniques in social network analysis is important to represent the descriptions of networks compactly and more efficiently. They operate on many levels and play an important role in solving problems and on how organisations are run, and they help individuals succeed in achieving their targets and goals. In today's society, social networks allow two people in different locations to interact with each other socially (e.g., chat, viewable photos, etc.) over a network. They are also very important for the social safety net because this is helping the society with the likes of the homeless or unemployed. Group politics relate to "In-Groups" and "Out-Groups," as each competes with each other. Social Networking is all around us and so there is always going to be friends and casual acquaintances, both within the subgroups and outside it. These status types link all subgroups together, as well as the internal structure of a group. Hence, there are direct and indirect connections to link everyone together within a work place, classroom, and sports club to online social circle Web sites like *Bebo.com*. Both these status types affect productivity, and so individual competition aside, success is determined by how well everyone involved can work toward a common goal.

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KEY TERMS AND DEFINITIONS

Betweeness: Measures the extent to which a particular point lies “between” the various other points in the graph. It is the most complex of the measures of point centrality to calculate. It is the number of people who a person is connected to indirectly through their direct links.

Closeness: The shortest distance between each individual and every other person in the network. The people who have the shortest paths have the best visibility into what is happening in the network.

Degree: The amount of ties to other points in the network. It measures network activity for a node by using the concept of degrees.

Cohesion: Cohesion measures how well the lines of source code within a module work together to provide a specific piece of functionality. It is expressed as either higher cohesion or low cohesion. The advantages of high cohesion are robustness, reliability, reusability, and understandability. The disadvantages of low cohesion are difficult to maintain, difficult to test, difficult to reuse, and difficult to understand.

Network Density: Individual-level density is the degree a respondent's ties know one another. Network/global-level density is the number of ties in a network to the amount possible.

Network Integration: This measures a group dispersion or how network links focus on a specific nodes.

Network Shape: The shape of the social network helps determine a network's usefulness to its individuals. Smaller, tighter networks can be less useful to their members than networks with lots of loose connections to individuals outside the main network.

Radiality: The degree in which a person's network reaches out into the network and provides new information and influence.

Reach: The manner which any member of a network can reach other members of the network.

Social Network: A network is a social structure made of nodes, which are generally individuals or organizations. It indicates the ways in which they are connected through various social familiarities, ranging from casual acquaintance to close familial bonds. The maximum size of social networks tends to be around 150 people and the average size around 124. Social network theory views social relationships in terms of *nodes* and *ties*. Nodes are the individual actors within the networks, and ties are the relationships between the actors..

Structural Equivalence: The extent to which nodes have a common set of linkages to other nodes in the system. The nodes do not need to have any linkages with each other to be structurally equivalent.

Structural Hole: These can be filled by connecting one or more links to link together other nodes. Structural Hole is linking to ideas of social capital, for example, if you link two people who are not linked, you can control their communication.

Chapter 1.14
Social Networks in Information Systems:
Tools and Services

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ABSTRACT

A social network represents a set of social entities that interact through relationships like friendship, co-working, or information exchange. Social Network Analysis studies the patterns of relationships among social entities and can be used to understand and improve group processes. The arrival of new communication tools and networking platforms, especially the Web 2.0 Social Networking Services, opened new opportunities to explore the power of social networks inside and outside organizations. This chapter surveys the basic concepts of social networks methods, approaches, tools, and services. In particular, this chapter analyzes state-of-the-art social networks, explaining how useful Social Network Analysis can be in different contexts and how social networks can be represented, extracted, and analyzed in information systems.

DOI: 10.4018/978-1-60566-650-1.ch020

INTRODUCTION

The notion of a social network and the methods of social network analysis (SNA) have attracted considerable interest and curiosity from the social and behavioral science communities in recent decades (Wasserman and Faust 1994). Social Network Analysis (SNA) has been used as a powerful tool in organizations to understand the connections and influences both inside and outside the organization as well as how these connections affect the performance of core processes.

A social network is generally defined as a set(s) of actors and the relationship(s) defined among them. Actors, also defined as social entities, can be individual or collective social units that are connected by links. Links constituting a social network may be directed or undirected, but they can be categorized as confirmed or unconfirmed based on the confirmation of the relationship by both actors (Cross and Parker 2004). The relationships between actors can be also classified based on cardinality: a dyad is a linkage or relationship between two actors and a triad involves a triple of actors and associated ties.

In structural terms, there are different kinds of social networks: one-mode networks study just a single set of actors, whereas two-mode networks focus on sets of actors and one set of events. Dyadic networks and affiliation networks are examples of two-mode networks (Wasserman and Faust 1994). An ego-centered network is an example of a one-mode network and consists of a local actor (termed ego), a set of alters who have ties to ego, and measurements of the ties among these alters (Wasserman and Faust 1994). Subsets or subgroups can be identified and studied separately in the network. A clique designates a subset of a network in which the actors are more closely tied to one another than they are to other members of the network (Jamali and Abolhassani 2006).

Both social actors and links may have additional attributes that express additional information about them. Such attributes include the relationship role played by the entity (Masolo, Vieu et al. 2004), more information about the entity, or the relationship between nodes.

The introduction of computational methods opened new opportunities for the use of social networks by allowing the analysis of larger datasets. This analysis facilitates the addition of social networks as well as their automatic extraction from existing information repositories.

Web 2.0 popularized the concept of the semantic web. Several social communities permitting users to connect and share information and knowledge with their friends or the whole community appeared.

This chapter presents the tools and methods for correctly extracting a social network and representing it in a form that can be later analyzed. After that, different software tools for performing SNA are analyzed. With regard to the organizational context, the Web 2.0 social networking services phenomenon is developed. Several examples of known worldwide platforms are presented and compared, and we show how organizations are using these tools to improve connections and knowledge sharing inside organizations. We discuss also our vision about what the future can bring to this field with the integration of different platforms and methodologies. Finally, we present SNARE (Social Networking Analysis and Reengineering Environment), a system we are currently developing that proposes to integrate Organization Network Analysis and Social Networking Services with different approaches and techniques. We conclude with our vision of the major concerns in these topics and how they are related to the general topic of the book.

BACKGROUND

Social Network Analysis represents a method for achieving analytical results about almost any group interaction in which social entities are present. This section introduces SNA and its most common measures and explains its use in the organizational context.

Social Network Analysis

The roots of SNA techniques were affected by three main influences beginning in 1930s. The most notable influence was Jacob Moreno, who investigated how an individual's group relationships affected his own actions and development. Moreno was credited of devising a sociogram as a way to depict such social relationships (Fredericks and Durland 2005). Most of the concepts and techniques were introduced in the 1950s by work done in the fields of sociology, anthropology, mathematics, networks, and graph theory. Even, if it was not always considered a theoretical field, the arrival of computer methods and the automatic analysis of large quantities of data gave SNA new importance. Since then, it has been the subject of studies and applications from widely diverse fields of study (Borgatti and Foster 2003).

In the 1990s, network theories emerged in virtually every traditional area of organizational scholarship (e.g. leadership, power, turnover, job satisfaction, job performance, entrepreneurship, stakeholder relations, knowledge utilization, innovation, and profit maximization) (Borgatti and Foster 2003).

SNA is now used wherever a social network is present, and its study can be interesting for understanding and improving any group process. Recent projects applied the same methods in the following totally different social network contexts:

- Economy (the analysis of economic relationships between countries (Krempel and Plümper 2002))
- Health (the analysis of social networks in epidemiology studies (Chen, Tseng et al. 2007; Rubeis, Wylie et al. 2007))
- Politics (the analysis of the political relationships in a congress (Fowler 2006))
- Academic research (the analysis the research network on a continent (Besussi 2006))
- Leisure and sport (the analysis of all the actions performed among all players on a football team during a game (Bundio and Conde 2004))
- Organization improvement (the identification of tacit knowledge in enterprises (ZHU, SHAO et al. 2007))
- Marketing (the analysis of customer preferences for buying certain items (Kappe 2006))
- Fight against crime and terrorism (Tsvetovat and Carley 2005).

Social Network Analysis is also the focus of associations (INSNA, INSNAE), conferences (SUNBELT), and journals (JOSS, Social Networks and Redes).

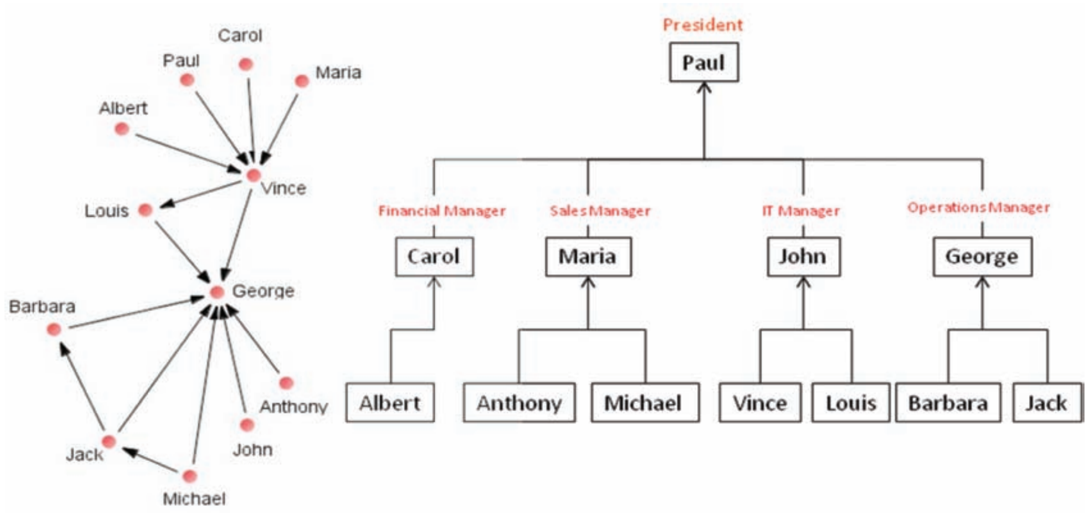
SNA Measures

To perform SNA, it is necessary to define measures that can be compared between actors or networks. Measures in SNA can be distinguished as those that evaluate the entire network and those that evaluate only a specific node (Wasserman and Faust 1994).

At the individual level, the most frequently analyzed measure is *centrality*. This measure evaluates an actor's position in the network and can be interpreted as the prominence of an actor in the social group. It can be measured using: (1) *nodal degree* (number of nodes adjacent to a node, with ties from it, or with ties to it), (2) *betweeness* (the number of times a person lies along the shortest path between two others), and (3) *closeness* (how far a person is from all others in the network). Other important concepts are the *geodesic distance* (the shortest distance between one node and another in the graph) and the *structural equivalence* (the extent to which an actor shares the same set of links with another).

At the network level, it is important to understand how the network is structured. *Clustering* measures the ease of partitioning the graph into a finite number of subsets: a higher clustering coefficient indicates greater separation between the groups in a network. *Centralization* is directly connected with the notion of central nodes: a more centralized network indicates that most of the ties are dispersed around one or a few nodes. *Path Length* is defined as the average of the distance between all pairs of nodes. *Cohesion* measures the percentage of actors directly connected to each other by cohesive ties. Directly linked with this concept are the members who would disconnect the group if they were removed. These kinds of nodes are called *cutpoints*. Ties that disconnect parts of the graph when removed are called *bridges.*

Figure 1. Example of differences between an organizational chart and real relations (adapted from Cross and Parker, 2004)



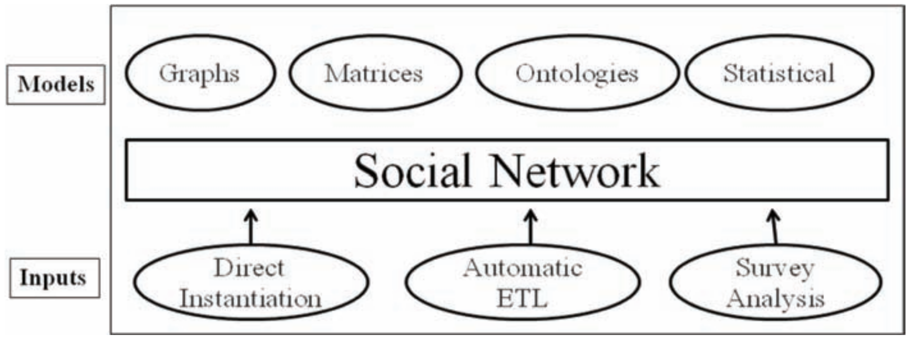
Organizational Network Analysis

The need for more agile, flexible, dynamic, and polyvalent organizations and employees in locations where organizational change is a daily routine, and the rise of new ways of working, collaborating and interacting has caused Social Network Analysis to become a "must-have" tool for analyzing communities and groups. Management consultants use this methodology with business clients and refer to it as Organizational Network Analysis (ONA). As Rob Cross states in his book, real organizations are typically different from those expressed in organizational charts (Cross and Parker 2004). A company's hierarchy topology is represented in Figure 1 along with the relationships extracted by internal questionnaires. Looking to the sociogram, we can understand that actors in lower hierarchical positions can have great importance inside the organization due to their knowledge, role, or personal relationships with other peers.

Factors like gender, age, ethnicity, and education can drive people to communicate primarily with peers who do not have relationships with them in the organizational chart or are not connected to their organizational role. The same reasons, when introduced into department and project separation, can produce a lack of communication, lack of awareness of resources, and lack of collaboration between actors within a company. Conversely, the excess of importance of an actor can bottleneck the entire organization. SNA is a powerful managerial tool because it makes visible the patterns of relationships within and across strategically important networks (Cross and Parker 2004).

Social network analysis can be used in an organization to better understand the social capital (connections within and between the network) (Borgatti and Foster 2003), support partnerships and alliances (Cross and Parker 2004), measure the degree of embeddedness of the actors as well as actors' importance in the network, support knowledge management policies, identify who really knows what in the company (Helms and Buijsrogge 2005), integrate networks across core processes, promote innovation, integrate new members or organizational changes, support the development of informal communities of practice,

Figure 2. Different approaches for capturing and representing a social network



improve leadership effectiveness, replicate high performance throughout an organization, and understand and improve the disconnects between groups in the organization or between groups and the outside world (Cross and Parker 2004).

TOOLS AND SERVICES

Several software packages that support Social Networks Communities or perform SNA are available. The packages can range from complete software to analyze and visualize social networks to systems that permit the design and execution of surveys and then use the data obtained to perform a full network analysis. Other systems allow the automatic discovery of network information via mining a data repository or communications gateway. As depictured in Figure 2, this section surveys approaches and formats for representing Social Networks as well as approaches, tools, and services supporting Social Network Analysis.

Representations

Most common forms of representing and analyzing social networks work through (1) descriptive methods (e.g. text or graphs), (2) analysis procedures based on matrix operations presented in data files with proper formats or ontological representations, and (3) statistical models based on probability distributions. One reason for the use of mathematical and graphical techniques in SNA is their ability to represent the descriptions of networks compactly and systematically (Jamali and Abolhassani 2006).

Graphs

Graph theory provides a vocabulary that can be used to label social structural properties: points called nodes are used to represent actors, and lines or arrows connecting the points are used to represent links. A graph is called directed when its edges have a direction, and it is called undirected when they do not. Visual representation of graphs can be used to center in the screen the most connected actors in the network, isolate in the periphery the less connected, and alter the actor and tie sizes in order to represent more or less importance in the network. It thus offers a powerful tool for uncovering patterns in the network (Cross and Parker 2004).

Matrices

Matrices contain the same information as graphs but are more suitable for calculation in the analysis. The adjacency list is the primary matrix used in SNA and is usually referred as the sociomatrix. Actors occupy the first line and first column of a matrix composed of as many rows and columns as there are actors in the dataset, and cells have a positive value when relations are present.

Ontologies

Conceiving ontologies (explicit specifications of the conceptualization of a domain) as engineering artifacts permits their objectification, separation from their original social context of creation, transferation across the domain (Mika 2005), and export to other sources. GraphML (Brandes, Eiglsperger et al. 2002) is a language for modeling graphs that can be adapted to represent social networks. FOAF (Miller and Brickley 2000) is a machine-readable ontology describing people, their activities, and their relationships to other people and objects. hCard (Çelik and Suda 2004) is a format for publishing contact details of people, companies, organizations, and places that is used to import and export data in social networking websites. DyNetML is a universal data interchange format that enables the exchange of rich social network data and improves the compatibility of analysis and visualization tools (Tsvetovat and Carley 2003; Diesner and Carley 2005).

Statistical Models

Statistics models enthusiasts argue that it is most fruitful to consider models where network evolution is represented as the result of many (usually unobserved) small changes made at discrete times occurring between consecutively observed networks (Carrington, Scott et al. 2005). That kind of model describes the evolution of local structure, global connectivity, search ability, and highly skewed degree distributions as mathematical formulae that can be predicted and analyzed. Recently, there has been a growing interest in exponential random graph models (ERGMs) (Robins, Pattison et al. 2007) that describe a general probability distribution of graphs on *n* nodes and consider the possible ties among nodes of a network as random variables.

Social Networks Tools

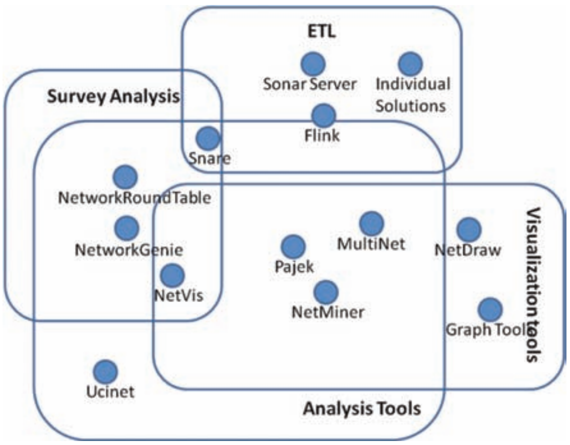
The common way to extract a social network is by instantiating it directly through SNA software packages. However, it is also possible to automatically extract Social Networks from information gateways or through automatic survey analysis. Figure 4 represents the most important tools organized by their main scope of application. Most of the software packages analyzed share common features to extract, analyze, and visualize social networks.

Visualization and Analysis Software

Ucinet (Borgatti 2002) is probably the best-known and most frequently used software package for the analysis of social network data (Wasserman and Faust 1994). It is a commercial product developed by Steve Borgatti's team, but an evaluation version is available for 30 days. Ucinet uses datasets as collections of matrices, can import data in various formats, and has a spreadsheet editor to permit data manipulation. Ucinet works as a graphical application and is distributed with a user manual and reference guide for social network analysis. It contains a large number of network analysis methods, such as analysis procedures for computing centrality degree, ego network analysis, and the detection of subgroups and structural holes in both the entire and parts of the network. It includes statistical procedures and can handle two-mode network transformations and analysis. Ucinet does not contain graphic procedures or visualization techniques, but it can export directly to NetDraw (developed by the same team and included in its package) or other formats. (See Figure 3)

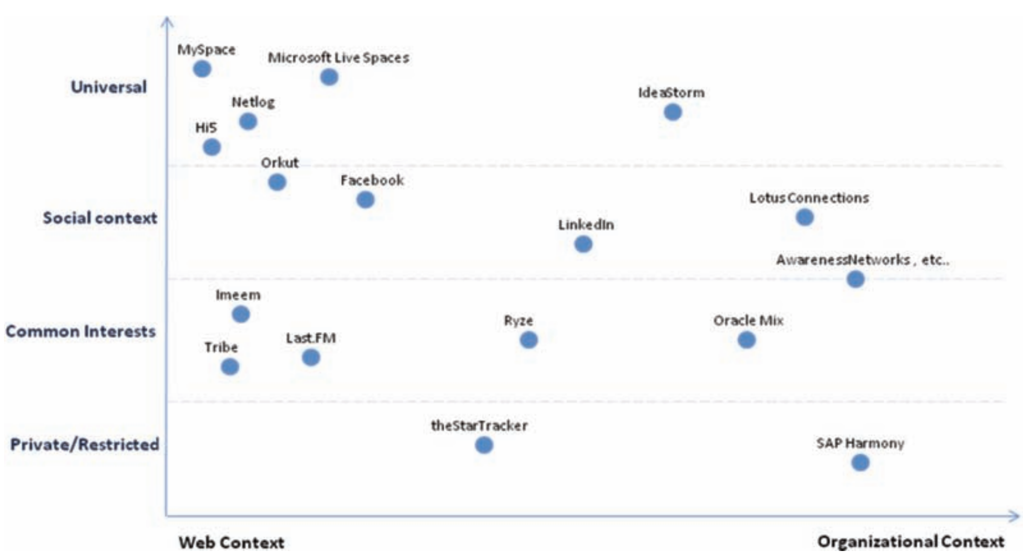
Pajek is a free software developed by the University of Ljubljana and is designed to handle large data sets (Batagelj and Mrvar 2008). It is distributed with a reference manual containing a list of commands and operations, but there is also a textbook about SNA theory, applications, and the use of Pajek in network analysis (Nooy, Mrvar

Figure 3. Main scope of Social Network Software



et al. 2005). Data can be entered directly into the program by 1) importing ASCII network data from network files, 2) importing data with other formats (e.g. UCINET), or 3) opening a Pajek project file (.paj) that combines all the data structures supported in one file. Pajek permits the manipulation of all of its structures (e.g. of the transposition of networks, change of directionality in graphs, or extraction of networks). Advanced visualization techniques are present in Pajek: network drawing is based on the principle that distances between nodes should reveal the structural pattern of the network. Pajek uses spring-embedding algorithms that seek a configuration of the bodies with locally minimal energy; they seek a position for each body such that the sum of the forces on each body is zero (Eades, Battista et al. 1999). The algorithms from Kamada-Kawai (Kamada and Kawai 1988) and Freuchterman-Reingold (Fruchterman and Reingold 1991) are good examples of this kind of technique. Graph images can be exported to traditional image formats. In Pajek, descriptive methods are also present and include: the computation of degrees, depths, and cores; centrality (closeness, betweeness); the detection of components, paths, structural holes, and some binary operations in twomode networks (Carrington, Scott et al. 2005). Unlike Ucinet, Pajek has no direct procedures for detecting cliques due to the difficulty of this procedure for large networks. However, it contains a p-cliques procedure that partitions the network nodes into clusters such that the nodes within one cluster have at least a proportion of p neighbors inside the cluster. Some statistical procedures are also available, and Pajek can invoke directly statistical software.

Figure 4. Social networking services scope



Netminer is a commercial product developed by Cyram and contains analysis and visualization techniques (Cyram 2007). NetMiner has an innovative data model composed of a dataset of various unit data designed to represent almost every feature of network data. NetMiner has the easiest and simplest user interface of all of the software in this category, and almost all of its results are presented both textually and graphically. Constructing new datasets out of nodes and links on a visualized network map for subgroup analysis can be easily achieved by mouse-dragging on the network map without time-consuming main menu navigation. Network-drawing can be based on spring-embedding algorithms, multidimensional scaling, analysis procedures (e.g. centrality), and simple procedures (circle, random). Built-in standard statistical procedures and charts are also integrated in NetMiner.

Survey Analysis Platforms

The problem present for software introduced in the last section is that this software requires the analyst to insert data gathered through other means (e.g. interviews, surveys, or observation) into specific formats. Other kinds of tools, including initial surveys to infer relationships in a network, have appeared to aid SNA.

Netvis is a web-based tool distributed as an open-source program to analyze and visualize social networks using data from comma-separated value files (csv) and surveys (Cummings 2008). The software permits the registration of actors present in the network, and then it allows users to define a survey and use the data received from the answers to perform a social network analysis. Although the software itself has standard procedures to analyze and visualize networks, it can also export data to most common formats.

A team at University of Virginia's McIntire School of Commerce headed by Research Director Rob Cross developed an application called Network Round Table. Most of the content and documentation is not public and is only available to clients who subscribe by paying an annual fee; however its features, steps, and procedures are available on the website. Based on an organizational perspective, the software permits an analyst to register or import all of the actors into the system, join them into teams or groups, and assign them roles. After that, the analyst can create a survey with questions to infer all of the social relationships in the network as well as their strength or frequency. The software is powerful enough to direct specific questions and answers to specific actors or groups, and questions can be open-ended, rating scale type, multiple-choice, order importance choice, or nested in groups. The analyst can explain how each question is important and what he wants to infer from the analysis of the answers. After the survey's activation, the users registered receive an email directing them to visit a web address and properly complete the survey. The analyst can check the status of the survey; when he gets a satisfactory amount of answers, he can close it. After closing the survey, an individual action plan is available to all actors with the analysis of their own answers. The analyst can view and analyze the results of the complete network. There are options available to export the data to the most common formats, but simple direct analyses are also present in the software. The analyst can also view, edit, annotate, or delete individual answers and filter them by parameters. The team states that the personal network feedback enables by itself each actor to assess his connectivity within the network and improve it by planning changes. The feedback is delivered either on paper that can be analyzed in group meetings or in an online action plan that allows actors to annotate and plan actions to increase connectivity.

Network genie is an online application developed by Tanglewood Research for designing and managing social network projects. It includes the design of surveys and survey questions, the management of social network projects, the collection of social network survey data, and the import/export of data to SNA software.

The main objective of this kind of software is to gather information from surveys and automatically export data to the most common software applications for SNA.

Platforms to Social Networks Extraction, Transformation and Load

More recently, the use of electronic data extraction became popular in the study of social networks. While traditional survey or interview methods are limited by the size of networks and the number of measurements (time-points), gathering electronic data enables large scale, longitudinal studies of networks (Mika, Elfring et al. 2006). Automatic detection of relationships is possible from various sources of information, such as e-mail archives, schedule data, and web citation information (Matsuo, Mori et al. 2006). What this kind of systems proposes is to 1) gather information from a large collection of data, 2) identify and disambiguate social entities, and 3) understand both the links between them as well as their strength, periodicity, and probability.

The SONAR platform developed by Trampoline Systems proposes to plug into a corporate network and connect to existing systems like email servers, contact databases, and document archives to extract and analyze data to build a map of social networks, information flow, expertise, and individual interests throughout the enterprise (TrampolyneSystems 2008). The platform consists of several functional modules that can be combined as required by each customer; all information is available to managers, and personal data is available to users.

Flink, the best semantic web application at the semantic Web Challenge of 2004 in ISWC2004, was developed by Peter Mika's team and supports the complete process of data collection, storage, and visualization of social networks based on heterogeneous sources of electronic data (Mika, Elfring et al. 2006).

Data comprising social networks tend to be heterogeneous, multirelational, and semi-structured (Han and Kamber 2006). Link mining is an emergent field of research with contributions from many areas that can help in social network mining. It can be used to classify entities based on their links, predict the type or even the existence of links and their evolution, and detect subgroups and properties common to some group (Han and Kamber 2006). Polyphonet (Matsuo, Mori et al. 2006) is a social network mining system that has been used at four academic conferences in Japan to infer the relationships between authors, reviewers, and participants. It is a good example of the use of link mining, because it uses web search engines to understand and measure the connections between people via balanced coefficient that define relationships.

SOCIAL NETWORKING SERVICES

Although the Web itself is an example of a social network and the formation of communities is one of its most important achievements, the Web 2.0 boom brought the possibility of group information sharing to users via the spread of wikis, forums, blogs, and social networking communities. Although these websites feature much of the same content that appears on personal Web pages, they provide a central point of access and bring structure in the process of personal information sharing and online socialization (Jamali and Abolhassani 2006). People can register or be invited to these websites. After uploading information about themselves, they can upload photos, join groups of people, and connect to other friends or people with similar interests. People become organized in networks or groups and can see each other's profiles, relationships, and actions in the network. Most of these websites allow people to upload and tag photos, share files, post in blogs, and interact in other ways with their peers. (See Figure 4)

Community-Wide Services

According to web statistics (HitWise.com), Myspace is still the dominant social networking service and has more than 200 million users registered (Alexa.com 2008). It is also the sixth most popular website in the world. Founded in 1999, MySpace offers to its users features like profile customization, comments, and the ability to post videos and music and participate in groups and bulletins. Apart from these functions, MySpace offers users an instant message service, a classified ads system, news, and a video sharing system.

Founded in February 2004, Facebook.com was initially open only to college students; today, it has more than 70 million active users and 55,000 networks. The website permits people to register and join a university, workplace, or village network, upload information and photos, tag photos, organize and join events in the network, and exchange messages and other content with friends' networks. Facebook's Platform API enables anyone to build complete applications that users can join and use with their profiles and friends network, opening new opportunities for development of new concepts using the social network. To date, 12000 applications have been built on Facebook platform. Other facts about Facebook are impressive: the number of active users doubles every 6 months; more than half of the active users return daily; people spend an average of 20 minutes on the site daily. (See Table 1)

Friendster.com, with almost 50 million registered users, is a very important website in Asia and has recently developed a public API as Facebook that permits the growth of the community. In Europe, Netlog.com has more than 32 million registered users and Hi5.com has 50 million users.

Big enterprises are also already in this market: Microsoft has Live Spaces, Google has Orkut.com, and Yahoo has Yahoo 360º .

Specific networks oriented to people with similar interests (e.g. Tribe.net, iMeem, Last.fm), people who want to find old friends (e.g. classmates.com, graduates.com), people who want to share photos with friends (Flickr.com), or people who want to join in charity projects (SixDegree.org) also exist.

According to Hitwise.com, 6.5 percent of all Internet traffic in February 2007 in the world was generated by this kind of social networking website. According to Nielsen/NetRatings (another web statistics website), social networking sites are the reality television of the Internet. In Portugal, the most frequently used social networking website is Hi5; this was the most frequently visited website in Portugal in 2007 according to Alexa.

Even if few social networks currently charge money for membership, the fact that these kinds of communities are constantly renewed by their members and organized in networks by interests, location, or situation means that these websites can sell specific ads to specific groups. This is quite appealing for investors and can extend the context of these communities even further in the future. There is also a tendency to define a standard way to exchange data between these services. Google OpenSocial (Google 2008) provides a common set of APIs for social applications across multiple

Table 1. Most popular social networking services

	Users (Millions)	Notes
Myspace	200	Oldest and most famous SNS. Sixth most visited website in the world.
Facebook	70	Has the most rapid current growth. The number of users doubles every six months.
Friendster	50	Used particularly in Asia.
Hi5	50	Most visited website in Portugal in 2007.
Netlog	32	Used particularly in Europe.

websites and is supported by some social networking websites. It is composed of three APIs that permit programmers to access core functions and social network information like profiles, friends' information, and activities.

Some concerns are being raised due to the success of these communities. These include concerns about users giving out too much personal information, lack of privacy, and fake content and profiles. Information posted on sites like MySpace, Hi5, and Facebook has been used by the police to prosecute users.

Social networking services can be also used in a more oriented professional context. LinkedIn is a website where people can post their professional experience as well as share and connect with others with the same interests, professional background, or company. Ryze is designed to link business professionals, particularly new entrepreneurs. The site claims to have over 250,000 members in 200 countries, with over 1,000 external organizations hosting subnetworks on the site. The Portuguese website theStarTracker allow its members to join communities of Portuguese people working abroad and understand what they are doing.

It is not easy to explain why different services have different popularities in different countries and cultures. Each service is mainly used by a certain type of community or culture. ValleyWag published in 2007 a world map of social networks according to their use in different countries. Even though MySpace is still the global leader, different websites are more popular SNSs in different regions.

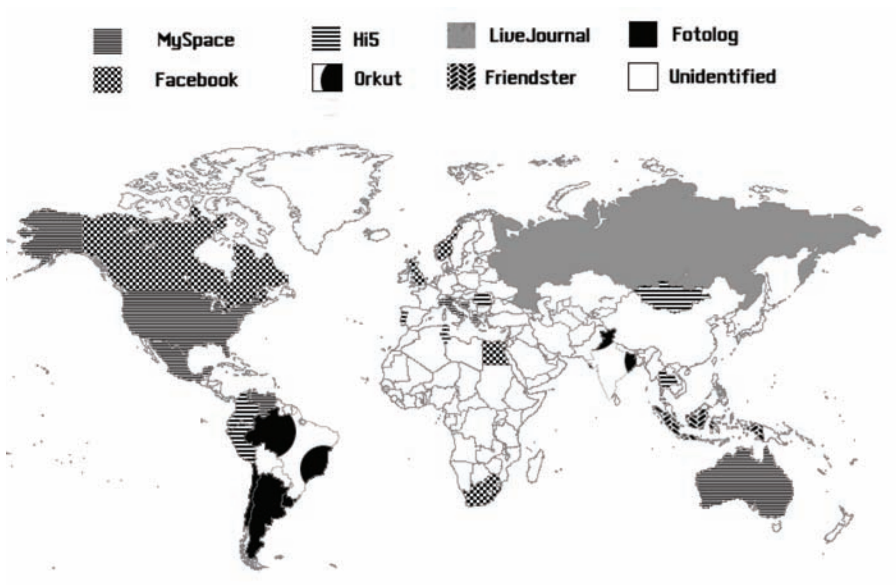
Organization-Wide Services

Big companies have begun to understand the power behind this kind of system for sharing knowledge, experience, and practices inside and outside their companies. In November 2007, a team in Oracle launched Oracle Mix (Oracle 2007). Oracle Mix is a social network for oracle developers, partners, employees, and customers that allows them to share the best practices, experiences, and ideas. Dell also developed a similar system called IdeaStorm (Dell 2007), which is used by customers to share ideas with the company and receive feedback from the community. Sap developed an internal system called Harmony that is already being used by SAP Labs users behind the firewall. IBM went further, introducing in July 2007 the Lotus Connections Suite. This software suite permits a company's employees and partners to register profiles, share ideas, experiences, activities, and resources about company products as well as what they are doing in the company, and create new communities. IBM uses this suite inside the company as the company yellow pages. Even SharePoint 2007, a collaboration suite from Microsoft, already has some business social networking capabilities like user profiles, people search facilities, and tools like wikis and blogs; it is expected to be expanded by a social networking driver. Other firms like AwarenessNetworks and HiveLive are also developing this kind of social networking applications for enterprises. (See Figure 5)

FUTURE TRENDS

The integration of social network-based platforms is already a reality, and their use should prove effective to organizations that adopt them. Platforms that gather social communities, social network analysis, and knowledge management features would be an amazing information broker inside the organization. They would offer a powerful directory in which knowledge and expertise is easy to find, and they would centralize information and reduce the distance between departments and groups inside the organization. Additionally, these platforms would also be a powerful decision tool to help managers understand the real connections and daily activities developed by their employees. By joining the best of these two worlds, organizations would gain a real notion of what is going on

Figure 5. The world map of social networks (Adapted from Valleywag, http://valleywag.gawker.com/tech/notag/the-world-map-of-social-networks-273201.php, published June 27th, 2007 © Gawker Media 2007. All rights reserved. Used with permission.)



inside and outside their walls; employees would have access to a new tool to increase their productivity and provide precious information that would be covered in other ways.

However, copying or adapting existing social networking services is not sufficient. These kind of joined platforms that can be referred to as Social Networking Services for Enterprises (SNES) have different requirements than normal social networking systems do. They need to be used in an organizational context, and they should be used to increase productivity. They should be extremely secure, and privacy should be a major concern. Users should be able to feel secure and in total control of the information they share.

Organizations already have their own information systems, and SNES should plug into them to make sure that information is automatically and constantly retrieved. This represents a huge challenge because of the heterogeneity of tools, servers, technologies, and software present inside organizations. SNES should plug into mail servers, workflow applications, client relation management systems, phone logs, or other information systems that employees or customers use to communicate or work.

Systems should adapt to an organization's characteristics and workflow processes to provide increased value to employees and departments instead of creating unnecessary entropy inside an organization's walls. Employees should recognize a system's value before they begin using that system. These systems should contain important information even without the contribution of organizational actors. However, actor contribution is fundamental for success, so different modules should be present in order to promote strong connections among actors. These modules could include bulletin boards, profile pages, groups and communities of practice, messaging, the ability to find people based on their interests, departments, or related work, easy content sharing using wikis or blogs, and other popular Web 2.0 tools.

Following these concerns, we are currently working on the SNARE project (Barão and Silva 2008) to design and develop a suite of software tools to be used in organizations to analyze and capture social networks. The SNARE system provides social network features in information systems not originally designed for this effect. SNARE is also able to capture existing social networks by analyzing answers to surveys and inferring relationships and properties. These questions focus mainly on how people trust, rely, and work in the organization; they can thus be useful for analyzing the way people understand each other in the organization.

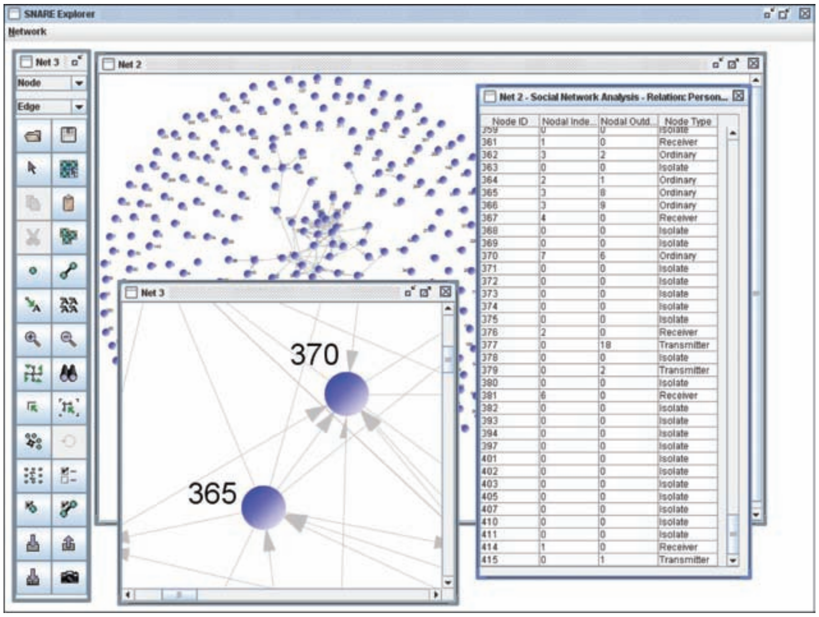
SNARE architecture is composed of a core application in which other applications can connect through web services. WebSNARE is a web application designed to help managers and consultants construct social communities, define social entities (persons, groups, and external entities), define the type of relationships and their instances, and enrich relationships and social entities with customized properties. Managers can also define surveys to apply to the network in order to infer relationships from the answers given. Every social entity can have a unique system login, so users can update their personal data or answers to surveys after seeing after their personal results. In addition to these functions, SNARE can be used like the usual Social Networking Systems: social entities can connect to each other and define what they do together. Each user is able to search in the organization by some context or name and retrieve the content required. Users can also organize and join groups (e.g. groups based on interest or communities of practice inside the organization). Users are able to publish and retrieve content in their profiles or network pages.

In addition to the ability to promote networking and knowledge sharing inside the organization, SNARE can also perform Social Network Analysis on relationships defined by users or extracted from surveys. Managers can identify bottlenecks inside organizations or specific groups, highlight social entities with specific properties, and use SNA measures to analyze different domains or enterprises processes. SnareExplorer is a stand-alone application that is used to visualize and analyze social networks and can import and export data directly to SNARE.

SNARE ETL Services provide a technical interface-to-Desktop ETL Tool. This desktop application defines and controls ETL actions and has a required interface for executing SNARE Service methods. The aim of this component is to extract relevant social network data through ETL mechanisms. This tool allows users to specify transformations through a graphical user interface. Data transformation can involve the following: (1) smoothing, which works to remove noise from data, (2) aggregation, which involves summary operations applied to the data and is typically used in constructing a data cube for the analysis of data at multiple granularities, (3) generalization of the data, where low-level data are replaced by higher-level concepts through the use of concept hierarchies, (4) normalization, where attribute data are scaled so as to fall within a small specified range, and (5) attribute construction, where new attributes are constructed and added from the given set of attributes to help the mining process (Han and Kamber 2006). This module can be used to plug SNARE into different existing systems and constantly update data that can be analyzed. Future work will be done in this field, and different modules will be developed in order to achieve integration with common systems. (See Figure 6)

SNARE is already being applied in some projects and tested in different contexts and with different goals. The SNARE model is able to represent relationships in almost any context and enrich them by populating relationships and entities with customized properties. The ability to join entities and relationships with temporal or contextual similarity is a powerful advantage and will be fundamental for achieving the richest analysis. It will better support reengineering in organizational contexts while it promotes networking and information sharing inside organizations.

Figure 6. Snare Snapshot



CONCLUSION

Social Networks are not a new or recent concept. However, Web 2.0 evidence suggests that they now constitute an emergent field of study. The way people connect and work in enterprises brought a new drive SNA and changed its main goals. Using traditional concepts, studies conducted in many subjects and areas uncovered interesting aspects. Now, the challenge is to create systems that are able to represent, extract, and analyze social networks in the context of enterprise information systems.

There is not a perfect way to take a snapshot of social relationships, and all methods present some problems and limitations. Surveys can be manipulated by who is answering. Direct observation does not permit understanding of all relationships present in a group, and the most important relationships cannot be extracted from information gateways like email servers. The combined application of these techniques can, however, provide the best approach to represent and analyze a social network.

Social Networking Services are also a key player in this field. They began as just a new way of connecting people but are already being used in organizations. Companies who use them understand that injecting trust into the equation lowers the barrier to entry and sharing ideas. Employees and customers find these systems useful and fun to use, and that permits a new way to connect inside and outside the company. The future will show what benefits social networking tools and services provide when they care connected with HR (Human Resources) systems, ERP (Enterprise Resource Planning), CRM (Customer Relationship Management) software packages, and different SNA tools.

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KEYS TERMS AND DEFINITIONS

Organizational Network Analysis: Organizational Network Analysis (ONA) involves the use of Social Network Analysis in organizational contexts in order to help managers to better understand the relationships present inside and outside the organization. It can be used in an organization to better understand the social capital, support partnerships and alliances (Cross and Parker

2004), measure the degree of embeddedness of the actors and define their importance in the network, support knowledge management policy and reveal who really knows what in the company, integrate networks across core processes, promote innovation, integrate new members or organizational changes, support the development of informal communities of practice, improve leadership effectiveness, replicate high performance throughout an organization, and understand and improve both the disconnects between groups in the organization as well as connections to the outside world.

Social Network: A social network is generally defined as a set(s) of actors and the relation(s) defined for them. Actors, also defined as social entities, can be individual or collective social units that are connected by links. Links constituting a social network may be directed, undirected, or mixed. Social Networks can be analyzed using defined measures, and their results can be compared with those from similar networks. Each actor's position and connections can also be individually analyzed and compared with those of other actors in order to understand their relative importance in the network and highlight network bottlenecks and cutpoints as well as isolated and equivalent actors.

Social Network Analysis Measures: Measures in SNA are the metrics through which networks and social actors can be evaluated and compared. SNA measures can be distinguished into those evaluate the entire network and those that evaluate only a specific node. At the individual level, the most frequently analyzed measure is *centrality;* this can be measured using *nodal degree*, *betweeness*, and *closeness.* At the network level, is important to understand how the network is structured; it is therefore important to measure network *cohesion*, *centralization*, *and clustering* and identify important nodes like *cutpoints*.

Social Network Tools: Social Network Tools are software tools that can be used to represent, visualize, and analyze social networks. These tools can usually read and write in common formats and use matrices to compute social networks and graphs called sociograms to represent them. Other platforms have other important characteristics like the ability to convert answers from internal surveys to social network data or extract social network information from existing systems using ETL techniques. Some graph software or general network analysis software can also be used to identify key aspects in social networks.

Social Network ETL: Social Network Extraction, Transform, and Load designates the set of techniques used to map existing information system data into social network models. Entities present in the systems should be normalized and resolved, and the selected interactions between them are transformed into relationships. After extraction and transformation, data can be loaded in the usual SNA tools. Good examples of social network ETL use arise from community boards, server communication logs, knowledge repositories, and wikis.

Social Networking Services: Social Networking Services (SNS) are websites where people can register their personal profiles and connect with others to share information based on interest, upload photos, or join groups. This kind of website is a popular Web 2.0 phenomenon; millions of people are currently registered, and SNS websites are some of the most visited websites on the internet. SNS represent a new way to connect to collaborators, and they permit the sharing of information and breaking of common barriers. Although concerns regarding privacy issues arise, restricting information to only those users people trust circumvents the problems of sharing it with no restrictions in the network.

Social Networking Services for Enterprises: Social Networking Services for Enterprises are internal information systems used by organizations to increase connections and information sharing among their collaborators. These systems share the same features as social networking services but are used to low barriers inside organizations.

They are intended to promote productivity by increasing information sharing. Usually, they are platforms that try to join features of Social Networking Services and knowledge repositories with Social Network Analysis. They give the managers and consultants the ability to access existing organization networks and hidden relationships and make decisions for reorganization based on what is really happening in the organization.

This work was previously published in Handbook of Research on Social Dimensions of Semantic Technologies and Web Services, edited by M. M. Cruz-Cunha; E. F. Oliveira; A. J. Tavares; L. G. Ferreira, pp. 392-410, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.15

Educational and Social Benefits of Social Network Sites:

Applications to Human Services Education and Practice

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ABSTRACT

Online social network sites present opportunities for human service educators, practitioners, and clients. Human services education students can collaborate through multimedia networks, sharing ideas and experiences. Human services professionals can leverage online networks to problem solve, socialize and develop common resources, and clients can use such networks to engage in self-reflection and get support from those facing similar challenges. This chapter offers an introduction to online social network sites, summarizing their features, uses, demographics, and trends, and presents emerging research on their social and educational potential. An accompanying case study reveals how young adults might use online social network sites to further personal and educational goals. The chapter concludes with a discussion of how such sites might be employed by human services education students, practitioners and clients.

DOI: 10.4018/978-1-60566-735-5.ch002

'In education there should be no class distinction'.

Confucius (K'ung Fu tzu 551-479 BC), *Analects, ch.15, v.38* in *Oxford Dictionary of Quotations* (2004, p.238:8).

OPENING VIGNETTE

It is seven o'clock in the evening. Emilio has just finished dinner with his family and retreats to his bedroom to check in on the other social network in his life. Like the majority of U.S. online teens who are daily users of a social network site, logging twenty minutes to an hour or more, Emilio goes to MySpace.com and signs in. Once within his profile page — his entry point to this online international community — he notices that several things have changed among his "friends" in just the few hours since he last communicated with them. Looking at his list of "updates" he notices that Julia has joined the network. Alex has written in his blog about the challenges of college life. Jade has finished her midterm and thinks she did okay. Whitney has become a supporter of the Democratic president-elect, Barack Obama, and Jose has added four new photos of his new dorm room. Emilio accepts Julia as a friend so she can see his complete online profile. He comments, "Congratulations!" on Jade's update. He visits Alex's page to leave a comment about his blog entry on college life. He visits Whitney's profile to see what other people have said about her support for the U.S. president. He visits his own home page to read comments friends have left him about a video he created for a school project about sports casting, his career interest. Earlier, he had posted an unfinished essay for sociology in his blog so that friends could give feedback on what he had written. Using the instant messaging feature within the MySpace network, Emilio messages another classmate who appears to be online and asks for advice on a social work assignment. He stays logged into the MySpace system while he works on his homework, waiting for friends to respond to his requests and comments. Soon messages began to appear. One friend instant messages some feedback on the sociology essay. Another friend compliments him on the finished video, and another gives him advice on the psychology assignment. At nine o'clock, Emilio changes his MySpace mood setting to "tired" and signs out of the network. His work is finished. He looks forward to following up with his friends on the night's events when he meets them tomorrow, online or off.

INTRODUCTION

This opening vignette describes some of the many ways young people participate in online social network sites (SNSs). Emilio (a psuedonym) was a shy, soft-spoken eighteen year old who had a few close friends at university. Within MySpace (www.myspace.com), however, Emilio had a large network of friends, acquaintances, and contacts from within and outside his local community. His MySpace profile contained videos and photos he had created and posted to share. Often portrayed in the media as dangerous or distracting (Hass, 2006; Rowan, 2007), many young people are actually making important, positive connections through their use of online social network sites. They find emotional support, get help with school work, relax, socialize and flourish in using this outlet for their creativity.

The purpose of this chapter is to explore the social and educational benefits of online social network sites and the implications of social network site affordances for human services education and practice. The unique features of today's social network sites will be discussed in relation to other forms of virtual communities. The chapter will present theoretical foundations, application of social network site features to education and ways in which the competencies users demonstrate in social network sites can have educational benefits and enhance learners' experience. Moreover, a case study of one students' use of an online social network will be provided for tertiary social work students who seek to consider the potential application of this information communication technology for human services education and practice. This case study may also be useful for researchers in the field of information communication technology and human computer interaction in various disciplines who seek to describe and illuminate online social networking practices.

BACKGROUND

Adherents of social networking – including 70% of today's 15- to 34-year-olds– utilize their preferred social networking sites at all hours of the day and night to fulfill a roster of needs as diverse as the users themselves (February 2007, U.S. ComScore data, ages 15-34 at all locations).

Social Network Sites: A Unique Form of ICT

Since their introduction in the late 1990's, and rising to mainstream prominence with MySpace and LinkedIn in 2003, online social network sites have attracted millions of users. In the United States, a majority of online teens have created a personal profile on a social network site like MySpace or Facebook and visit their social network site daily or several times a day, devoting an average of 9 hours a week to the network (Lenhart & Madden, 2007; National School Boards Association, 2007).

According to boyd & Ellison (2007) an online social network site is a 'web-based service that allows individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system' (p. 1). What distinguishes social network sites from other forms of virtual communities is that they allow users to articulate and make visible their social networks, similar to allowing others to view your address book and interact with it online. In this way your connections potentially become the connections of your "friends." Boyd & Ellison (2007) suggest that these "friending" behaviors through social network sites can result in more and different types of connections between individuals that would not otherwise be made (Haythornthwaite, 2005). In addition to individuals, SNSs may include profiles of bands, companies, events, non-profit organizations or political parties (Childnet International, 2007). Other terms such as "online social networking site," "networked social media" and just "social network" have been used to describe these Web 2.0 technologies. For our purposes, we will use the term online social network site (SNS) according to boyd and Ellison's (2007) definition.

A growing body of survey research suggests that youth's participation in online social network sites may cross gender, ethnicity, and income boundaries as teens once disconnected from the Internet (e.g., low-income African-American, Latino and other low-income students) now largely have access (College Access Marketing, 2008; Lenhart, Arafeh, Smith & Macgill, 2008). For instance, in our surveys with 600 urban high school students from low-income families in the upper Midwestern United States (i.e., median family income at or below US$25,000), we found that over 80% go online regularly from home and 77% have a profile on an online social network site. The majority use MySpace (65%) with Facebook (37%) being the second most popular site, and many students belong to more than one network (Greenhow, Walker & Kim, 2008).

Use of Social Networking Sites for Social and Educational Purposes

Social Networking Sites can serve a range of purposes, including helping users maintain existing friendships or forge new relationships based on shared professional interests, political views, a common language or shared racial, sexual, religious, or cultural identities. In studying U.S. Internet trends, Lenhart and Madden (2007) found that 91% of SNS users employed these sites to maintain relationships with existing friends with whom they frequently socialize, and 82%, to maintain connections to others with whom they do not socialize; 72% used these sites to make social plans.

Such relationship building can be accomplished through a range of SNS features that accommodate data-sharing in various forms (e.g., video, audio, text, photo, hyperlinks, etc.) and user-generated content. For instance, most sites allow users to share personal profiles, write comments, upload files, and select applications, although the extent to which sites incorporate new information and communication tools, such as mobile connectivity, blogging, and photo/video-sharing varies. Many SNSs offer condensed versions of their services for customers who want access via mobile handheld devices such as cell phones, which have become nearly ubiquitous among youth and adults of all ages (Lenhart, Madden, Macgill & Smith, 2007).

Some of the most common activities young people engage in are creating online profiles, visiting others profiles and leaving messages, viewing digital content, authoring content and sharing content created by a third party (Childnet International, 2007). Indeed, students engaged in SNSs are more likely to be content creators: posting or remixing digital images or video, creating or commenting in blogs, or maintaining a website (Lenhart & Madden, 2007). Interestingly, a recent survey involving over 2,000 nine- to 17-year old students, parents and school district leaders in the U.S., reported that much of students' online sharing in SNSs involves frequent exchange of private and public messages and comments, with education being a common topic of conversation —e.g., 60% of students surveyed reported using their SNS to talk about education topics and 50%, to talk specifically about schoolwork) (National School Boards Association, 2007). Outside of the United States, the Digizen Project of Childnet International is examining how SNSs can benefit young people in the United Kingdom and around the world. The Digizen site (http://www.digizen.org/) offers a framework for evaluating the appropriateness of SNSs for formal or informal learning. A downloadable evaluation chart considers a site's age restrictions, the presence of advertisements, collaboration tools, security options and data management restrictions. The site also outlines considerations for educators trying to integrate such sites, including privacy issues, cyberbullying prevention and legal issues.

Demographics of SNS Use

Typically thought of as a youth phenomenon, the demographics of SNS users are increasingly diverse. Today there are hundreds of online social network sites, the two most popular being MySpace and Facebook with about 115 million users each worldwide (Stone, 2008). Launched in 2004, MySpace generated more page views than Google or Yahoo and has broad appeal across all age ranges (Compete, 2008). More than half of MySpace users in the U.S. are under 35 years of age (77%), with young people 12 -17 years (29%), 18-34 years (44%) and the over 35 demographic representing a smaller (23%) but still significant proportion of users (Quantcast, 2008). About 300,000 new people sign up for MySpace every day. Its users span more than 20 international territories, including the United States, United Kingdom, Australia, Japan, France, Germany, Mexico, and Canada. In the U.S. one in four Americans is on MySpace and in the UK, it is as common to have a MySpace profile as it is to own a dog. Moreover, MySpace has a large presence within the entertainment industry. It maintains a dominant position as a media-sharing site (i.e., uploading music, videos, scanned artwork, photography, etc.), giving users the opportunity to interact with brands, bands, artists, actors, and other creative professionals as well as to self-express. Analysts expect to see more television and video networks integrate and work with MySpace (Owyang, 2008).

By comparison, Facebook also appeals to a broader demographic than simply teenagers. People ages 18-24 (34%) and 35-54 years of age (33%), constitute Facebook's two largest groups of users. Originally created to foster social networking among U.S. college students, Facebook is still a dominant presence on college campuses; however, more than half of Facebook users are outside of college, and its fastest growing demographic is 25 years of age and older (Owyang, 2008). Facebook has also expanded internationally, with the most active users residing in the U.S., Canada, the UK and Australia. Facebook's orientation overlaps with MySpace in that it maintains regional, profession-related, and school-related networks; however, Facebook is perhaps more strongly affiliated with collegiate and work-related networks than is MySpace and maintains 85 percent market share of 4-year U.S. universities.

Moreover, Facebook emphasizes its niche as a platform for independently generated applications. According to the company's analysts, 24,000 applications have been built on the Facebook platform and an estimated 140 new applications are added per day allowing users to increasingly customize the functionality of their network (See for more information: http://www.facebook.com/press/info.php?statistics). *Socialyze,* for instance, is an application Facebook users can add to their profiles (and invite friends to add) which enables them to analyze data, statistics and trends generated by their "friends" within the Facebook system. The application can be used as a game to get to know people better and strengthen social connections. Users can test their social knowledge and compete against friends to earn points and "climb the social ladder." *Books iRead* is a Facebook application that may be useful for educational or professional uses. It lets one share ratings of books and showcase a virtual bookshelf. Users can see what their colleagues or students are reading and read reviews of what others have read. Users can join a virtual bookclub, get book recommendations or meet new people who share the same reading interests. Facebook *translator* applications allow real-time translation of messages between users who speak different languages. The *Where I've Been* application allows users to post an interactive world map on their profile, showing those who visit their site, where they have been, lived and want to go. Visitors to a user's *Where I've Been* map can click on a country or city to get more information.

No overview of online social network sites would be complete without emphasizing the increasing proliferation and diversity of this emerging information and communications technology. A quick Google search reveals millions of hits for "online social network sites." Wikipedia lists over 130 on its list of "notable, well-known" sites (http://en.wikipedia.org/wiki/List_of_social_networking_websites) and reviews abound, such as this one from Top Ten Reviews (http://social-networking-websites-review.toptenreviews.com/), which strive to characterize and distinguish one site from another. Sites like Hi5.com, Friendster.com, Orkut and Bebo.com rank just below MySpace and Facebook in size and international presence (ComScore, 2008a). Bebo is especially popular in the U.K., Ireland and New Zealand while Orkut is popular in Brazil, Paraguay and India, and Cyworld is the site of choice among many young South Koreans (Wikipedia, 2008).

Furthermore, a growing number of SNSs are designed specifically to support education. EducatorCentral (http://www.takingitglobal.org/tiged/ec/) within TakingITGlobal (www.takingitglobal.org) supports teaching and learning (Childnet International, 2007). Ning (www.ning.com) is an increasingly popular SNS that allows people, schools, and companies, to build and design their own social Web sites tailored to their students, clients, friends, and employees. Within Ning.com there are a few SNSs that specifically address human services professionals. These include Social Work 2.0 (http://www.socialwork20.com/) and Social Work Advocates (http://socialworkadvocates.ning.com), which is a community of social workers who are passionate about advocating for vulnerable and oppressed populations. Other sites are just beginning such as Social and Human Services (http://sociallyhuman.ning.com) and Social Work Grad Students (http://socialworkgradstudents.ning.com/). In the UK, a relatively new SNS offered by the social work magazine *Community Care* (http://www.communitycare.co.uk/carespace/) features high quality podcasts of research seminars and educational products, which can be subscribed to within iTunes (http://www.iriss.ac.uk/audio). In addition, this SNS features an open access repository of human services related content called the Learning Exchange (http://www.iriss.ac.uk/openlx/).

There are also numerous networks for specific human services client populations. For instance, people addicted to alcohol and other drugs can identify treatment options and get peer support within SoberCircle (http://www.sobercircle.com/). Sobercircle blogs and chats offer a place for clients in recovery to voice their struggles with addiction and seek support from others. Separate forums for social service professionals allow those who counsel people recovering from addiction to connect and share ideas. PatientsLikeMe (http://www.patientslikeme.com/) allows people dealing with certain life altering neurological conditions such as multiple sclerosis or Parkinson's disease to share their experiences, find similar patients, and learn from the latest research. People with mood disorders (e.g., depression, bipolar disorder) are also supported within the site. The philosophy of open sharing within PatientsLikeMe allows people to discuss their treatment histories anonymously so others can benefit from information about successful approaches. Although we have been focusing on SNSs used primarily by teens and adults, there are also sites, such as ClubPenguin (http://www.clubpenguin.com/) and Imbee (http://imbee.com/) that are designed for and used by younger children, ages 8-14. These sites have stricter privacy controls and require a parent's email to sign up.

Finally, there is significant diversity in the SNS user population. A person's gender, race and ethnicity, and parental educational background, for instance, are all associated with SNS use. According to the Pew Internet and American Life studies in the United States, older girls ages 15-17 are more likely to have created an online profile on a social network site (70%), while only 57% of online boys have done so (Lenhart et al., 2007). Hargittai (2007), in studying college students' differential adoption of online social network sites, found differences in the percentage of racial and ethnic groups that used four popular SNSs (Facebook, MySpace, Xanga and Friendster). Hispanics favored MySpace over Facebook and other sites. Students of Asian background favored Friendster and Xanga. Both African Americans and Caucasian students used MySpace and Facebook more than the other two sites in the study. Using parental education as a measure of family income, Hargattai (2007) also found that students with parents who had less than a high school diploma were significantly more likely to be on MySpace than Facebook. Students whose parents had a college degree where significantly more likely to use Facebook. However, it is important to note that this study was completed before Facebook opened its membership to everyone. Previously only those with a college email could use Facebook. Next we turn to the theoretical foundations underlying this chapter.

THEORETICAL FOUNDATIONS

Not surprisingly, given that people's use of online social network sites is a relatively recent phenomenon, much of the published research on the use of SNSs is still emerging. The handful of studies that exist stem mostly from communications, information science, anthropology, sociology, economics, political science, cultural studies, and computer science and are both conceptual and empirical in nature (boyd & Ellison, 2007). Very few studies explore the link between social network site use and education. For instance, Hewitt and Forte (2006) examined how college age students feel about having their professors on Facebook, and Mazer, Murphy & Simonds (2007) investigated how faculty presence on Facebook impacts student-educator relationships, but these studies do not deal directly with *students'* experiences in using online social network sites and how

SNS use may impact their *educational* experience, which is the focus of this chapter.

The theoretical foundations for this research stem from education, communication and sociology, specifically interpersonal ties theories from communication and sociology, constructivist frameworks for how people learn, and twenty-first century skills frameworks in education.

Meeting Interpersonal needs Online

Despite troubling public accounts of Internet-mediated communication as socially isolating and necessarily inferior to other modes of communication (Thurlow, 2006), a number of studies have argued that, in fact, communication via the Internet can help users develop, maintain, and extend social relationships, leading to a broader network of support when faced with important life decisions (Ellison, Steinfield, & Lampe, 2007; Kraut et al., 2002; Wellman, Haase, Witte, Hampton, 2001). Such findings are important for human services education if we consider that interventions which increase students' connections to their peers and community resources can lead to greater persistence and success in university programs (Zhao & Kuh, 2004; Tinto, 1998).

In examining interpersonal interactions within the context of a SNS and how SNSs may be supporting interpersonal needs, it is important to consider: the technological affordances of the environment; how users employ (or not) these and for what communicative purposes; and the conditions surrounding these interactions (e.g., computer and Internet access/context, frequency and duration of social network site use, nature of the relationship between SNS participants). This examination of the potential of social network sites to fulfill interpersonal needs, as illustrated in the case study that follows, is informed by recent studies on how social networks are created, maintained and negotiated through media (Donath & boyd, 2004; Gross & Acquisiti, 2005; Ellison, Steinfield & Lampe, 2007; Herring, 2004; Wellman, Salaff, Dimitrova, Garton, Gulia, Haythornwaite, 1996).

Supporting Constructivist Pedagogy and How People Learn

Social Networking Sites are uniquely positioned to mesh with theories of adult pedagogy which stress that adults expect their experience and connections will be incorporated into their learning. Younger and older adults are entering university education classes with the expectation that they will be able to contribute to the discussion, giving feedback as well as receiving it. Students expect to critique each others' ideas and projects as well as contribute to class discussions blending their ideas and experiences with others to create learning. This atmosphere of constructivism is different from that of classrooms where students submit assignments to one person (their instructor) and receive feedback from that person. Multiple evaluations by peers, instructors, and others are quickly becoming the norm in the networked classroom. In synthesizing over a decade of educational and cognitive neuroscience research on how people learn, Bransford, Brown and Cocking (1999) developed guidelines for effective teaching that emphasizes learning with understanding. Effective instructors, they argue, help structure a complete learning environment that encompasses three focal points-- learner, knowledge and assessment--within a larger community or society (p. 120-130). High technology-using environments, such as those embodied by social network sites, may be conducive to both developing learning and innovative pedagogy because they typically feature "learners" informally sharing thoughts, emotions, and skills within a networked community where production, distribution, feedback and reciprocity are valued. Moreover, in developing and displaying a "public" profile and engaging in collaborative acts of production with others in the system, users may be demonstrating the kinds of knowledge construction and problem-solving activities frequently sought in twenty-first century instructional reform efforts.

Although there are various forms of educational constructivism, generally, constructivism is a theory of learning that views the nature of "knowledge" as created or formulated by the learner actively engaged in the process of making meaning (Fulton, 1999). Learners make or "construct" new meaning by taking what they already know and applying what is being learned to new situations. "Knowledge," rather than inherently meaningful, becomes meaningful through the learner's interpretation and application of what he or she knows in a community where knowledge is shared. Experience and individual differences, therefore, are important and respected, and situations that have direct relevance to the learner or applicability to life are those that provide the best opportunities for learning. In the constructivist model, the learner's background, expertise, and beliefs all affect the learning or knowledge that is assembled (Brown & Duguid, 2000). When applied to pedagogy, the constructivist view of learning supports a learner-centered instructional environment where learning and teaching are "facilitated" by the instructors rather than "transmitted" as in a traditional lecture-oriented teacher-centered classroom. Online social network site features may support such environments by enabling users to profile their individual differences and commonalities, communicate interests, ideas, and experiences in multimedia forms, negotiate learning goals, aggregate the wisdom of the group to co-construct solutions, and solicit and get feedback from multiple audiences.

21st Century Skills Frameworks

Ultimately, at all levels of education, from undergraduate to graduate programs, we want our students and clients to be trained in and proficient at using emerging digital tools and social media to ultimately enhance their career-related decision-making and performance. Therefore, this chapter considers how students, in using SNSs, are practicing the kinds of "21st century skills" that are increasingly emphasized in educational and workplace settings, but perhaps especially important in human services occupations. These include *creative thinking*: the ability to construct knowledge and develop innovative products and processes; *communication and collaboration*: the ability to communicate in multiple media and to work collaboratively to support individual learning or the learning of others; *research and information fluency*: the ability to locate, organize, evaluate and process data from a number of sources and present the results; and *problem-solving*: the ability to define problems and manage activities toward a range of solutions (International Society for Technology in Education, 2007; Partnership for 21st century Skills, 2008). Moreover, today's instructors are expected to develop and model these competencies as well as to facilitate their development in students (International Society for Technology in Education, 2008).

CASE STUDY CONTEXT

Drawing on these frameworks above, we undertook an exploratory qualitative study in the spring of 2008 to examine whether and how urban youth from low-income families in the upper Midwestern United States used the online social network site, MySpace.com, as part of their everyday lives and whether and how their MySpace use demonstrated educational and social benefits. This investigation is part of a larger three-year effort to profile these students' Internet technology access, use, and capacity. A total of 1200 students (17- and 18-years of age) were given paper surveys in the winter of 2007 (number of respondents=850) and again in the winter of 2008 (number of respondents=600). They were asked a series of questions about their location, frequency, duration, type of computer and Internet use, and their purpose for using various Web-based technologies. Focus groups were also conducted to triangulate survey data. Students who participated in this research were from thirteen urban high schools (56% female) and were all participating in an after-school program, Admission Possible, aimed at improving college access for low-income students. These students were from families whose incomes were at or below the county median income (at or below $25,000) (Greenhow, Walker, & Kim, 2008).

To investigate students' use of online social network sites, specifically, we conducted follow-up in-depth interviews, talk-alouds, and content analysis of MySpace profiles with a randomly selected sub-group of eleven students (all frequent MySpace users). The case study that follows draws from this larger research effort.

THE CASE OF THERESA SOMMERS

[You learn] different things about different people. . . . you get afforded different opportunities from the social network like with the [political] caucus invitation. I wouldn't have been able to go there; I wouldn't have known how to get there otherwise. (Theresa, age 21)

Theresa Sommers grinned as she talked about getting to know different sides to her "friends" within MySpace.com. She talked excitedly about friending the Democratic nominee for United States president, Barak Obama, and the opportunities to get involved in the 2008 presidential election that had come her way through her online social network. A young woman from a Chinese-American family, Theresa spoke animatedly of her plans to attend a university next year. In just a few short weeks, she would graduate from her large urban high school and transition to the next phase of her life.

Technology Background & Context for SNS Use

We met Theresa in the spring of 2008 when we interviewed MySpace-using teens in order to begin to understand whether and how online social networks might be utilized to support educational and social goals. Theresa was 18 years old and from a low-income family living in a Midwestern city. Like many of the students in our study, Theresa had access to high speed Internet at home. However, unlike others, she had her own laptop and did not have to share time on the Internet with siblings or parents. Theresa was a relatively experienced SNS user, having used MySpace for three years and Facebook.com for 1.5 years. Thus, she maintained two SNS accounts: her MySpace account, for its connections to high school friends, musicians, artists, politicians, and entertainment or school-related groups and her Facebook account as part of her journey toward college access and enrollment. In fact, she used Facebook to "network" with students currently enrolled in colleges she was considering, and she believed these online interactions had factored into her college decision. Theresa used her MySpace several times per week for about one hour, which was slightly less than the majority of students we interviewed who visited daily or every other day. However, her time on SNSs also varied depending on her workload and purposes; she used her SNSs most intensely in the time leading up to submitting her college application, wanting not only to network with current college students but to keep her contacts updated on her college search process.

Patterns and Purpose for SNS Use

As Theresa sat down in front of MySpace, she talked us through her most common activities and strategies when logging in. Like many online teens who prefer communicating through the multiple channels offered by SNSs rather than through older technologies such as email (Lenhart et al., 2007), Theresa used MySpace to make and maintain connections to friends, acquaintances, and potential "friends" within the system. Keeping up with "mail" communications within her MySpace account was, therefore, a top priority. Typically, she sorted through and responded to incoming messages and checked that older messages had been answered or deleted. Next, she moved on to review "friend requests," that is, other people within the MySpace system who wanted to be part of her "friend" network. She accepted the request of an old friend from middle school who had since moved away and that of an acquaintance who had graduated from her high school last year. She denied the request from a "random band" because she did not like the music playing on the band's MySpace page. Next, she skimmed the latest updates among her friends list (e.g., updated profile information, new connections among members, new photos posted to an online photo album, new blog entries on college life). Clicking on the most interesting updates, or on updates from those she had not visited in a while, took her to their individual profile pages. There she "commented people," posting her feedback to a friend's blog or picture or posting a message to a friend's page so that he knew she had stopped by. In travelling to the MySpace pages of people in her network, Theresa could also see who was connected to whom and decide who among her "friends' friends" she would like to get to know. Clicking on the photo of a person outside her network, instantly brought her to that contact's limited profile with the option to "add to friends." Clicking on this option would generate a "friend request" and send it to that person, asking him or her to accept Theresa as a new "friend, thereby, allowing her access to his or her complete profile and online address book.

Theresa also used her network to find multimedia resources and information. For instance, she was looking for a new photograph of herself for her profile homepage. She remarked that she had not changed her profile picture for some time yet valued the dynamic and continually updating nature of the MySpace world. Browsing for photos within her friends' online photo albums, where she had been tagged, enabled her to identify potentially useful images. She mentioned another incident where she had needed resources for a class project. Sending a bulletin or group message to the many friends in her network, she claimed, provided an easy way to gather valuable resources. When time allowed, she wrote poetry in her blog and composed updates on her college application process for those younger friends in her network she hoped to motivate and inspire.

When asked why she used SNSs such as MySpace, she explained how her purposes had shifted from purely social ones to more complex social and education-related purposes. Introduced to MySpace as a sophomore, she had logged in daily, spending an hour or more crafting an online persona through her profile page, searching for "cool" background layouts and changing the colors, design, music, and overall "look and feel" of her page. In many ways, she felt that she was participating in an online popularity contest to see who could have the most interesting-looking profile, the most number of "friends," and the most heavily visited site. As she eventually integrated MySpace into her everyday life, with its competing priorities and time constraints, her purpose for using the site became more authentic and personally meaningful. As a high school senior about to enroll in college, Theresa now says she uses MySpace primarily to strengthen and maintain relationships with people she has met online and offline, to obtain emotional support from her peers, to solicit help with school assignments, to report on school/college-related progress and accomplishments, and to express her creativity.

In this next section, we will discuss how these stated goals were manifested in Theresa's case, highlighting observed social and educational benefits of her participation in the MySpace network.

Developing Relationships & Meeting Interpersonal Needs

The young people in our study, like Theresa, used the capabilities of the online social network MySpace.com to develop and maintain various types of relationships. Contrary to the popular perception that SNS users falsify their identities making truthful relationships difficult, Theresa's profile illustrated her attempts to craft and present an authentic self within the online space. She posted an actual photograph of herself, listed her hometown and country, displayed a username that related to her first name only, truthfully reported her relationship status as single, provided her actual age and encouraged her "friends" to exchange messages with her: "Facebook or text me," now that she was entering college. However, she also took steps to protect her full identity from unwanted viewers, setting her MySpace profile to "private" and allowing only those within her approved network to see her full profile and contacts. Moreover, like the other students we interviewed, Theresa, talked about the advantages of freely expressing her thoughts, opinions, fears, and emotions through the multimedia channels SNSs afford but also noted her hesitancy to reveal too much personal information, such as her full name, address, and contact information, which could subject her to unwanted fraud or abuse.

Walking the line between self-expression and anonymity, Theresa's profile revealed that she used various MySpace features to maintain interpersonal connections with people she saw everyday as well as with those she rarely saw or had never met. Features such as the address book, asynchronous message system, online chat, bulletins, friend requests, event alerts, and automatically generated, aggregated lists of friend "updates" or "status and mood" reports allowed her to keep abreast of the lives of people in her network and grow it. In her view, MySpace was a virtual "hang out" where one could relax around other people (e.g., close friends, distant friends, acquaintances, people she had never met) and keep the "line of communication open" without frequent and costly time and emotional investment:

I think it's a good way to keep in touch with people you may not have time to call or meet or even text them…it's kind of a "kick-back"…it's just kind of a way to relax and hang out and not necessarily having to worry about talking directly to a person but just kind of like keeping that line of communication open.

However, Theresa also noted that a core group of "friends" in her MySpace network were actually people she talked to and physically hung out with regularly. She felt that her connections to those people, especially, deepened with her use of MySpace because she was able to "see more sides to them" than she would have otherwise as they could now express themselves in audio, video, graphical, and text media. For instance, friends she never knew had political interests or artistic abilities were displaying these sides of themselves in MySpace. Friends who were not usually emotional in person were revealing emotions through emoticons, descriptive status updates, or online writing.

Maintaining this range of social connections from which to draw—e.g.,"strong ties" as among family members and close friends and "weak ties" as among acquaintances, distant friends and potential contacts (Granovetter, 1973)— makes SNSs potentially advantageous to young people who are able to activate connections appropriate to their purposes when they need them. For instance, one "friend" in Theresa's network, a former classmate now at a distant university, activated his network to build an audience for his budding radio career. Using the "bulletin" feature in MySpace, he posted the following message titled "New Information," which asked his contacts to check out a new radio show:

I have a radio show entitled "Know it Al!" (a pseudonym for the real title). The information for that is on facebook. Also, if you search for "Know it Al!"on facebook there is a fan site that you can join and become a fan. Through that site I will be sending people updates and everything. So there are two things going on.... The radio show is on Thursdays from 2:30-3:30 and you can stream it online at [name of URL] . All you have to do is hit listen and even if you have a slow internet connection you can still get it. Trust me...

Theresa also used MySpace to initiate connections for career-building and inquiry purposes. For example, she was interested in photography as a potential career. Through MySpace she was able to view the work of professional photographers and exchange comments and questions with them about the field, including the kinds of training and skills that are needed. MySpace allows its users to join public forums and search within the network for people with particular skills like "professional photographers." Because it is a media-rich environment that lets users post their own content without requiring sophisticated technical expertise, experienced and novice artists can scan and upload or link to their work, asking others for advice and feedback. Such intergenerational and cross-disciplinary exchange might rarely happen in the "real world" but in the virtual world of SNSs, with its low costs to self-promotion and sharing, such interconnections are prevalent.

Similarly, Theresa used MySpace to become a resource for younger students, making visible her college search and application process. Posting personal updates where others could view them allowed her to model the process for students like her who were just beginning to think about choosing and applying to schools:

And I would even get questions [online] from different organizations I work with, like students in them, and they'll ask me like what's the process like? and what schools are you picking from? and they seem like they're really into it because that's what they're looking forward to, and so I think I did it a lot more for them [posted that information on MySpace] than for my peers here in school that I work with. (129-133)

Mentoring younger students, something Theresa may not have had the time, inclination or opportunity to do face-to-face, was facilitated through this networked information space. As this example suggests, social digital technologies available on the Web, such as SNSs, may prove particularly useful in helping us address educational inequities. For instance, it is well known that students from low-income families do not graduate from high school, enroll in postsecondary education, or obtain undergraduate and graduate degrees at the same rate as their peers from more affluent families. Often these students lack the social and cultural capital available to students from college-educated and affluent families. Technologies, such as online social network sites, may help "level the playing field" by providing such students with rich, affordable access to supportive peers and adults from similar backgrounds who have succeeded.

Moreover, in providing a range of creative and communication tools without the physical social cues that can discourage self-expression face-to-face, SNSs offer young people an interactive outlet for their emotions, reflections, and experience. For instance, when writing in her MySpace blog, Theresa wrote about topics that were personally meaningful and emotional, "It's kind of me venting." She wrote for herself as well as for an audience, straddling the line between confession and meditation:

I know my friends will go on and read it. For the most part, I'm really up front with them, but then for some things that are kind of hard to say to people… with those things, they read it, and then they take it in their own way and they have time to digest it and then, react to it, like they [have] *a little section where they can leave a comment (178-184).*

Below, Theresa recalled how she was prompted to respond to a friend in need through MySpace, speculating that she probably would not have done so otherwise:

Like somebody will write me and tell me, "I'm going through this." And I wrote a poem for a friend because she and her boyfriend broke up, and that's just probably one thing I wouldn't have done [written the poem] if she hadn't written me about it on MySpace" (475 -478).

As these examples illustrate, SNSs facilitate semi-public sharing, as opposed to writing in a private journal, emailing, or posting in a public online community; feedback and encouragement from other members are aggregated, archived, and can be viewed over time within a sanctioned social circle. Such collective thoughts can provide a powerful source of support, motivation, and recognition for a job well done, even building on and extending relationships in the physical world. For example, in Theresa's case, one of her senior projects was to give a final in-class performance related to an issue she cared about. She felt that many of her peers gave fine performances and wanted to tell them so. Her strategy was to recognize her peers semi-publicly within MySpace: "I like to post it so that everybody can see it [my positive comments to a person]. Of course, you'll tell them face to face but I like to put it on MySpace just so everyone can know they did a good job. (591-596)"

In addition to cultivating and maintaining close and distant interpersonal connections for a range of purposes, young people may be using SNSs to demonstrate the 21st century competencies that educators value, including creativity, communication in multiple media, collaboration to support one's own or the learning of others, problem-solving, and research and information fluency. Examples from Theresa's case illustrate how some of these competencies may be demonstrated.

Demonstrating 21st Century Competencies

Recent survey reports and preliminary descriptive research suggest that today's young people are using participatory media such as SNSs to practice and develop creative processes and innovative content (Lenhart et al., 2008; Lenhart et al., 2007; Perkel, 2008; Hull & Nelson, 2008; Coiro, Knobel, Lankshear & Leu, 2008). Copy/paste literacy practices where youth manipulate and "remix" code in the production of a MySpace profile are giving new meaning to our notions of "reading" and "writing" online (Perkel, 2008). Youth's digital stories, multi-medial compositions produced by layering text, music, and images, are engendering new, respected writing genres (Hull & Nelson, 2005). These are just some examples of how young people may be developing creative capacities and technical proficiency within SNSs which have implications for formal education. Theresa, for example, posted original photographs within her MySpace profile as a means of personal expression. She credits MySpace with motivating her to share this work with a wider audience:

I always liked to take photographs, and I had a bag full of like 15 disposable cameras that had not been developed. So MySpace got me to develop them and put them on MySpace. . . . I develop more pictures; I make more of an effort to get what I'm doing out to people just because it's an open space for people to observe.

In fact, she marveled at the positive effect SNSs had on her ability to represent herself, "I think [SNSs] have changed my communication skills in some ways because I don't necessarily have a problem [now] speaking my mind." We also saw evidence of this in the range of artifacts students posted within MySpace (e.g., videos they had created, photographs, graphically interesting backgrounds, music, song lyrics, links to other artifacts).

In addition to sharing photographs, Theresa shared her creative and school-related writing. Prior to joining MySpace, she felt others rarely read her work, but MySpace helped motivate such efforts by giving her multiple audiences for which to perform. The audience for her school writing was generally classmates while the audience for her creative writing and photography was a diverse group of people, such as artists she had come into contact with through MySpace and believed she would not have known otherwise. Theresa's sense was that people young and old enjoyed sharing their creativity in SNSs: "I know people that dance and sing and they have little videos on their profiles and I know some other poets and people who like to write and rap and do art and paint and take photographs and everything."

The interconnections and creative capabilities evident in SNSs like MySpace offer learners initiation into a Web-based "participatory culture" (Jenkins, 2006) with low barriers to artistic expression and civic engagement, strong support for creating and sharing one's digital productions, a sense of social connections to each another (or at least caring what other people think about what one has created), and a belief that contributions matter. Participatory culture is manifested as: *affiliations* such as "groups" or "forums" centered around people's background, interests, connections, and media; *creative self- or collective expressions* (e.g., video-making, mash-ups), and *circulations* (e.g., podcasting, blogging) (Jenkins, 2006, p. 1). Such opportunities potentially enrich learning by making it more personally meaningful, collaborative, and socially relevant.

Moreover, the self-assertiveness and confidence developed by "speaking my mind" to a select audience, often for purely social reasons, may encourage youth to turn to those networks for help in solving important problems or decisions. As 21^{st} century educators, we value critical thinking, reflective decision-making, and collaboration and seek to develop these competencies in today's learners to prepare them for tomorrow. In MySpace networks, youth may be developing their ability to solicit advice and feedback from others they trust in order to manage projects and explore solutions. This was evident in Theresa's case where she and her peers in a school program posted excerpts of their essays within MySpace so that the group could collaboratively determine how the essay should be structured. Theresa commented: "Everybody's always working on projects like this at the same time and so, we'll [post in MySpace]: 'How long did you take on your essay?' or 'How'd you begin in there? How'd you write it?' So then sometimes we'll share that and everybody kind of does it, at least in our SLC [small learning community]."

Beyond creative thinking, multimedia communication, and collaborative problem-solving skills, we as educators also want our students to develop research and information fluency for the 21^{st} century. It is not enough to consult one source, such as a family member or book; in today's constantly shifting, global economy, learners need to be skilled in consulting multiple sources of information and people and synthesizing disparate bits of data, often in teams, to make well-informed, strategic decisions. Past research on students' online inquiry processes has documented students' difficulties in finding quality information online and discerning the truth or reliability of information they find (Kuiper, Volman & Terwel, 2005). "Social navigation" (Jonassen, 2000) within SNSs—as when a group of users with common interests help each other navigate the Web's complexities by sharing URLs, personal contacts, and aggregated resources —may help learners develop more nuanced research strategies and greater information fluency. The young people we interviewed told us they "tapped the network" to gather information on various topics, and this was evidenced in MySpace bulletin posts from individuals seeking information or responding to requests. In Theresa's case, she supplemented the information she found about different colleges from promotional materials, college Websites, college guides, and people in her local network with first-hand personal accounts from actual college students she had identified and contacted through Facebook:

It kind of was, like, I had a laundry list of schools I wanted to apply to. And so, I kind of narrowed it down based on my conversations on Facebook because the students on there, they feel more comfortable telling me what they think of the school . . . So they can kind of just share their honest interpretations and some schools, I got such great feedback and others, it's was just like, well, I know not to go there. (291-296)

Learning how to quickly mine different types of information from a diverse but bounded universe of social and professional contacts, as Theresa did, may help learners develop research and information fluency more effectively than relying on a single authority (e.g., the instructor) or peer group for guidance. Indeed, the new social Web is generating a particular brand of social network sites dedicated to making the Web more navigable and semantically organized. Social bookmarking and tagging sites (e.g., http://delicious.com/) allow their members to develop folksonomies. Folksonomies are collections of resources on varying topics such as educational research, cooking, video games, computer software, research on health conditions, tennis and other special interests. Anyone with a special interest can start tagging sites that relate to a topic and add them to an existing folksonomy or start one of their own. For instance, Citeulike.org is a site specifically oriented towards scholarly resources where groups can post articles related to the topic they are researching and other scholars can post articles to the same topic. These social bookmarks can be private, shared only among members of a particular social network (e.g., American Association of Internet Researchers) or they can be publicly available for anyone to use and contribute.

DISCUSSION AND RECOMMENDATIONS

The case of Theresa Sommers, and that of students like her who use online social networks for interpersonal relationships, school-related processes, college and career inquiry, leisure pursuits, community service, and 21st century skills development, offers several insights for human services education and practice.

SNSs in Human Services Education

First, in human services education, online social network sites might be integrated as a component in flexible learning and human service delivery within graduate school education, complementing the core practicum and other integrated learning components of university programs. Instructors seeking to implement learner-centered constructivist teaching strategies may benefit from layering an online social networking component over traditional in-class, online or hybrid course structures. For instance, it is well established that large enrollment classes and online or hybrid (partially online) courses which have high levels of peer-to-peer and instructor-student interactivity also tend to have higher student retention, satisfaction, and course completion. However, typical course management systems used to support or deliver such courses, such as Blackboard (http://www.blackboard.com/us/index.bbb), are designed more for content delivery controlled by a central administrator (instructor) than they are for ongoing, multi-channel communication, multimedia-sharing, and networking among course members. In addition, incorporating peer-to-peer interaction and group-building activities is time-intensive, costly, and usually not feasible where curriculum demands and staffing shortages favor direct instruction.

Supplementing human services courses with anytime/anywhere, freely available online social networking services may help work around these barriers, providing all course members with a cheap solution to help them monitor, learn from, and co-construct the group's experience. For example, *Social Work 2.0* (http://www.socialwork20.com/) is an intergenerational SNS of current undergrad and graduate students, social work professionals (1-20 years in the field), non-profit leaders, researchers and others. Within this network, each member has an individual online profile page where he or she can list location, professional status, degree-granting institution, and areas of social work/interests. Online forums within this SNS such as "Speak" and "(ME)Career" reveal a wealth of career and job-seeking resources, experiences, and advice for social work students and early career professionals. In addition, each Social Work 2.0 member can share reflections in his or her blog, generate discussion questions, share resources, request contacts, invite new members, etc. When an online profile is changed, as when someone writes a new blog entry or uploads a video or shares a question, the change appears prominently on the community home page so all members can track each others' activities. For instructors who seek to foster reflective practitioners, group cohesion, and a supportive and caring community for their students, SNS environments may help facilitate this by motivating students' self-expression, public sharing, support and commentary as we saw in Theresa's case.

Moreover, information and communication tools such as SNSs offer a dynamically updating method of pooling users' collective wisdom, interests, and contacts. As Theresa's case suggests, when initiated into an online community where multi-media sharing is not only valued but promoted, students may be developing important habits, preferences and skills that prepare them for the human service education workplace of the future. Theresa tapped her network to promote her creativity, solve problems, make life-altering decisions, augment her knowledge base, and pull others with varying levels and types of expertise into her network. Initiating students into these ways of thinking and using social digital technologies may help them develop the interpersonal skills and creative practices that are essential to cultivating an effective professional network of colleagues, service providers, and clients in the human services field. As future human services professionals, graduate students must develop proficiencies in: helping others obtain information and services, keeping and monitoring updated records, communicating clearly in varied formats to multiple audiences, collecting input/ideas/information from clients, establishing trust, and leading or facilitating team activities. Employing a customized SNS for similar tasks within a guided learning environment, such as a university course, may help students develop these proficiencies as part of their core practicum or work-integrated learning experience. However, SNSs may be most powerful as educational tools when the community students join goes beyond the limited experience base of a particular course or university program to encompass and expose students to the broader institutional, social, cultural, and political perspectives of a national or international network in their field.

SNSs as Tools for Human Services Practitioners

Second, human services practitioners might leverage SNSs to reflect on their work, tap peer-reviewed online continuing education, develop 21st century work practices, and grow their personal and professional networks, thereby improving their ability to develop, implement and maintain a comprehensive service plan. Similar to integrating these tools into human services education, practitioners in the field might utilize SNSs as outlets for personal reflection and creative expression. Keeping an online semi-private journal with SNS blogging tools, for instance, may motivate practitioners not only to vent and get support from friends or troubleshoot with colleagues but reflect on their practices over time. Within the Social Work Advocates and Community Care SNSs introduced earlier, human services practitioners use a range of online communication tools to reflect on their stance toward particular issues, to strategize how to advocate successfully, and to educate themselves (e.g., uploading educational videos, reports, relevant URLs, anecdotal evidence, etc.). SNSs that interface well with multi-functional handheld devices such as "smart" phones may be especially beneficial to travelling practitioners who need continuous, multi-channel, on-the-job access to their professional network. In addition, using SNSs to foster ongoing exchanges between students entering the field, current graduates, and experienced practitioners may do much to keep human services education programs relevant, to facilitate effective job placements, and to keep professionals current on research and evidence-based best practices.

Furthermore, Web-based SNSs, or some future version of them, may eventually help human service professionals engage in transformative inter-agency data-sharing, case planning and service coordination, which current proprietary knowledge managements systems and bureaucracies prevent (O'Looney, 2005). Various sectors, not just human services, are inquiring into how to harness emerging social technologies for organization- and job-changing impact. For instance, businesses are looking into how to tap their employees "social connections, institutional memories and special skills – knowledge that large, geographically dispersed companies often have a difficult time obtaining" by using social networking software to connect a company's employees into a single private Web forum (Stone, 2008, p. C2; Gratton, 2007). News media are increasingly tapping viewer participation in the form of online comments and testimonials, independently produced videos, and citizen journalist blog entries to enhance the accuracy, power and spread of centrally produced stories (e.g., CNN's documentary *Black in America*).[1,2] And apparent in the U.S. 2008 presidential election campaign is a new style of "Netroots" politics: "open-sourced and inclusive, multi-racial and multicultural" where potential voters don't just consume campaign propaganda but help shape and distribute it via online meet-ups, blogs, videos and Internet social networks (Sheehy, 2008, p. 79) Small scale proof-of-concept projects between human services units may help move us closer to understanding how the field can similarly benefit from the range of affordances SNSs allow.

SNSs as Tools for Serving Clients

Third, practitioners may also consider identifying SNSs that fit the needs of particular clients and recommending how clients might use them to obtain support, learn healthy behaviors, mitigate stress, express their passions or career interests, and other potential uses as appropriate to an overall personal development plan. In Theresa's case, MySpace was a place to work out everyday personal, school, and career-related issues and identify or process emotions by blogging, writing poetry or finding a song that matched her mood. In SoberCircle, introduced earlier, clients can find support from others who understand how difficult recovery can be when struggling with emotional and relationship issues. Family and friends of those in recovery can also obtain support on SoberCircle. Clients and/or their families can explore treatment options as well as find a human services worker. Within PatientsLikeMe, members can find information on the latest treatments from those who are using them. Information is available on neurological disorders including: Multiple Sclerosis (MS), Amyotrophic Lateral Sclerosis(ALS), Parkinson's, Progressive Muscular Atrophy (PMA) and Devic's Neuromyelitis

Optica as well as other conditions. PatientsLikeMe also offers specific resources for people with mood disorders such as depression, anxiety, bipolar disorder, obsessive-complusive disorder (OCD) and post-traumatic stress disorder (PTSD). The site supports clients with immune conditions HIV/AIDS. Patients can volunteer to be in research studies or read about cutting edge treatments under development. The site is searchable by location, age, disease, treatment, or symptoms, making it easy for members to connect with each other and find relevant information. Privacy protections prevent using real names (patients use screen names) or contact information. Members have the option of posting photographs or diagrams with their condition, gender and age. Multiple communication channels encourage open sharing about new treatments, uncommon symptoms or overcoming everyday problems, and site features address a range of learning styles

In addition to potentially developing clients' basic technological competence, confidence, and 21st century skills, which are prerequisites for many jobs and education options, facilitating their use of social digital technologies, such as online social network sites, may provide them with a rich, multimedia toolkit through which to express their talents, interests and aspirations. Early research is beginning to discern how digital story creations, for example, serve social functions, especially for traditionally underserved, disengaged students (Hull & Nelson, 2005). Displaying different sides of oneself in a supportive peer-to-peer network may help forge beneficial social relationships around common interests and/or help human services professionals, if linked in to such profiles, better understand their clients' needs.

Gustavsson and MacEachron (2008), in examining the role of the Internet in foster care, suggest that where youth experience multiple placements and risk losing an accurate biography of their childhoods, email accounts that function as an electronic diary may be one solution. We suggest that agencies and human services professionals might better serve such young people by not only helping them develop a secure digital repository —providing "a portable life biography and sense of self over time" —but also a portable, dynamic network of people and resources they take with them independent of place and time. An online support network can be available when a social services professional is not. Since many of these networked communities are international, members are online chatting and blogging at all hours of the day dealing with a variety of issues. Clients are likely to find someone who can empathize and offer support when other resources may be unavailable. In these ways, SNSs may complement or extend a client's overall treatment plan.

FUTURE TRENDS

As human service professionals utilize social networking technologies to forge individualized, constructivist learning experiences, work practices, and technology-integrated service or treatment approaches, new research opportunities will develop and best practices, evolve. People, both young and old, who understand how to use these online social networks for self expression, community-building and professional development, may have a decided advantage over those who do not. According to a survey by the U.S. National Association of Colleges and Employers published in March 2008, employers will not only use online social network sites to check profiles of potential hires, over 50% will use sites like Facebook (www.facebook.com) and LinkedIn (www.linkedin.com) to "network" with candidates. Recruiters and recruits in entertainment, business, higher education and other industries are beginning to capitalize on these social digital technologies to find new talent, make professional connections and promote their accomplishments (Rosenbloom, 2007). Moreover, technology executives predict an increasing proliferation of SNSs as online social networking moves away from restricting users to walled-off membership in a few sites toward a more open and flexible sharing between numerous niche communities (Stone, 2007; Helft & Stone, 2007). Thus, participation in such networks may increasingly become part of the educational and career development process for people of all ages, in all fields.

CONCLUSION

This chapter introduced the reader to online social network sites, summarizing their features, uses, demographics, and trends, and presenting emerging research on their social and educational potential through the case study of one young woman in transition. Exploring SNSs through a case study illustrated how they can be used to support young people's social and emotional development as they provide spaces to express emotions, deepen friendships and demonstrate creativity. The young woman in the case study developed 21st century skills working in the multimedia environment of her MySpace profile. She also utilized her connections for academic ends, getting help with homework as well as giving advice to younger students about the college application process. Other young people can use SNS's to similar advantage.

Social networking sites specifically for human service professionals and their clients were also discussed. Several sites where professionals can share resources, mentor others and find career information were listed. This chapter also listed SNSs that support clients such as SoberCircle and PatientsLikeMe. We also emphasized how private networks can be constructed to facilitate work with clients without exposing private information online. Finally, in our discussion and recommendations, we suggested how human services educators, students, professionals, and clients might take advantage of such information and communication technologies to advance their own development and the state of the field. Through a greater accumulation of research and practice we look forward to building on the conversation started here.

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This work was previously published in Information Communication Technologies for Human Services Education and Delivery: Concepts and Cases, edited by J. Martin; L. Hawkins, pp. 15-36, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 1.16
Teens and Social Networking Services: An Overview

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ABSTRACT

This chapter provides an overview of the ways teens interact with social networking services. It acknowledges that teens are active users of social networking sites, and the implications of this usage affect and/or cross social, moral, educational and political lines. By reviewing current trends and statistics from various authors and sources, this chapter provides background information to understanding the growth and importance of online social networking among the Internet generation. Topics include demographics, ramifications on social behavior, adults' concerns, policies designed to restrict teens' Internet access, educational benefits and future directions of teens' use of social networking services. Realizing the importance and influence of online social networks among teens should provide readers with a better understanding of how these sites can not only be used for educational and marketing purposes, but also be integrated within work environments.

DOI: 10.4018/978-1-60566-104-9.ch009

INTRODUCTION

Adults may refer to the online sites as social networking services or sites, online social networks, interactive Web applications, or variations on a theme of Web 2.0. But as adults create titles and descriptions for these sites, "teens are speeding ahead, making it up as they go, including the language and the tools and their uses. To them, these sites are just another tool for socializing" (Magid & Collier, 2007, p. 2). Teens generally refrain from using any of the adult variations of titles and simply refer to the services and sites by function or commercial site name. By reviewing current trends, uses, effects and concerns of teens' use of social networking services, this chapter provides background information about the continued growth and importance of online social networking among teens.

In order to increase awareness and understanding of the various implications of social networking as they influence teens, this chapter will attempt to do the following:

- Review the way the Internet in general and social networking services specifically have influenced teen generations;
- Examine teens' online behavior and their use of social networking services;
- Discuss why social networking sites are so attractive to teens;
- Consider the ways social networking affects teens' interaction in online and real-life social situations;
- Address the concerns of parents, other adults and media reports of online dangers;
- Review information about various legislations and policies designed to restrict minors' use of social networks;
- Present successful and creative uses of social networking among teens;
- Show that social networking services are a major part of teens' lives and a viable aspect that will continue to increase in usage among teens and impact their adult lives.

While the exact age of teens varies among sources, the term usually describes students in middle school and high school. The American Library Association's division of Young Adult Library Services Association (YALSA) defines *teens* as students ages 12-18 (American Library Association [ALA]:Young Adult Library Services Association [YALSA], n.d.). It is the definition generally used for purposes of this chapter.

When Donald Tapscott wrote his book *Growing Up Digital: The Rise of the Net Generation* in 1998, he referred to teens as the Net generation (also Net Gen or N-Gen). Teens born after the rise of computer technology have been given an assortment of generational titles including the Internet generation, Generation M (for Media) (CBS, 2005), Gen Y and MySpace generation. The Pew Research Center for the People and the Press calls these teens "Generation Next" (2007). The assortment and interchangeability of titles seem appropriate for a generation that is used to constant change in technology. For purposes of this chapter either Net Generation or Next generation (or variances of those two titles) will be used to describe the generation. The titles describe a generation used to multi-tasking and instant information (Tapscott, 1998). This generation is willing to compromise privacy (Kelsey, 2007) in exchange for accessing the world 24/7 via the Internet. They are more literate in visual concepts than previous generations (D. Oblinger & J. Oblinger, 2005), yet equally comfortable with text that amply appears on the screens of computers, cell phones and video games. They are a generation that is inclusive and social (D. Oblinger & J. Oblinger, 2005), as well as interactive and investigative (Tapscott, 1998). Specifically, they are a generation born around 1980—after Generation X which comprises individuals born from 1966-1980 (Pew Research Center, 2007). Tapscott refers to the Net generation as those people "born between 1977 and 1996 inclusive" and declares that "internationally the Net Generation is huge, numbering over two billion people" (Tapscott & Williams, 2006, p. 46). Next generation teens are creative, and they have found an outlet for their creativity by using social networking services to express themselves, and to evaluate each other and their world.

INFLUENCES OF THE INTERNET AND SOCIAL NETWORKING SERVICES ON TEENS

Anastasia Goodstein (2007) wrote in her book *Totally Wired: What Teens and Tweens are**Really**Doing Online,* that while teen trends may have changed, the basic struggles of adolescent development have not changed much from previous generations. Goodstein believes these wired teens, like their predecessors, are still "trying out different identities, learning responsibility, being impulsive and idealistic, feeling invincible, dealing with physical changes, distancing from parents, and creating meaningful relationships with friends" (2007, p.2). One thing that does denote a change for the Net generation, however, is the fact that this generation is "the first cohort to grow up fully wired and technologically fluent" (Hempel & Lehman, 2005, p. 88), and that fact has had an obvious effect on teens.

Professors Diana G. Oblinger (2005) and James L. Oblinger (2005), editors of *Educating the Net Generation*, identify five characteristic differences in the way Next Gen students analyze and absorb information. Oblinger and Oblinger credit all of these characteristics directly to technology's influence on the generation. Among these differences are students' ability to understand more visual communication, to easily navigate between the virtual and physical worlds, to learn through self-discovery, to quickly retarget their attention (similar to multi-tasking), and to respond quickly and anticipate equally fast responses (D. Oblinger & J. Oblinger, 2005). Social networking services feature capabilities that cater to these types of characteristics by including ample visual stimulation through photographs, videos, virtual environments and vlogs; allowing students to have real-life types of communication, relationships and experiences in a virtual setting; giving teens the opportunity to explore topics, express their ideas and learn for themselves; and enabling instant messaging and rapid posting of constantly-changing information. Another observation by Oblinger and Oblinger is the desire for socialization by Net generation learners, who prefer activities that encourage "social interaction" (2005, p. 2.6). In many online situations, this social interaction becomes mass collaboration or what Tapscott calls "peer production" (2006, p.11). Additionally, these teens have an "openness to diversity, differences, and sharing;" "are at ease meeting strangers on the Net;" are "emotionally open," and have "developed a mechanism of inclusiveness that does not necessarily involve personally knowing someone admitted to their group" (D. Oblinger & J. Oblinger, 2005, p 2.6).

USE OF THE INTERNET AND SOCIAL NETWORKING SERVICES AMONG TEENS

According to 2007 reports by the Pew Internet & American Life Project, 93% of American teens use the Internet (Lenhart & Madden, 2007b, p.3), and "more than half (55%) of all online American youths ages 12-17 use online social networking sites" (Lenhart & Madden, 2007a, p.1). Berkeley doctoral candidate Danah Boyd believes the latter figure is low. Boyd, who has become the oft-quoted and recognized leader in social networking research, particularly as it pertains to teens, says that in her experience with teens, 70-80% of them have an online profile (2007b, Methodological notes, para. 4). Boyd acknowledges that not all the teens she interviews are active on their profile accounts or may not have created the profiles themselves (rather, allowing friends to create profiles for them). She believes 50% indicates the percentage of teens who are active (as opposed to inactive) users of social networking services (2007b, Methodological notes, para. 4).

Globally, the number of people accessing the Internet and (often) social networking sites is increasing. In July 2007, comScore, which calls itself "a global leader in measuring the digital world" (Lipsman, 2007c), released global statistics regarding the use of social networking sites among Internet users over the age of fifteen. According to comScore's executive vice president of international markets, "social networking has really taken off globally" (Lipsman, 2007c). Observing an increase in the daily visits to social networking sites, comScore says "it would appear that social networking is not a fad but rather an activity that is being woven into the very fabric of the global Internet" (Lipsman, 2007c). In the United Kingdom, people aged15-25 are "25% more likely to be online than the general population" (Lipsman, 2007b). In Australia, nearly half of all children ages 6-17 are online daily (Woodhead, 2007). Australian teens ages 15-17 go online daily, often to access social networking sites (Woodhead, 2007). Canada boasts "the world's ninth-largest Internet population" with 80% of the population visiting social networking sites (Canada online overview, 2007). As of May 2007, Japan's Mixi, the nation's largest social networking service, had eight million registered users (McNicol, 2007). Half a million teens are part of Mixi's registered users (Katayama, 2006). CyWorld has 18 million Korean users (Schonfeld, 2006) with 90% of Korean teens and twenty-somethings having an account (Ihlwan, 2005). Orkut, Google's social networking site, has made major inroads in Latin America, particularly in Brazil (Kharif, 2007). 12.4 million unique users from Latin America visited Orkut in August 2007, twice the amount of visitors from that same region to MySpace and Facebook combined (Kharif, 2007).

Lenhart and Madden's study analyzes American teens' online behavior by demographics and shows that younger teens with online profiles are fairly divided between the genders until they get older (2007a, p.3). A larger gender division occurs when age becomes a factor. Seventy percent of online girls ages 15-17 have created a profile, while 57% of online boys this age have done likewise (Lenhart & Madden, 2007a, p.3).

An earlier Pew Internet report (Lenhart, Madden, & Hitlin, 2005) indicates a major increase in Internet use as teens advance in grade levels. These figures denote general online use and not necessarily use of social networking sites. While 60% of 6th grade students were shown to be online, by 7th grade the number rose to 82%, and by grade eleven 94% of teens indicated being online (Lenhart et al., 2005, p.1). Age is also a factor in the frequency of Internet use. American teens between the ages of 15-17 frequent the Internet more than younger students, with 59% of those older teens going online at least once a day (Lenhart et al., 2005, p.2).

The amount of time teens spend online continues to increase. Nielsen/NetRatings from October, 2006 showed the amount of time American teens spend online increased 27% within a three-year time period (Bausch & Han, 2006). The survey shows that American teens spent an average of nearly 27 hours per month online (Bausch & Han, 2006). A study with variances from the aforementioned comparison indicates the hours European visitors over age 15 spend on social networking sites and rates the United Kingdom with the highest time spent at an average of 5.8 hours per month, followed by Germany at 3.1 hours per month (Gavin, 2007). "Heavy users" in the U.K. spend an average of 22 hours on social networking sites (Gavin, 2007). According to Lenhart and Madden (2007b), daily use of the Internet by American teens has risen from 42% in a study conducted in 2000 up to 61% in a similar study conducted in 2006 (p.3). Teens are spending much of their online time visiting social networking sites. "[Forty-eight percent] of teens visit social networking Web sites daily or more often; 26% visit once a day, 22% visit several times a day" (Lenhart & Madden, 2007a, p.2).

Sites that are especially popular among this age group tend to be those that are social networking in nature (Lipsman, 2007b). Bob Ivins, executive vice president and managing director of comScore Europe, says the high Internet usage among younger people shows that the Internet is "integral" to this generation (Lipsman, 2007b). "Younger people use the Web for communications, content, community and commerce more than other age segments," says Ivins (Lipsman, 2007b). So many young Australians are using the Internet that statistics among youth ages 6-17 have now plateaued at 92% (Woodhead, 2007). Commenting on American students' use of social networking sites, Ken Cassar, chief analyst for Nielsen/Net Ratings says, "The Internet is as much a part of children's lives as TV, school and books. We can expect the time kids spend online to increase along with expanded offerings on the Web and the growing network of their friends and family who use the Web frequently" (Bausch & Han, 2006).

One of the ways teens use social networking services is by creating and maintaining a personal profile page on a site such as MySpace, Facebook, Orkut, Bebo or one of many other such commercial sites. These profiles usually include photographs, comments, surveys, likes and dislikes, and personal interests. Video clips, songs, and decorations often complement the profile. Online profiles may be compared to interactive scrapbooks or photo albums. Since keeping their profile pages interesting is an important aspect for teens, it is possible that many teens are spending their online time posting new information to their profile. The Nielsen/NetRatings survey shows that American teens' favorite Internet sites are those which offer tools or assistance in developing content or layouts for online profiles (Bausch & Han, 2006). However, according to Lenhart and Madden, the overwhelming reason American teens cite for visiting their social networking sites so often is to "stay in touch with friends" (2007a, p.2).

Social networking sites are often compared to the malls, soda shops and other assorted hangouts that appealed to previous generations of teens. "Social networking sites have become the virtual commons where teens go to hang out with their friends" (Rapacki, 2007, p.29). In a *People* magazine article about MySpace, psychologist David Walsh said "Kids have always congregated with other kids. Two generations ago, it was at the corner candy store. Now, in this high-tech age, MySpace is the candy store on steroids" (Hewitt et al. 2006, pp. 116, 118). Teens do many of the same things online that previous generations did in school hallways, friends' rooms, locker rooms or local hangouts. They talk, laugh, gossip, share and flirt with each other. Just how many teens are on which sites is difficult to determine, primarily because the numbers keep increasing so rapidly, and as Boyd recently observed, "one of the biggest problems with studying youth culture is that it's a moving target, constantly shifting based on a variety of social and cultural forces" (2007b, Methodological notes, para. 3). Couple that moving target with rapidly evolving aspects of technology, and statistics often become difficult to track. In December 2005, *BusinessWeek* named three popular social networking sites and showed that the number of users ages 12 to 24 accounted for 45% of all users on MySpace, 50% of all users on Xanga, and 57% of all users on Facebook (Hempel & Lehman, pp.90, 92, 94). The January 2007 Pew Internet report also shows that MySpace, Facebook and Xanga are popular sites among American teens (Lenhart & Madden, 2007a, p.4).

ComScore released statistics on July 31, 2007, revealing the "expansion of social networking across the globe" among various users ages fifteen and over (Lipsman, 2007c). The study lists seven sites, all of which experienced significant growth from the previous year ranging from a 56% increase for Hi5 to 774% for Tagged (Lipsman, 2007c). ComScore notes that "specific social networks have a tendency to skew in popularity in different regions" (Lipsman, 2007c). MySpace and Facebook are the top contenders in North America, Bebo's audience appeal is in Europe, Orkut's following is in Latin America, and Asia-Pacific regions prefer Friendster (Lipsman, 2007c). Hi5 and Tagged are identified as having "more balance in their respective visitor bases, drawing at least 8% from each of the five worldwide regions" (Lipsman, 2007c).

Boyd (2007) offers an interpretation of teens' preferences for specific sites as those preferences fall within social issues. On her blog, Boyd discusses recent trends of high school students transferring their online profiles to Facebook from MySpace, a change she believes reflects socio-economic factors rather than age or gender (2007b). Boyd calls this exodus a "fragmentation" (2007b, para. 1) rather than a shift, and her essay has been summarized as suggesting "MySpace users tilt toward the lower middle classes" (Atal, 2007). Although Boyd admits the essay she posted on her blog is not academic in nature, she writes that she has recently seen a clear division in the kinds of students using MySpace versus Facebook. Facebook, which was previously open only to college students, opened its membership in 2005 to include high school students. Boyd acknowledges that students who are from families where education is emphasized are the ones now using Facebook (2007b). She believes MySpace is the preferred social networking site for teens whose parents did not go to college, and who themselves will be expected to get a job rather than pursue higher education after high school (2007b). Boyd divides the two groups of teen users, those on Facebook versus those on MySpace, as hegemonic and sub-altern, respectively (2007b). She admits that the terms are not completely adequate for her descriptions but adds, "Sub-altern teens who go to more mixed-class schools see Facebook as 'what the good kids do' or 'what the preps do.' … [T]he hegemonic teens see MySpace as 'where the bad kids go'" (2007b, Socio-economic divisions, para. 9). Boyd summarizes her observations by saying that this "division around MySpace and Facebook is just another way in which technology is mirroring societal values" (2007b, Thoughts and meta thoughts, para. 2). Additional research is necessary regarding this division.

BusinessWeek notes that many of the same online users are utilizing both MySpace and Facebook and quotes comScore as reporting "a 64% overlap" of those people who use both sites (Atal, 2007). *BusinessWeek* does not indicate the ages of the people in their findings.

THE ATTRACTION OF SOCIAL NETWORKING TO TEENS

Regardless of which teen is using which social networking site, just what is the appeal of these sites to teens? Social networking sites are the commons or hangout for Next generation teens. Because this hangout is in a virtual world, it not only means that it is open any time, but also that it is, more often than not, clear of parental control. Parents are often not as tech-savvy as their online children and therefore do not always frequent the same online social networks as their teens. Candice M. Kelsey (2007), author of *Generation MySpace: Helping Your Teen Survive Online Adolescence*, compares MySpace to a kind of virtual "clubhouse" for teens—a clubhouse with access through the "doors" of every computer, PDA and some cell phones (2007, p. 2). Kelsey adds that MySpace is a "parent-free zone" where teens "can pretend to be anything or anyone they want" (2007, p. 2), both of which are additional appeal factors to teens. The same descriptions can be said of most social networking sites frequented by teens.

Boyd agrees that the absence of parental or adult authority is part of the appeal of social networking sites among teens. As quoted in Kelsey's book, Boyd says "MySpace is the product of youth creating space of their own. Teens are looking for a release from the control of their usually unstable homes. …It is a control issue at heart" (Kelsey, 2007, p. 13). Boyd also says that technology (namely social networking) is helping teens cope with their often stressful and fragmented lives by providing places to socialize and develop a sense of "community" with other teens (2007b, Thoughts and meta thoughts, para. 7).

Tapscott rightly predicted that the Internet would soon become a place that would "carry audio and full-motion, full-color video" and that "anyone…with a video camera and PC will soon be able to broadcast to the world" (1998, p. 50). He declared that "tens of millions of N-Geners around the world are taking over the steering wheel" (p. 26) of the media and added that this generation was unique in that it was the first group to take "control of critical elements of a communications revolution" (p. 26). Again, the issue of control becomes a factor when reviewing reasons social networking sites appeal to teens. Teens grabbed hold of the steering wheel, and as Magid and Collier declare in a subtitle, "Teens Are in the Driver's Seat" (2007, p. 172). Instead of being just spectators to information, stories, events and news (as previous generations had to be with television and print sources), teens are now content creators and contributors through the concepts and capabilities of social networking sites.

With little parental involvement or control, teens are very open in their online postings and express an attitude of independence—aspects which, for many adults, open issues of Internet ethics. Teens' postings often include "raw content" (Hewitt et al., 2006, p. 119) such as crude language and risqué photographs or videos, in addition to discussions of sex, alcohol and drugs (Simon & Majewski, 2007). As Tapscott (1998) noted, independence and openness, as well as free expression are some of Net generation's characteristics, although past generations of teens have also freely shared dirty pictures and discussed taboo topics among themselves when parents or caregivers were absent. Part of the way teens develop independence is by exploring their identities as they mature, and social networking sites can contribute to this self-identity process by allowing teens to experiment with different representations or identities of themselves online. Tapscott addressed the topic of "vanity" (p. 113) in his book although he believed the opportunity for teens to post personal information online was a way for students to develop their self-esteem.

Some adults believe teens' social networking use goes beyond building self-esteem and use the word *narcissism* to assess teens' love affair with social networking. Psychologist Michael Brody boldly declares "digital technology is associated with self absorption, narcissism and isolation" (2006, p. 8). Boyd acknowledges teens' desires for fame, something akin to "peer validation" (2007a, para. 7) and admits that technology such as social networking allows for free distribution for teens and other "fame-seeking narcissists" to post themselves online "in the hopes of being seen and being validated" (2007a, para. 7). Boyd's comments echo Lenhart and Madden who show that a major attraction of social networks for teens is the feedback and sense of belonging to a group that they receive from the sites (2007b, p. 13). To some teens, having their image and ideas noticed by others on the Internet is the equivalent of fame.

When *University Business* wrote an article about social networking services (Sickler, 2007), research was conducted with college students about their use of Facebook and MySpace. Although slightly older than teenagers, these college students' comments echo many teens' views of social networking sites:

- "It is way too much fun to think that people are looking at me and paying attention to me in their free time"
- "It reminds me that I have friends"
- "I also like that it is an excellent way to get people to stare at pictures of me and basically worship me by writing things on my Facebook wall" (Sickler, 2007).

While Boyd does not believe social networking sites cause narcissism, she does believe sites such as MySpace serve as "a platform for people to seek attention" (2007a, para. 15). Mike Riera, author of several parenting books, says," I think the very nature of being a teen is very narcissistic. They're so in love with themselves that they think everyone else will love what they have to say, too" (Goodstein, 2007, p. 34).

SOCIAL NETWORKING SERVICES AND TEEN SOCIAL BEHAVIOR

Having their say on blogs is yet another way teens are socializing and promoting themselves online. According to Forrester Research, blogging—including publishing a blog—is "booming" among North American youth ages 13 to 17 (Charron & Florentino, 2006). Blogs, which may be compared to online diaries, allow teens to express themselves in an environment free from parents, to explore their own identities, to form virtual relationships, and to locate people with common interests (Goodstein, 2007, pp. 30-32). An interesting aspect of online socializing is the way anonymity affects teens' interaction with each other. Teens online find that they are not judged by physical characteristics such as race, clothing styles or age as they might be in real life (Goodstein, 2007, p. 66; Lenhart & Madden, 2007b, p. iii). Goodstein references a *San Jose Mercury News* article that discusses teens at a particular high school who socialize virtually with classmates they would never socialize with in person. "For some teens, the friends they meet on blogs remain online friends who don't interact at all offline, even if they pass each other in the hallways" (Goodstein, 2007, p. 32).

The New York Times published an article about the rise in popularity of self-portraits, especially among teens (Williams, 2006). Williams' article refers to the generation as one "raised on a mantra of self-esteem" who now is comfortable with taking pictures of themselves and posting them online for anyone to see. Williams quotes a developmental psychologist as saying young adults have an idea known as "the imaginary audience"—that is, "the idea that adolescents think people are more interested in them than they actually are" (2006). Although the concept may not be new, today's teens seem "more comfortable with public self-exposure" (Williams, 2006).

Unfortunately, many teens are willing to do or post anything to gain exposure online, which causes actions that raise additional concerns about Internet ethics. According to a *USA Today* report, some children identified in Internet child pornography are actually photographs of older teens who have taken provocative photos of themselves and posted them online (Sher, 2007). Kelsey's research indicates this phenomenon is common and growing among American teens, especially girls. Kelsey writes, "girls are ferociously searching for boys' attention, and MySpace is the ideal platform for achieving this goal. The sexier the photos, the taglines, and the screen names are, the more male MySpace friends a girl will earn" (2007, p. 144). In a random search of high school students' profiles, a professor at Fresno State found photographs of sexual poses on 59% of the sites (Kelsey, 2007, p. 148). Detective James McLaughlin of the Keene, New Hampshire police department says, "I don't think a week goes by where we don't see two to three adolescents post nude photos of themselves" (Hewitt et al, 2006, p. 120).

A *Washington Post* article indicates peer pressure as one of the growing reasons teens exaggerate their online postings (Bahrampour, Aratani, & Stockwell, 2006). However, sometimes students are tricked into posting provocative photographs of themselves. Older men create fake profiles and disguise themselves as teen boys who then identify "lonely" girls (based upon information contained in the girls' profiles) and become a "boyfriend" to the girl (Sher, 2007). With a little coaxing, such at-risk young females end up being seduced online and convinced to send the so-called boyfriend a sexually graphic picture, a process sometimes called "sexual grooming." The United States Justice Department refers to these kinds of solicitations as "cyber enticement" (Sher, 2007). Emily Vacher is an FBI undercover agent who says this type of online behavior is "a trend, and it's scary" (Sher, 2007).

There are other forms of misrepresentation that take place on social networking sites. For example, MySpace has a minimum age requirement of fourteen to join, yet "the most common example of misrepresentation [online] is teens under age fourteen lying about their age to beat the minimum age requirement for using the service" writes teen services librarian Sean Rapacki (2007, p. 30). As already noted, teens can post profiles that reveal anything they want, including a totally different personality from what they display in real life. Kelsey describes her shock at viewing a social networking profile of one of her students—a student she described as polite, conservative and quiet. The student's MySpace page, however, reflected "an angry young woman in full gang attire" with numerous references to sex, derogatory slang, and assorted images and phrases that were completely contradictory to the image the student portrayed on a daily basis at school (Kelsey, 2007, p. xxii). Lenhart and Madden (2007b) show that over half (56%) of online American teens have posted some false information to their online profiles (p. 23). However, only 8% of online teens have created mostly or entirely fake profiles (Lenhart & Madden, 2007b, p. 23). Boys are more likely than girls to post false information to their profiles (Lenhart & Madden, 2007b, p. 24). When Kelsey asked a psychotherapist about which representation of a student is real—the online or real-life version—the psychotherapist responded that neither version correctly identifies a student since teens are still developing their identities (Kelsey, 2007, pp. 158-159).

Teens often falsify information on their social networking profiles in an attempt to get the most visits to a page, or to collect the most *friends* on their profiles (Kelsey, 2007). The concept of meeting people and collecting friends online describes *friending*, a word used to describe the development of online relationships. Boyd writes that friending is "a key component of social network sites" (2006, abstract). "Friending" writes Kelsey, "is a newly coined verb direct from the MySpace lexicon, short for befriending. It simply means *the act of accepting or being accepted by a new contact with the mutual intent of labeling one another 'friend'* [*sic*]" (Kelsey, 2007, p. 81). "Friending supports pre-existing social norms, yet because the architecture of social network sites is fundamentally different than the architecture of unmediated social spaces, these sites introduce an environment that is quite unlike that with which we are accustomed" (Boyd, 2006, abstract). Just as past generations had cliques, and teens' social statuses were dependent upon their circle of friends, so do today's teens rely upon the circle of online friends with whom they keep company to establish their status. The difference, however, is that friends in the online world are often really strangers, a fact that raises concerns about online behavior and relationships.

Visitors to an online profile can ask for a "friend request" or to be "added" to the teen's profile page. Being included on another teen's profile (especially if that other teen is deemed socially cool) can elevate an individual to wider and often higher social circles. Likewise, a teen whose profile has numerous friends is showing that he or she is popular and worthy of having even more friends. Not only does the teen accumulate a higher number on his or her profile listing of friends, but that teen is then added to the profile page of the persons whom the teen accepts as friends. Since profile pages often list the number of friends the profiler has, friending thus becomes a numbers game as well as a vicious popularity competition. "As people navigate Profiles [*sic*], they build an image of who people are through their Friends [*sic*]" (Boyd, 2006, Friending as context creation, para. 2). Kelsey calls the friending process a "commodities-trading style of relating" where teens judge each other "merely by how many other people like him or her" (2007, p. 86). "Listing your buddies and your friends is a way of establishing yourself, of feeling connected and feeling like you're accepted" says adolescent psychologist Susan Lipkins (Kelsey, 2007, p. 83).

In addition to collecting numerous online friends (often numbering in the thousands), teens are also ranking those online relationships. MySpace initiated the concept of a *Top 8* friends list. Instead of listing friends in the order of the date of their acceptance to a profiler's page, the profilers themselves can put friends in a pecking order, so to speak. "By implementing a 'Top 8' feature, MySpace changed the social dynamics around the ordering of Friends [*sic*]" (Boyd, 2006, But am I, para. 2). Teens often admit that they do not really know many of the so-called friends on their lists, and they realize the damaging consequences of *friends lists*, especially among younger teens who may not be strong enough mentally or emotionally to understand why they may not be part of a Top 8 list. "MySpace is a psychological warfare" says one teen (Boyd, 2006, But am I, para. 4). Dr. Lipkins says "friending is not just a pastime, it's also an indication of social success or failure" (Kornblum, 2006). Teens can add, rearrange, and even delete friends with little more effort than clicking a computer key. "If someone seems interesting or you want to get to know them better, what's the loss in Friending [*sic*] them? As far as most participants are concerned, Friendship [*sic*] doesn't mean anything really, so why not?" (Boyd, 2006, To friend or not, para. 9). Quoted in a *USA Today* article, Michael Bugeja, author of *Interpersonal Divide: The Search for Community in a Technological Age,* makes the following distinction between the superficial online friending list and the real-life list of friendships: "Friending really appeals to the ego, where friendships appeal to the conscience" (Kornblum, 2006).

BusinessWeek's cover story titled "The MySpace Generation" (Hempel & Lehman, 2005) notes that social networks are "creating new forms of social behavior that blur the distinctions between online and real-world interactions" (p. 89) and "today's young generation largely ignores the difference" (p. 89). Even some teens are beginning to worry about their generation's attitudes regarding friendship. "All those friendships aren't real" says one 17-year-old student (Kornblum, 2006). Another teen says, "MySpace cuts out real communication between people.… Since the communication is so meaningless, it makes relationships meaningless" (Kelsey, 2007, p. 85). Dr. Larry D. Rosen, professor at California State University, has spent over two decades examining what he calls "the psychology of technology" (Rosen, 2006, p. 1). In a 2006 study, Rosen researched pairs of teens and parents and found that teens had "about 200 friends" on their MySpace accounts with 75 of those friends being deemed "close friends," in spite of the fact that teens had never met them (p. 2).

ADULTS' CONCERNS

The amount of time teens spend online concerns some adults who wonder about the possibility of teens becoming addicted to computer use. Psychologists seem divided on the issue of Internet addiction, and the topic is still deemed relatively new in the field of psychology, although Dr. David Greenfield, a clinical psychologist in Connecticut, believes the concept is "getting more and more recognition" (Klimkiewicz, 2007). Concerns about teens' "Internet gaming addiction" has led the Chinese government to initiate a nationwide program to "promote civilized Internet use" and limit the amount of time students under age eighteen spend online gaming (M. Lee, 2007). The discussion of online or Internet addiction has been debated for only ten years, and the American Psychiatric Association has not yet recognized the description as a disorder (Klimkiewicz, 2007). However, a Stanford University study shows that "one in eight Americans exhibited at least one sign of problematic Internet use" (Klimkiewicz, 2007). Psychiatrists who disagree with the diagnosis of Internet addiction believe that people who spend large amounts of time online are often suffering from other problems such as depression or anxiety (Klimkiewicz, 2007). Dr. John Grohol, a psychiatrist who oversees PsychCentral.com, believes that previous generations have had similar experience of abuses of new communication modes and says, "When you introduce a new technology into society, it takes a generation or two before it becomes well integrated" (Klimkiewicz, 2007). Rosen's study reveals that 20% believe "MySpace has negatively affected school, job, family and friends" (2006, p. 3) and that depression and Internet addiction were attributed to more time spent on MySpace in spite of the fact that more online friends were a benefit of time spent there (p. 3).

Kelsey devotes an entire chapter in her book to the subject of teen addiction to MySpace. She observes that many of the effects from frequent

MySpace use are similar to those of other compulsive behaviors or addictions, and she readily admits that she believes teens have become Internet addicted to MySpace (2007, p. 17). Kelsey writes that an addiction can be described as "an uncontrollable compulsion to repeat a behavior regardless of its negative consequences" (2007, p. 16). She quotes teens who admit that MySpace is "ruining" their lives, is "unhealthy," and "addicting" (2007, p. 16), yet those same teens will say they are unwilling to give up their MySpace profiles. One user of Japan's Mixi comments, "It's fun getting replies and comments to your diaries. Pretty soon, you get addicted" (Katayama, 2006). Dr. Michael Brody, professor of American Studies at the University of Maryland and CEO of the Psychiatric Center in Washington, D.C., says, "The words 'addicting' and 'obsessive' seem to describe much of the teen involvement in these electronic activities" (2006, p. 8). Kelsey's book includes the narrative of Rob Alderman, a graduate student who struggled to give up his MySpace profile. While Kelsey acknowledges that Alderman is beyond the teen years, his struggle is still the same as that of many teens she has interviewed. Alderman tells of his staying awake late at night in order to be part of a social network, of typing so often that the letters faded from his keyboard, and of spending more time with his online friends than his real-life friends (Kelsey, 2007, p. 23). "You can be who you want, when you want, with whom you want. In fact, it's so perfect and so addictive that it's easy to spend all of our time there, pouring ourselves into our own little MySpace kingdoms," says Alderman (Kelsey, 2007, p. 23). Alderman compares his online interactions to "worshipping at the MySpace altar" (Kelsey, 2007, p. 23).

A 2005 study by the Stanford Institute for the Quantitative Study of Society, as reported in *The Standford Daily*, revealed results of "social isolation" among those individuals with high Internet usage (Hanson, 2005). "[T]ime spent on the Internet is time taken away from other activities. Every minute spent on the computer is a minute taken away from face-to-face relationships with family and friends" (Hanson, 2005). Authors of the study reported that "each hour spent on the Internet reduces face-to-face time by 23.5 minutes" (Hanson, 2005).

Lenhart et al. (2005), however, found different results in their studies of online teens. They found that teens between the ages of 12-17 actually spend more physical time rather than online time with their friends (Lenhart et al., 2005, p. 30). On average, teens spend "10.3 hours a week with friends doing social activities outside of school and about 7.8 hours talking with friends via technology like the telephone, email, IM or text messaging" (p. 30). Additionally, 83% of teens participate in at least one group activity such as a school club or youth organization (Lenhart et al., 2005, p. 12). The author of this chapter has observed groups of teens in a public library setting who use computers to access social networking sites. Often these teens are interacting online with people sitting at a neighboring computer, or several of the teens will congregate around one computer and view aspects of a social networking site together, making comments to each other in the process. Thus, while the teens may individually be on the Internet, they are simultaneously interacting with real-life friends and not isolating themselves from real-life socialization. As previously stated, researchers and psychologists are still divided on the issue of Internet addiction and its ramifications on real-life social interactions. Additional research is needed, especially where these topics concern adolescents. Whether or not a formal acknowledgement of online or Internet addiction disorder is made, "teens are affected by this electronic culture and in turn, are effecting further changes in it" (Brody, 2006, p. 8).

In addition to their concerns about addiction, many adults (especially parents) fear that young people are making themselves too vulnerable to contact from online predators. Headlines and assorted media reports of such predators help feed adults' fears. Police warn there are predators who purposely search social networking sites in order to find their next victim, and finding that next victim is not hard for these predators to do according to Detective Frank Dannahey, an officer with the Rocky Hill, Connecticut Police Department. Dannahey provided written testimony before the Committee on Energy and Commerce Subcommittee on Oversight and Investigations, United States House of Representatives, about his findings as an online undercover detective. Early in 2006, Dannahey went undercover as a teen and created a MySpace account. He called himself "Matt" and claimed to be nineteen years old. Dannahey testified, "I have seen technology change in a direction that both benefits and assists online predators in carrying out their criminal activity. With the majority of America's teens online, the pool of potential online victims is vast" (2006, para. 1). He highlights the following results of his undercover social networking scenario: Teens as young as 14 and 15 years old willingly allowed Matt (presumably an adult) as a friend on their private profiles; many teens allowed Matt as a friend with no questions asked; teens voluntarily shared personal information; teens posted inappropriate and provocative photos of themselves on their profiles; teens routinely discussed their social activities and included dates, times and locations of such activities, as well as phone numbers to contact them; online surveys that include detailed personal information about the teen were common aspects of teen profiles (2006).

Dannahey summarizes his findings by observing that "teens are very trusting of people they meet online and are very willing to share their personal thoughts and information with virtual strangers" (2006, para. 6). He adds that bulletins, which often post real-time information, and the aforementioned surveys are key components whereby predators can glean pertinent information to learn details about a teen's daily routine, personal interests, and contact information. Dannahey's undercover assignment was developed in conjunction with a Dateline NBC broadcast and in reaction to the sexual assaults of seven teenage girls within a one-month time period in Middletown, Connecticut—assaults that were all the result of MySpace encounters (Dannahey, 2006).

Although many teens seem to realize (at least to some extent) the fact that their social networking profiles can be public information, they are not overly concerned about this fact. One sixteen-year-old says, "We're willing to give up some of our privacy to connect with people easier. The realization that people can find you online isn't that threatening to this generation" (Kelsey, 2007, p. 272). In spite of being comfortable sharing personal information online, teens are becoming more cautious with what they post to their online profiles. Lenhart and Madden indicate that 66% of American teens' online social networking profiles have limited access (2007a, p. 5). Fifty-nine percent of teens limit their profiles to viewing only by their friends, and the actual percentage of teens who post ample personal information to a public access profile is only 3% (Lenhart & Madden, 2007a, p. 5). However, as Detective Dannahey's undercover profile revealed, teens sometimes accept friend requests from people who are adults and total strangers, often without question or thought. Teens may also fail to realize that although they may be careful in setting their own page to private, their personal information can end up on someone else's page, and that second person may not have private settings. Lenhart and Madden (2007b) note that "many, but not all, teens are aware of the risks of putting information online in a public and durable environment. Many, but certainly not all, teens make reasonable, informed choices about what to share in what context" (p. 30). Lenhart and Madden further observe that "the warnings and concern coming from parents and educators are not falling on deaf ears" (2007b, p. 36).

Some of those warnings have come from news reports which abound with details of adult sexual predators who pretended to be teens online and lured unsuspecting, vulnerable young people to personal meetings where the teens were subsequently assaulted. ABC News and Good Morning America aired a report titled "All Children Vulnerable to Online Predators" and included the following quote as a byline in its online version: "Authorities Say 1 in 5 Children Has Been Approached By Online Predators" (Muir, 2006). The report included the story of a teen who had been swept into the online world of self-promoted sex sites by an online predator. "My experience is not as isolated as you might hope," said the teen, who added that "there are hundreds of kids in the United States alone who are right now wrapped up in this horror" (Muir, 2006).

Stories such as the one published and aired by ABC News focus on extreme incidents and often utilize the numbers reported in the Youth Internet Safety Survey (YISS) (Wolak, Mitchel & Finkelhor, 2006), a national survey conducted in the United States by the Crimes Against Children Research Center. Two such surveys were conducted. YISS-1 statistics were gathered from August 1999 to February 2000, while YISS-2 surveys were conducted from March to June 2005 (Wolak et al., 2006, p. 1). The ABC News "1 in 5" quote about children being approached by online predators stems from YISS-1. YISS-2, the more recent survey, shows a decrease in this number with 1 in 7 youth receiving "unwanted sexual solicitations" (Wolak et al., 2006, p. 1). An interesting discovery of the YISS-2 study is the additional information noted about the "1 in 7" sexual solicitation. YISS-2 shows that "43% of all solicitations and 44% of aggressive solicitations" were made by individuals under the age of eighteen (Wolak et al., 2006, p. 17). In other words, in many cases it is teens themselves who are making the solicitations of each other. Additionally, 14% of solicitations came from people the teen knew in person prior to receiving the solicitation (Wolak et al., 2006, p. 17). In 2000, a Pew Internet report showed that 60% of teens had received online contact from a stranger (Lenhart & Madden, 2007b, p. 34). A 2006 study shows the number dropped to 32% of teens who have been contacted online by a complete stranger, and of those teens, 65% of them say they ignored or deleted such contacts (Lenhart & Madden, 2007b, p. 34). Additionally, only 7% of online teens say they have been contacted by a stranger to the point of "feeling scared or uncomfortable" (Lenhart & Madden, 2007b, p. 35). According to the National School Boards Association, only .08% of students between the ages of nine to seventeen have met someone in person (without parental consent) after an online introduction (NSBA, 2007).

Teens often face a more immediate threat than predators on social networking sites—bullies. "Cyberbullying" is defined as "willful and repeated harm inflicted through the medium of electronic text" (Patchin & Hinduja, 2007). Cyberbullying can include a variety of tactics, such as sending nasty or threatening messages, posting untrue or exaggerated stories about the victim, impersonating the victim, or intentionally excluding someone from an online group. "Cyber-bullying is nothing short of social terror by technology" (Kelsey, 2007, p. 108) and is "the most common 'risk' for middle-school-age social networkers" (Magid & Collier, 2007, pp. 114, 115). A comparison of the two YISS surveys (Wolak et al., 2006) show that online harassment increased 50% by youth ages 10 to 17 (p. 10). The YISS-2 survey also notes that the number of students who say they have harassed or embarrassed someone else online has increased to 9%—up from YISS-1's 1% statistics (Wolak et al., 2006, p. 11). "The Internet is apparently being used more and more for the bullying and harassment widespread among many youth peer groups" (Wolak et al., p. 11). Half of teens surveyed at Ireland's Young Scientists' Exhibition said they had "experienced or witnessed" cyberbullying, with 10% saying it had happened "lots of times" (Cullen, 2007). An Associated Press story about online bullying indicates that Internet bullying, which allows harassment and insults to be sent to victims anonymously "can be more damaging to victims than traditional bullying like fistfights and classroom taunts" (Norton, 2007).

The New York Times published an article titled "Teenagers Misbehaving, for All Online to Watch" (Norton, 2007) which discusses teens' seeming obsession with posting online pictures or videos of violent behavior, including the abuse and beating of other teens—an extreme form of cyberbullying. While adolescent bullying is nothing new, it has "taken on a new dimension as online cinema verite. Instead of being whispered about among friends and then fading away, such rites of ridiculousness are now routinely captured on video and posted on the Internet for worldwide perusal, and posterity" (Kilgannon, 2007). The article included comments by Nancy E. Willard, author of *Cyberbulling and Cyberthreats,* who observes that teens may not realize the seriousness of posting themselves (or others) committing crimes such as vandalism and abuse, "but a lot of teens have this idea that life is a game and it's all just entertainment" (Kilgannon, 2007).

LEGISLATION AND RESTRICTIONS

In an effort to combat cyberbullying, predators, and pornography, the United States Congress introduced legislation in 2006 known as the Deleting Online Predators Act (Fitzpatrick) or DOPA, as it was more commonly abbreviated. The bill targeted schools and libraries in an attempt to establish Internet policy that would "protect minors from commercial social networking Web sites and chat rooms" (Fitzpatrick, 2006). DOPA passed the House in July, 2006 but later died in Senate (American Library Association [ALA], 2007). At the beginning of 2007, Senator Ted Stevens of Arkansas introduced S. 49, the "Protecting Children in the 21st Century Act" which is also known as the Deleting Online Predators Act of 2007. S.49 includes three components or titles. It is the second title that most affects teens. Title II mimics DOPA but targets schools and libraries by requiring them to enforce Internet safety policies that prohibit cyberbullying and to prohibit access to commercial social networking sites and chat rooms without parental consent and/or educational purposes (Stevens, 2007). As of July, 2007, this bill had been referred to the Senate's Committee on Commerce, Science, and Transportation (GovTrack). Not trusting another defeat in Congress, at least six states have initiated their own versions of DOPA—bills designed to place more restrictions on social networking among minors (Medina, 2007).

Other countries are equally concerned about Internet predators and are developing ways to establish some sort of Internet policy or protection plan for children online. Australia's federal governmental program, NetAlert, has a taskforce created to "examine the potential use of networking sites by pedophiles to groom children for sexual abuse and exploitation" (Wilson, 2007). The Council of Europe, which comprises 46 countries (including the United States), is hoping to pass a treaty that "seeks to protect children by criminalizing online behavior like 'sexual grooming'" (Carvajal, 2007). Germany already has a public service commercial that has become a "cult classic" on YouTube—one that is designed to warn children about "potential hazards" they may face online (Carvajal, 2007). The European Schoolnet hosts "Safer Internet Day" which involves schools in countries throughout Europe, as well as Australia, the United States and Canada (Richardson, 2007). The annual event has developed a "worldwide blogathon" which allows hundreds of schools throughout the world "to create internet safety awareness material" (Richardson, 2007). The Korean National Assembly is seeking ways to prevent "cyberviolence" (Katayama, 2006). In the United States, several states are seeking legislation to establish an age verification system (Medina, 2007). Such a system could require minors to prove they are old enough to meet minimum age requirements to establish social networking profiles and/or prevent older users from disguising themselves as teens.

Adam Thierer, director of The Progress & Freedom Foundation's Center for Digital Media Freedom, wrote a lengthy report titled "Social Networking and Age Verification: Many Hard Questions; No Easy Solutions," published in March, 2007. Thierer writes "Age verification is extremely complicated, and it would be even more complicated in this case because public officials are demanding the age verification of minors as well as adults, which presents a wide array of special challenges and concerns" (2007, p. 3). Thierer examines a variety of those challenges and summarizes his concerns with three generalizations about age verification, namely that such attempts would raise concerns of privacy issues as well as freedom of speech, it would not be foolproof, and finally that "education is absolutely necessary" (2007, p. 3) as the ultimate solution to preventing many of the problems that concern parents and politicians. Thierer also believes "that part of what is driving the push to regulate social networking sites is that many adults simply don't understand this new technology and have created a sort of 'moral panic' around it" (2007, p. 10). This misunderstanding, says Thierer, is also fear-driven by "a handful of highly publicized cases of minors being contacted and later abducted or abused by child predators on social networking sites" (2007, p. 5).

Tapscott (1998) implied the same reasons for adults' concerns over the then-new Internet. He believed the Internet posed "a challenge to the existing order on many forms" (1998, p. 50) and that adults who were more comfortable with their pre-existing forms of media and communication were "being made uneasy by a new generation and a new communications media that is controlled by no one" (1998, p. 50). Tapscott, like Thierer, also believed that "kids and the new technology are often unfavorably portrayed publicly" (1998, p. 45), and he noted that denial of the Internet to minors was often an answer to adults' concerns rather than education about online safety.

Attempts to curb cyberbullying are also being made by many U.S. states and schools (Norton, 2007). Although educators acknowledge the need for "guidelines" that would effectively help punish cyberbullying, others warn that such guidelines and laws cannot prevent cyberbullying, "You can't legislate norms, you can only teach norms" says a Rhone Island educator (Norton, 2007). The American Civil Liberties Union also believes it will be difficult to create legislation that would effectively prevent cyberbullying without imposing upon "free-speech rights" (Norton, 2007).

Perhaps due to negative media exposure, MySpace, one of the most popular of the social networking sites for teens, has developed several ways to make its site safer for minors. Partnering with the National Center for Missing & Exploited Children, MySpace will now post Amber Alerts of missing children (Lehman, 2007). The site has also attempted various verification systems that will prevent contact of older users with younger ones and allow parents to monitor their children's profiles to verify ages of other users (Lehman, 2007). MySpace has also initiated a "full privacy setting" and deleted hundreds of thousands of under-age users (Lehman, 2007). More recently, MySpace deleted over 29,000 registered sex offenders' profiles from its site (Associated Press, 2007). MySpace received especially negative media coverage when several families filed lawsuits against the company, claiming the site did not do enough to protect the families' teenage daughters from predators (Lee, 2007). One such lawsuit was dismissed by a Texas judge who declared, "If anyone had a duty to protect Julie Doe, it was her parents, not MySpace" (E. Lee, 2007). The dismissed lawsuit involved a 13-year-old girl who misrepresented herself as an 18-year-old on her MySpace page and was sexually assaulted by a 19-year-old man whom she met in person after being introduced to him on MySpace (E. Lee, 2007). In January, 2008, MySpace was subpoenaed by a United States federal grand jury in connection with the 2006 incident of a teenage girl who committed suicide after the boy with whom she had been corresponding on the social networking site rejected her (Glover & Huffstutter, 2008). It was later revealed that the "boy" with whom the girl had been corresponding was actually an adult woman who knew the girl (Glover & Huffstutter, 2008). No criminal charges were filed against that adult woman since prosecutors were "unable to find a statute under which to pursue a criminal case" (Glover & Huffstutter, 2008). However, prosecutors in the U.S. attorney's office of Los Angles, California believe there are possibilities of filing charges against the woman based upon wire fraud and cyber fraud (Glover & Huffstutter, 2008). Although the original case transpired in Missouri, the California prosecutors are assuming jurisdiction since the headquarters of MySpace are located in that state (Glover & Huffstutter, 2008). Other attorneys and prosecutors worry that 1st Amendment free speech issues may be compromised if an indictment in such a case were to occur (Glover & Huffstutter, 2008). The story of the subpoena, which appeared in a *Los Angeles Times* article, states that "it could be difficult to draw the line between constitutionally protected free speech and conduct that is illegal" (Glover & Huffstutter, 2008). Facebook also faces challenges. The New York State attorney general subpoenaed Facebook after undercover investigators "were solicited by adult sexual predators and could access pornographic images and videos" (Adegoke, 2007b). The subpoena is a result of a 50-state joint investigation and accuses Facebook of "not keeping young users safe from sexual predators and not responding to user complaints" (Adegoke, 2007b).

Some schools and public libraries are imposing their own Internet policies by restricting minors' use of social networking sites. According to the National School Boards Association, 52% of all U.S. school districts "specifically prohibit any use of social networking sites in school" (NSBA, 2007). At the beginning of 2006, a school district in Washington prohibited students from registering on Facebook with school e-mail addresses (Bahrampour et al., 2006). One parochial school even banned the use of social networking sites at students' homes (Bahrampour et al., 2006). MySpace was banned from some Florida schools after parents complained about the site (CBS, 2006), and a high school in Vermont banned blogging sites after deeming them non-educational (McKenna, 2005). At least one public library has banned MySpace from its public access computers. Wake County Public Library in Raleigh, North Carolina imposed such a ban after its library saw too much gang activity—activity the library's director says stemmed from postings on MySpace (Oleck, 2007a). The American Library Association (ALA) does not promote banning social networking sites from school and library computers. The ALA Council has passed a Resolution in Support of Online Social Networks which clearly affirms "the importance of online social networks to library users of all ages for developing and using essential information literacy skills" (ALA, 2006).

SOCIAL NETWORKS AS EDUCATIONAL SITES

Adults who realize the prominence of social networking sites in the lives of teens are choosing to use the sites as educational tools rather than banning them. ALA's division of Young Adult Library Services Association (YALSA) believes "social networking technologies have many positive uses in schools and libraries" (ALAALA: YALSA, 2007). YALSA encourages the use of social networking technologies by school and public libraries in order to help teens receive the following educational benefits: learning and creating together, receiving feedback, developing a "sense of community," learning from adults about safe and smart uses of social networking (ALA:YALSA, 2007, p. 2).Teens are already incorporating for themselves those first three benefits as they interact with each other on social networking sites. Steven Johnson wrote in a *Time* magazine article, that technology is "sharpening the minds of Generation M, not dumbing them down.… They're learning to analyze complex systems with many interacting variables, to master new interfaces, to find and validate information in vast databases, to build and maintain extensive social networks crossing both virtual and real-world environments, to adapt existing technology to new uses. And they're learning all this in their spare time—for fun!" (2006, p. 56).

The kind of learning that can occur from social networking sites is what Marc Prensky calls "engaging" (2005, p. 60). Prensky says Net Gen students are used to "being empowered to choose what they want … and to see what interests them …and to create their own personalized identity" (2005, p. 62), yet schools typically choose to teach subjects with traditional, non-tech methods—methods Prensky describes as "stale," "bland" and "yesterday's education for tomorrow's kids" (2005, p. 62).

The National School Boards Association (NSBA) conducted a study of United States students between the ages of nine and seventeen and found that 96% of them are using social networking sites (NSBA, 2007). One of the most encouraging outcomes of this report is that nearly 60% of these students are using social networking sites for educational purposes, with 50% of the students using the sites to "talk specifically about schoolwork" (NSBA, 2007). Among the many uses of their preferred social networking sites, these teens and preteens are sharing music, videos and photos; creating content (including site building), and blogging (NSBA, 2007). "There is no doubt that these online teen hangouts are having a huge influence on how kids today are creatively thinking and behaving," says the executive director of NSBA, Anne Bryant (Hunter, 2007). Bryant believes the "challenge" for educators is to "keep pace with how students are using these tools in positive ways and consider how they might incorporate this technology into the school setting" (Hunter, 2007).

Stephen Abram, a librarian and vice-president, innovation, for SirsiDynix, has written much about educational uses of technology with teens. He offers tips for using social networking sites to teach students information fluency (2006). Abram suggests that educators teach a program for teens about *pimping* (decorating) MySpace pages and interject online safety components into the program (2006). "A few asides can offer a lot of cyberknowledge," says Abram (2006, para. 4). Abram also suggests that using virtual worlds to create an avatar "with a great back story" could help students learn more about characterization in novels (2006, para. 5). He says students are already researching information about the characters and avatars that are found on many video games and "this creative act demonstrates that kids actually will do research for fun" (2006, para. 5). Some teachers have successfully created interest in literature by assigning students the task of creating a MySpace profile page for a character from a book (Kelsey, 2007, p. 26). Teens have readily accepted the assignment, created impressive projects and learned about literary tools in the process (Kelsey, 2007, p. 26).

YALSA published a "toolkit" guide to using social networks as a means to facilitate learning in schools and libraries (ALAALA: YALSA, 2007). The organization cites several ways in which social networking services can be used to enhance learning among teens. For example, school newspapers can be published online as blogs, wikis can encourage student reading and writing, teen advisory groups can host and post to MySpace profiles on behalf of libraries or school clubs, and book and author discussion groups can occur through blogs and MySpace accounts (ALA:YALSA, 2007).

The *Chicago Tribune* featured an article about the use of blogs among educators as a means to allow "kids a chance to share what's important to them" (Black, 2007). A teacher who successfully uses blogs in the classroom chose this medium in order to allow otherwise quiet students a chance to participate in class discussions. "The student who may be quiet in class will sometimes be liberated by it," says the teacher (Black, 2007).

School Library Journal included an article that encouraged using MySpace to teach aspects of art, social studies and music (Harris, 2006, p. 30). Teens who were asked why technology is an important part of their education noted that they had observed struggling students become better students through the use of computers (D. Oblinger, & J. Oblinger, 2005, p. 2.3). Modesto City Schools (California) became one of the first school districts in the United States to use the virtual world Teen Second Life (Balassone, 2007). Modesto partnered with Kyoto Gakuen High School in Japan to conduct synchronous student exchanges in Teen Second Life (Balassone, 2007). The collaborating English teacher at the school in Kyoto believes Second Life's "interactive nature" and game-like elements can make his students more likely to want to study English (Balassone, 2007). Universities are beginning to see the benefits of virtual worlds. Hundreds of colleges and universities, including Harvard Law School and New York University, are already conducting classes in Second Life (Balassone, 2007). Eye4You Alliance created an entire island in Teen Second Life that is devoted to education (Hale, 2007). The first college fair held in Teen Second Life occurred on that island in October, 2007 and had approximately 150 teen avatars in attendance (Hale, 2007). The University of Kentucky (UK) was one college that participated in the fair. The school sponsored university representatives (in the form of avatars) at its display, featured video display, gave a synchronous presentation, and even passed out UK t-shirts to visiting avatars (Hale, 2007). "I personally talked with teens from the Netherlands, England, New York and Texas," said one of the school's representatives (Hale, 2007). Having a presence in Second Life gave the school an opportunity to expand its geographic boundaries in ways it might not have been able to do in the real world.

Some public libraries are utilizing social networking to create online book discussion sites. Such sites have proven effective in outreach to young adults. Message boards, blogs, MySpace profiles, and book review capabilities linked from library online catalogs are just some of the ways online social networks are being used to encourage reading among teens (Rettberg, 2006). As of July 2007, 55 American public libraries and one Canadian library have profiles on MySpace (Oleck, 2007b). Hennepin County's public library in Minnesota created a teen-friendly MySpace page in 2006 and has seen "more than 21,000 monthly MySpace page views…and 500 weekly pass-throughs" from the profile to its library Web page (Oleck, 2007b). Libraries have embedded their online catalogs into social networking sites such as MySpace and linked their databases from similar sites (Farkas, 2007). "Creating presence in social networking software makes the library more visible and more convenient to access" says Meredith Farkas, a distance learning librarian (2007). A message on a youth librarians' electronic mailing list included comments from librarians who have had positive experiences using social networking services as outreach to teens. Those librarians who had incorporated the use of online social networks into their teen services commented that teens deemed libraries "cool" for having a MySpace page; teen participation at libraries increased because of a presence on a social networking site; the sites proved to be a tremendous means of reaching teens and promoting reading and library programs to students (Neville, 2006).

Teens use social networking services to write poetry, create instructional videos, compose songs, develop interactive Web sites for activities and organizations that interest them, and counsel other teens online. In fact, the National Suicide Prevention Lifeline has reported that one of the reasons for an increase in calls to their hotline has been teens spotting distress signals on other teens' social networking profiles (Magid, &

Collier, 2007, p. 174). As some teens openly express their suicidal thoughts on their profiles, other teens are paying attention to those signals and offering referral help. Australia's Inspire Foundation created a game-like virtual world known as Reach Out Central to promote mental health issues and management specifically among young people (Hoffman, 2007). It is the first such game created to assist with mental health issues (Hoffman, 2007).

Teens seek advice from each other online about issues pertaining to drugs and alcohol. They post messages to their social networking sites about the dangers of recreational drug use and where to go for help for loved ones suffering from substance abuse (Simon, & Majewski, 2007). They also use social networking services as places to grieve and mourn. Online social networks "have become as important to young people in death as they were in life" (Heher, 2007). Tom Anderson, president of MySpace, was recently quoted in a *Miami Herald* article as saying, "We often hear from families that a user's profile is a way for friends to celebrate the person's life, giving friends a positive outlet to connect with one another and find comfort during the grieving process" (Beras, 2007). Teens are one of the generations most likely to use social networking services for bereavement purposes (Beras, 2007).

Chris DeWolfe, one of the creators of MySpace, thinks "the mainstream media have so far missed the boat on the extent to which MySpace serves as a platform for doing good" (2007, p. 74). He argues that the younger generation who frequents MySpace is not self-absorbed and disconnected from society; rather, he states that this generation cares "about community, and they're actively engaged in civic causes" (2007, p. 74). DeWolfe cites examples of his company's social networking site being used to further such causes as feeding the homeless and promoting democracy worldwide.

MOVING FORWARD WITH TEENS AND TECHNOLOGY

It is obvious that Next generation's use of social networking sites affects the way they interact with each other, the way they learn, and the way they access and assess information. These effects will transform the future workforce. In fact, such transformations and acceptance of technology in the workplace are already visible now that many Net generation students have graduated from college. For example, in October 2007, the United States National Center for Health Statistics released statistics about physicians who use electronic medical records (EMR) in their practices. The study showed a 60% increase in the use of EMR as compared to usage in 2001, with age of the physician being a definite factor in usage (Hing, Burt, & Woodwell, 2007). EMR are used more than twice as much among physicians under age 35 as compared to doctors between 55 to 64 years of age (Hing et al., 2007).

In their book *Wikinomics: How Mass Collaboration Changes Everything,* Tapscott and Williams (2006) describe seven Net generation "norms" in the workplace: speed, freedom, openness, innovation, mobility, authenticity, and playfulness (p. 54). These norms or expectations are the result of mass collaboration, peer production and the interactivity of Web 2.0 applications this generation has come to take for granted. Tapscott and Williams refer to mass collaboration as a "participation revolution" and believe that "new models of peer production can bring the prepared manager rich new possibilities to unlock innovative potential in a wide range of resources that thrive inside and outside the firm" (2006, p. 17). They call these models "wikinomics"—a "new art and science of collaboration" (2006, p. 18). When Facebook incorporated a wikinomics-type of business by releasing its code to outside developers, it saw a 28% increase in users within two months (Kharif, 2007). Yahoo has plans for opening its site to outside developers, and Google is also introducing software they call OpenSocial which allows music and video creations to be distributed on multiple sites (Google launches social-networking software, 2007). Openness, as noted by Tapscott and Williams, is what the Net generation desires. "Having been nourished on instant messaging, chat groups, playlists, peer-to-peer file sharing, and online multiplayer video games, [the Net Gen] will increasingly bring a new collaborative ethos into the workplace. Working together and sharing their knowledge across organizational boundaries—in much the same way as they swap songs and videos over the Internet—will be perfectly normal for tomorrow's workforce" (Tapscott & Williams, 2006, p. 247).

One source for collaborative sharing is virtual worlds or immersive worlds—3-D interactive sites where users engage within the site through use of an avatar. EMarketer estimates that 24% of under-age-eighteen people access virtual worlds monthly, and they predict usage will continue to increase (Williamson, 2007). Linden Labs' "Second Life" virtual world has a population that is "growing by 15 to 20 percent per month" (Tapscott & Williams, 2006, p. 126) and has over eight million avatars or registered members (Jana, 2007). Second Life, an adult virtual world, has a counterpart known as Teen Second Life for people under age 18. Other popular virtual worlds include World of Warcraft and Vside, a music-oriented world that its creators hope "will become a destination for teens and young adults who want a next-generation entertainment experience" (Takahashi, 2007). Gaia, another popular teen virtual world, increased its number of unique users from .5 million to 2.5 million in less than a year's time (Liew, 2007). Many of the extremely successful virtual worlds are "targeted at kids and teens" (Liew, 2007), the generation most eager to adopt interactive technology, a fact not overlooked by businesses. When Active Worlds created a 3-D application for Facebook, it was noted as "a new milestone on 3-D Internet implementation" (Virtual Worlds Management, 2007). "The push is on for interoperability and a set of standards which will drive Virtual World technology into the future" said Active World's chairman, J.P. McCormick (Virtual Worlds Management, 2007). It is anticipated that businesses will turn more and more to virtual worlds as they seek to attract teen users. North American and European respondents to the Online Research Barometer survey predict increases in the use of "online respondent providers," and European researchers anticipate a decline in the use of telephone and face-to-face methodologies in favor of online research (Greenfield Online-Ciao, 2007).

A company in Finland is already using its virtual world, Habbo, to solicit marketing information from teens. Through Habbo, the company was able to "survey more than 42,000 [teens—via avatars] in 22 countries" (Jana, 2007). Habbo boasts 76 million avatars from 29 nations worldwide (Jana, 2007). Habbo's creator, the Sulake company, "realized it could tap its millions of avatars for information on real-life teen trends around the world" (Jana, 2007). Sulake found that 60% of its respondents were between ages 13-15 (Jana, 2007). Responses came from countries such as Britain (which had the most respondents), United States, Norway, Venezuela, Portugal and Austria with gender responses being nearly evenly divided (51% female and 49% male) (Jana, 2007). Using virtual worlds to obtain teen-trend data is a current and future strategy (Jana, 2007). "The membrane between our real and our virtual worlds has become very thin, especially for teens today. For this generation, interacting in the virtual world isn't just a trend. It's their life," says Robyn Waters, head of a trend-watching firm (Jana, 2007).

Social networking sites are definitely big business. In 2005, News Corp. spent $580 million to purchase MySpace, and in 2006 Google purchased YouTube for $1.65 billion (Noguchi, 2006). Microsoft agreed to pay $240 million to Facebook for a mere "1.6 percent stake in the Web phenomenon" (Wakabayashi, 2007). Microsoft believes Facebook will become a "hub for all sorts of Web activity" and eventually attract 300 million users (Wakabayashi, 2007). Corporations realize that teen users of social networking sites, however, can be fickle. Nielsen-NetRatings' list of "most popular teen sites" often contains sites that are listed one year but are never mentioned the following year as teens' tastes change (Noguchi, 2006). "They're not loyal. Young audiences search for innovative and new features. They're constantly looking for new ways to communicate and share content they find or create, and because of that group mentality, friends shift from service to service in blocs [*sic*]," says Ben Bajarin, market analyst for Creative Strategies, Inc. (Noguchi, 2006). At the 2006 Piper Jaffray Global Internet Summit in California, there was debate over the future of social networks, with some skeptics wondering if such sites are merely fads (Olsen, 2006). Older teen attendees at the summit gave indication they are already growing out of their MySpace phase, although younger teens indicated they were still big users of the site (Olsen, 2006). By 2007, teens in the United Kingdom were already transferring loyalties from MySpace to Bebo and Facebook (Moulds, 2007). "You are getting a lot of younger people who are shunning MySpace because it is seen to be part of the establishment," says John Delaney, a technology analyst (Moulds, 2007). Other reasons for teens' abandonment of MySpace include the increasing numbers of parents and teachers reading teens' profiles, risks of predators, and new services from other sites (Noguchi, 2006). Sweden's Stardoll, a virtual world aimed at teen and preteen girls, acquired over seven million users from several countries within its first four years of existence, and the site's chief executive attributes part of its success to the fact that users of previous social networking sites "are maybe getting tired of having pages where they feel forced to look sexy or cool or write some outrageous stuff in order to stand out" (Adegoke, 2007a). Datamonitor released a report in 2007 by analyst Ri Pierce-Grove who said, "The extraordinary proliferation of online social networks is fueled by real innovation and is substantially changing the way we communicate. However, the hothouse atmosphere of easy capital, media attention and user curiosity which stimulates creativity will not be sustained" (Lomas, 2007). Pierce-Grove's report expects the number of registrants for social networking services to "plateau" by 2012" (Lomas, 2007).

Realizing the transience of social networking sites, MySpace has already begun to expand its services internationally in the hopes of maintaining it popularity. MySpace has communities in Europe, Latin America, North and South America, and Asia and plans to expand into additional countries (Dudeck & Akselrud, 2007). MySpace's managing director for international, Travis Katz, says the move to rewrite its code into non-Western languages "was the right thing to do; international growth is the key to our future" (Abboud, 2007). Internet companies based in America usually focus first on English-speaking markets before expanding to international non-English speaking possibilities (Abboud, 2007). European markets can provide a huge base of users, but the variety of languages spoken within those countries often pose "linguistic barriers" for start-up countries outside of North America (Abboud, 2007). Netlog is one company that has broken through those barriers and has created one of the largest social networking sites in Europe (Abboud, 2007). Using college exchange students to translate the site rather than the entire code, Netlog has attracted users between ages 14-24 as its typical market (Abboud, 2007).

Mobile markets are another area of increase in social networking services. Mobikade is "a free off portal social networking service" in Japan that acquired 500,000 members in its first six months (Inbabble, 2007). It already has plans to expand into the UK, Italy, Germany and the U.S. (Inbabble, 2007). Japanese teens are accustomed to using mobile Internet, and Mobikade predicts that European teens will become likewise. Mobikade's head of business, Atul Sasane says, "We have experienced the growth of the off portal market in Japan and this puts us in a very strong position to create strategies to capitalize on the opportunities unfolding in the UK market" (Inbabble, 2007). It is this high acceptance of mobility in Japan that led Transcosmos Inc. to create Meet-Me, a Japanese version of Second Life. Being deemed very American with its pioneering "ability to create something from nothing," Second Life has seen only 7% of its users come from Japan (Terada, 2007). Ken Aihara, who oversees Virtual Tokyo in Second Life, does not think Second Life will "take off among Japanese users until it becomes accessible from mobile phones" which are more popular than desktop computers among Japanese teens (Terada, 2007). Worldwide, Second Life has its largest audience in Europe, although America and Germany tie as countries with the highest number of in-world users (Lipsman, 2007a).

CONCLUSION

Having grown up with technology, Net generation teens have developed different habits and characteristics than their predecessors. But, according to Goodstein, "not much has really changed about being a teenager" (2007, p. 12). "Deep down most of us experienced the similar impulsiveness, invincibility, and highs and lows otherwise known as teen angst, puberty, or if you believe in modern psychology, a phase called adolescent development" (Goodstein, 2007, p. 12). What has changed, notes Goodstein, is that technology has "magnified and publicized" teen behavior (2007, p. 12) which raises "new issues for our society around privacy, safety, and parenting" (2007, p. 15).

Undoubtedly, much debate will continue to revolve around the issue of social networks and teens, with adults offering a variety of solutions. A decade ago, Tapscott offered viable advice to those who wondered "What is happening to our children?" (1998, p. 7). While he admitted there was "much to be learned" and that "many real dangers" would require "good management" by adults, he answered adults' fears with the following paragraph:

Everybody relax. The kids are all right. They are learning, developing, and thriving in the digital world. They need better tools, better access, more services, and more freedom to explore, not the opposite. Rather than hostility and mistrust on the part of adults, we need a change in thinking and in behavior on the part of parents, educators, lawmakers, and business leaders alike. (Tapscott, 1998, p. 7)

Thierer agrees. "There is simply no substitute for education" (2007, p. 25), he says. Thierer believes that if the government, media and schools want to improve and safeguard teens' use of social networking sites, those organizations need to actively promote programs that teach students about critical thinking skills and parents about parental controls (Thierer, 2007, p. 25). Says Thierer, "Lawmakers and educators need to focus on finding the 'teachable moments'" (2007, pp. 25, 26), and parents need to be more involved with their children (2007, p. 28).

Additionally, workplaces need to prepare for this generation's entry. "N-Gen's norms reflect a desire for creativity, social connectivity, fun, freedom, speed, and diversity in their workplaces. Attracting, engaging, and retaining these employees in an increasingly competitive environment will demand that companies understand the Net Generation and the individuals who will emerge as its leaders" (Tapscott & Williams, 2006, p. 248).

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This work was previously published in Social Networking Communities and E-Dating Services: Concepts and Implications, edited by C. Romm-Livermore; K. Setzekorn, pp. 160-188, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.17
Social Networking and Personal Learning Environment

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ABSTRACT

In social studies a social network is the set of relations that links people, through their interactions and familiarity of various kind. Today, however, social networking indicates a growing phenomenon, characterised by Web technologies that create and keep together groups of people on the basis of common interests. These tools (social software technologies) include for instance: blogs, podcasts, RSS feeds, social bookmarking, and offer new opportunities to promote collaboration, to assist conversations, to help in the sharing of knowledge, in work and learning contexts, both formal and informal. Although some of these tools are often used in LMSs, the main idea of this new approach is to consider the advantages coming from general purpose tools, widely available on the net, and characterised by an intrinsic vitality and spontaneity. In this context, also linked to a growing criticism of the current e-learning model, based on the extensive use of VLEs (virtual learning environments), new proposals oriented towards the definition of new models of Web spaces for personal learning (personal learning environment or virtual learning landscape) are being put forward. In these new systems the individual has a central place, in a network of resources and of social and friendly interactions that offer support on the emotional as well as on the cognitive level.

DOI: 10.4018/978-1-59904-845-1.ch094

INTRODUCTION

In social studies a *social network* is the set of relations that links people, through their interactions and familiarity of various kind. Today, however, social networking indicates a growing phenomenon, characterised by Web technologies that create and keep together groups of people on the basis of common interests. These tools (*social software technologies*) include for instance: blogs, *podcasts*, RSS feeds, social bookmarking, and offer new opportunities to promote collaboration, to assist conversations, to help in the sharing of knowledge, in work and learning contexts, both formal and informal. Although some of these tools are often used in LMSs, the main idea of this new approach is to consider the advantages coming from general purpose tools, widely available on the net, and characterised by an intrinsic vitality and spontaneity. In this context, also linked to a growing criticism of the current e-learning model, based on the extensive use of VLEs (*virtual learning environments),* new proposals oriented towards the definition of new models of Web spaces for personal learning (*personal learning environment* or *virtual learning landscape)* are being put forward. In these new systems the individual has a central place, in a network of resources and of social and friendly interactions that offer support on the emotional as well as on the cognitive level.

SOCIAL-SOFTWARE

In recent years, the availability of services and tools that enhance the creation of Web content by common users has grown enormously. Most of these "personal contributions" implicitly create interactions and connections among individuals on the net. It is not accidental that one talks of *social software,* referring to applications that make possible for people to interact and collaborate on line, particularly to create on-line communities. "Social software" is a term with a broad meaning, which includes systems and technologies used in various contexts: for this reason Terry Anderson (2005) has introduced the concept of e*ducational social software: "On line tools that support and encourage individuals to learn together with others, maintaining their control over time, space, presence, activities, identity and relationships".*

In this sense, specific tools such as *wiki*s (1) *and blogs,* acquire particular relevance.

Wiki

A Wiki is a special Web site that allows multiple users, to create and edit pages in real time. It has become emblematic of collaborative authoring of hypertextual documents, because one of the most widespread use is to allow different people to work at a distance, concurrently, on the same body of pages interconnected via hyperlinks. The system keeps track of the modifications carried out and of previous versions (*versioning*) making it possible for a coordinator to accept or, if necessary, to reject the changes made by the collaborators. The use of wikis in e-learning is linked to collaboration, the feature that more than anything else distinguishes this technology. In all those instances in which there is a need to collectively write a text, wikis offer a valuable technical solution. Through the versioning mechanism it possible to follow the process of the elaboration of the text, whilst the hyperlink management system allows for the planning and the preparation of complex investigations. The ease with which one can create glossaries, dictionaries, terminological indexes or organized collections of thematic pages, makes it possible, in many subject domains, to develop very interesting research activities. Compared to the traditional face-to-face group work, wikis offer higher capabilities, because they allow a reflection starting from the very textual nature of the product, and the possibility to operate simultaneously amongst many individuals, remotely.

Teachers as well can find wikis very useful for working on projects, preparing articles, putting together course materials. A wiki is ideal, for instance, for collecting proposals and ideas for a conference or within a research project. However, the main strongness of wikis can also be seen as a weak point: the possibility offered to all to modify content. For this reason the majority of sites is somehow monitored to avoid intrusions, spam, and other abuses.

Blog

The term *blog* is the contraction of *Web log,* that is *"a log on the Web."* Blogs offer the possibility of writing quickly, without having any specific technical knowledge, notes, thoughts, reflections, texts of any kind, in the form of a Web page. The blog is probably the application that marks, more than any other, the transition from the *read only*

Web to the *read and write Web*, where everyone can be an author, in addition to being a reader. The user thus writes new articles, whenever the user wishes, giving to the blog its characteristic appearance of a sequence of brief entries, similar to annotations in a diary. The blog is generally open to contributions from other users, who can add comments to the articles (if the author allows it), or can even be managed by many users, with writing rights.

The current use of blogs goes well beyond that of a "diary". The old "personal homepage" is increasingly giving way to blogs; journalists, public figures, politicians frequently use blogs, both as an extension of articles printed on paper, or as an alternative means of communication. It is a particularly significant phenomenon, because one notices how access to the production of Web content is available now to a large segment of users who were previously excluded. If the "personal Web sites" were generally a prerogative of ICT practitioners, today blogs are published mostly by nontechnical people.

It is very frequent, in addition, the contamination with other tools, such as *podcasting* and systems for archiving and sharing of digital photographs and videos (the new term videoblog or *vlog* has already been coined) (2).

The widespread use of these tools has given rise to information indexing and searching services inside what is now referred to as the *blogosphere*. With this "collective name" one indicates the entire blog community that increasingly takes the form of a *social network.* The majority of blogs are in fact densely interconnected: *bloggers* (3) very frequently read other blogs and link to them, reference them, post comments on them, thus forming a highly animated *agorà*. Blogs can thus become the true individual's on line "identity": according to a suggestive expression used by Granieri (2005), the blog is the stable "point of presence of a person". This is all the more true in personal blogs, when the blog is understood as a collection of content items, that range from professional, to spare time interests; differently from the "thematic" blogs, but still very interesting at the collective level, a multidisciplinary, personal blog can be a holistic representation of the individual, making it possible for him to participate (through cross links) in different social networks. One could hazard saying, that it is the very concept of identity that changes meaning on line, from "belonging to" or "being part of", it becomes being "linked to...".

Even in the field of formal learning the use of blogs presents some very interesting features: in the school blogs easily can allow teachers and students to become authors of log-books. This space can be understood also as a store of materials and exercises: an archive, or a course portfolio. Blogs can be an occasion for reflecting on lessons and a place for discussing and study in-depth certain topics.

This is the case of class blogs that enable teachers to actively exploit Internet potentialities, transforming students from passive users into authors.

Blogs have also an important role for providing the means to come into contact with experiences taking place "outside" one's own class. The coming into contact with research and didactic material developed by other work groups (for example by other schools) can become, in turn, an occasion for reflection and investigation, that teachers can suggest and organize.

In the informal learning context, instead, blogs represent an important space for the dissemination of ideas and research findings. Many researchers and scholars, in the ICT field in particular, use blogs to present and discuss the outline of their inquiry. Finally, other possible uses of blogs are linked to writing, as an introspective tool of investigation and, with its availability on line, to the dynamics of a social space (the blogosphere).

Tagging

Tagging is another example of the users' direct participation in the definition of Web content. In this case, however, it is not exactly concerned with the creation of content but, rather, of information relating to the classification of content. The question of classification and search for information on the Web became very early of crucial importance: search engines and *directories* (4) have been for many years the main point of access to the immense quantity of information contained in the Web. Search engines and indexers operate in a top-down way, implicitly imposing on users, in response to a query, their classification and their criterion of relevance (5).

Tagging completely reverses this approach: it is the single user that, with a *bottom up approach,* defines the link between the digital resources (Websites, images, films, music) and the terms used to describe them, which are exactly the *tags,* simple labels (single words or short sentences). Since tagging comes through the Web, above all through systems for the sharing of bookmarks called *social bookmarking,* the collaborative aspect emerges as well. This mechanism of spontaneous and collective categorisation done by means of tags is called *folksonomy* (a neologism from the root "folks"—people—combined with the word taxonomy; it indicates a system of classification (taxonomy) which is informal and managed autonomously by groups of people, who collaborate, spontaneously, in the organization of information. It is the opposite of the formal, a-priori, classification systems, in which the taxonomy is predetermined; it is also different from search engine indexing based on terms contained in the text: through folksonomy, meanings are continuously created by the users. The dishomogeneity and possible dispersivity are nonetheless the chief critical elements of folksonomy. In the absence of rules, each user is free to interpret the information tagging it freely. The lack of standards for the tag definition can lead to confusion: for instance a user can classify a resource using the singular, other the plural, there are generally no rules for using compound words or to represent hierarchical concept structures

Tagging is not an exclusivity of social bookmarking, for instance it is widely used also by blog authors to classify the articles and the pages they have inserted.

Systems based on tagging and social bookmarking, can thus be used as an alternative to normal search engines—still, this systems offers greater potentialities. For example, as the social bookmarking services keep track of who has created each reference and allows access to that person's other bookmarks, a form of *connection* with others interested in different topics is established. Users find as well a "measurement" of the popularity of a given resource, since the number of users that have tagged and saved each link, found in the system, is always shown. The act itself of tagging has potentially a value, as it obliges the user to reflect on the meaning of the information he is saving. Each time that a user comes across a Web page that he thinks is interesting, the user can with a simple gesture, catalogue it, and share this information with others: it is apparently a inconsequential step but it has an enormous reach in the sharing of knowledge. Finally, the significance of resources on the Web is decided socially and transparently, subtracting the decision to experts and to the complex algorithms used by search engines.

SOCIAL NETWORKING

The concept of a "social network" stems from the studies in socio-psychology, sociology, and anthropology as early as the beginning of the '900. The studies on the analysis of the interactions between individuals in a community are more recent, such as the Social Network analysis that deals with the study of the structure of the network of interactions (of various kind) which is established amongst individuals (Scott, 1997). In recent years, in addition, the theory of connectivism is gaining momentum, as the theoretical basis to consider the net itself as a tool for learning (Siemens, 2004).

The online version of the social networks is known today by the name *social networking* and it refers to technologies and services available on the net that make possible for individuals to participate in real and proper virtual communities.

It is a multifaceted phenomenon corresponding more or less to the equivalent contexts of human relations, although the boundaries are a bit blurred:

- In the professional context, with the creation of communities of colleagues or thematic communities;
- In the context of free time activities, for friendly and sentimental interpersonal relations and the exchange of informal relations (6).

Web sites that offer social networking services do not normally use particularly innovative technologies. Basically the user, after signing up, is invited to insert as much information as possible about the user, in order to draft a personal profile that is as detailed as possible. One starts from personal details to arrive to interests and hobbies, passions, and preferences of any kind (this is especially so in communities dealing with spare time interests), or a detailed curriculum (for communities in the professional sphere) The next step usually consists in inviting other people to sign up for the service. Generally one contacts his friend or colleagues inviting them to do the same, in a sort of endless progression that, ideally, could include the entire world population. The mechanism of the social networking is in synthesis the following one: "I sign up, I invite my friends, who in turn invite their friends an so on, to arrive to create a wide network of friendships."

Through some services one can even make acquaintances, be means of algorithms, varying in their degree of sophistication, that manage to match up the different personal profiles.

To indicate the members of a community, one usually uses the term "friends": the members are thus linked by a bond of "friendship" that, nonetheless, is limited to those who are registered for the same service. Each one can thus belong to different communities, through the registration to different social networking Websites. There is no lack, however, of standardization proposals to universalize the concept of friendship, at the base of *social networking,* which is now currently limited to the services offered by individual Websites. An example is the proposal named FOAF (friend of a friend), a project that aims at creating documents in XML format aimed at describing people and their connections (http://www.foaf-project.org) (7).

Content: Aggregation, Use and Reuse

The protection of personal data and the attention to the safeguard of intellectual property rights are usually a major concern on the net. Surprisingly, however, in many new Web applications there is, instead, an increasing "opening up" of corporate Databases.

Striking examples are offered by Google Maps (that allow the re-use of maps to add commercial and/or other type of information, in a perspective of *georeferencing*), Ebay, and Amazon: they both allow public access to their DBs, to the extent that Web sites that use data coming from these two organisations, to provide added value services, have been created.

The possibility of allowing the use of information, or parts of the services normally offered, can be regarded as a strong, rather than a weak point. The trend is to invest in the fact that users, anyway, use the data (O'Reilly, 2005). A specific term for this concept has also been coined: this "remix" of content and services is called *mashup.* One could observe that the re use of images, films, news, graphics and other types of content, provided that the source is cited, is part of the ethics of the *hacker* (Himanen, 2003) by which concepts such as "freedom of speech", "freedom

Table 1. PLE characteristic elements

Objective	Main tool /technology	PLE perspective
Learner-centred	Blog	It is the key concept of a PLE. From this point of view the environment is able to perform the functions of an e-portfolio, combined and/or implemented by means of a **blog**. The blog is seen as an essential element to overcome the difficulties that still limit the use on a wide scale of the e-portfolio. Differently from the latter, generally perceived as an "institutional" tool, a blog is considered a true "personal area", informal, where no limitations are imposed on spontaneity. The success of informal environment shows how important it is to be able to choose the place and the way we wish to present ourselves. It is typical of blogs to be able to find different aspects of the author's personality: alongside ideas and reflections related to one's own study and profession, one often finds notes on interests, hobbies, and personal aspirations.
Informal learning	RSS	PLEs/blogs are able to integrate elements coming from informal learning situations on the net, for example the aggregation of RSS feeds coming from Websites that do not belong to formal learning systems. It is up to the user/owner, through appropriate presentation tools, to highlight the significant elements of the user's own educational path, to be found both in formal and informal activities.
Collaborative learning	Social networking and social software	PLEs are open to social networking; systems and they support and integrate them. They are *natively* a typology of social software and foresee the possibility of sharing resources, including social bookmarking.
Micro-contents	RSS / Mashup	PLEs are based on microcontents. Their structure is based on, or inspired by, the model of a Web Service and the opening to any other system, in addition to the intrinsic orientation toward RSS as a powerful tool for the aggregation of content.
Open	Web Service	The *openness* is the chief feature of a PLE. If it is viewed as a technological system, it must interface with the greatest possible number of heterogeneous systems, for example with numerous LMS platforms, for the *formal* element and with public services of social software for the *informal* element.

of action" and "self realisation", through one's own contribution to the creation of the net, are the parameters that since the 1980s populate the dreams of those who believe in the development of a *network society* free from monopolies and restrictions (8). The new network develops new rules. The Open Access Initiative, born from the Berlin Declaration in 2003, to promote free circulation and dissemination of human knowledge and of the cultural assets produced by the scientific community (9); projects like the already cited Free Software Foundation, active since 1985 aimed at the promotion of the user's right to use, study, copy, modify, and redistribute software (10), and finally the Creative Commons licences proposed by the nonprofit organization known by the same name, as alternatives to the traditional copyright, share this new spirit of the Web, seen as an open network based on the participation and the creative involvement of the users (11).

According to a research study of the *Pew Internet & American Life Project* on the use of Internet by young Americans (12-17 years old), 57% of them use the PC for "recreational" activities, such as the management of a Blog or the production of music and videos; 20% of them affirms, in addition, that they normally use materials produced by others, feeling free to download from the net and to manipulate texts, images, and audio to be recombined in their production (Pew Research, 2005).

An Application of Social Networking in Online Learning Systems

Starting from 2004, thanks above all to the activity of the British research community, the concept of *personal learning environment (PLE)* is gradually taking ground. Starting from the experiences and the studies on the e-portfolio, and including new life-long learning issues, with the PLE there is an effort to highlight even further the centrality of the individual. The acronym itself is not accidental: the assonance with VLE (*virtual learning environment*) is deliberate and wanted. The PLEs, in their being environments centred on the student, are contrasted to VLEs, considered institutionalised learning environments, that leave very little control to the student.

In 2005, Scott Wilson, published in his blog dedicated to the research in this field, a diagram that thanks also to successive re-elaborations, is now very well known in the blogosphere: In synthesis, a PLE (the "future of VLE", at the centre in Wilson's representation) should function as an "operational centre", managed and controlled entirely by the student. The system should be able to interact with a series of external systems, partly related to formal learning activities (for instance the e-learning platforms and/or the institutional services provided by schools and universities attended by the student) and partly relating to social networking services and Websites in which the student could be registered and actively using, which represent the area of informal learning.

Some authors stress that it is important to keep the concept well separated from the technical system: there are different ways to implement a PLE, some are based on an ad hoc software, and others, on the contrary, use a mix of already available desktop software and Web services which, one hopes will develop further in the future (Attwell, 2006). The risk is that PLE might become in the end something very similar to the very thing they want to contrast (VLE): a new form of *walled garden* in which to isolate students from the rest of the external world (ibidem). In a more radical fashion, Blackall (2006) maintains that, after all, Iternet itself is a complete personal learning environment, and, therefore, no intermediate dedicated system is necessary.

The PLE Components

The basic matrix that comes out from the proposals at the theoretical level, but also from the early implementations carried out, is based on the *e-portfolio* model. The PLE are seen as an extension of the latter but revisited in the light of the social software.

The following table sums up the main functions attributed to PLE, in relation to some key objectives identified in the debate on this new vision of e-leaning.

CONCLUSION

The proposal of the *personal learning environment* presents itself as a "bridge-solution" between two worlds. Although highlighting in their name the contrast with institutional Virtual Learning Environments there is, however, the attempt to recuperate, as much as possible all the learner-*centered* elements present in the worlds of the e-learning, namely the e-portfolios, combined with the technologies and, above all, the practices of social networking: from the closed environments represented by the platforms that keep students "separated" from the real world, one moves instead to open environments that, on the contrary, can include connections with a VLE, but keep the door always open towards the external world, towards a Web rich with information, but above all, with links to people and not only pages. Blogs, social bookmarking, RSS, as "universal source" of information", seem to be the bases on which to build systems that are able to accompany people's real life, providing them with an on-line identity, an authentic telematic alter-ego

The debate has just started: for example it should not be taken for granted that PLE must be developed as true and proper applications, but it is equally true that it is not realistic to think that the system of VLEs can soon cease to exist. The very emphasis on informal learning can't be to the detriment of formal learning: schools and universities will probably continue to exist for a long time. What is certain is that "integration" is the key word for the future: tools, methodologies, and opportunities for learning.

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KEY TERMS AND DEFINITIONS

E-Portfolio: A collection of material in the guise of *digital artefacts* (documents, multimedia clips, links to resources, notes, etc.) related to a person's educational path. It can be referred to a specific course, or it can be seen as a permanent support for the individual, in the perspective of lifelong learning.

Folksonomy: A neologism that indicates the contribution from people (*folks*) in the definition of meaning and in the classification of information on the Web. It is contrasted to a-priori taxonomies complied by experts (for example in the library field).

Microcontents: In the perspective of *mashup*, the microcontent is the ideal unit for the re-use of information (MacManus e Porter, 2005). The Web is no longer viewed as a set of pages, but instead of even smaller units (for example a single post in a blog or a pod-cast).

Podcasting: The term podcasting groups all the techniques aimed at the production, the sharing and the use of audio/and or video material. The basic element of this technique is an audio or video recording—varying in the degree of expertise with which it is made, that can be used directly online or downloaded for listening or viewing off-line. This denomination is derived from the well known digital music reader Apple iPod; with the suffix "casting", derived from broadcasting, it comes to indicate a system for the transmission of audio material that can be listened to on many different devices, from the PC to a digital reader, to mobile phones.

RSS: RSS stands for *RDF Site Summary*, a format for the diffusion of content through the Web. From a technical point of view, RSS is based on the XML mark up language, well known for being the "foundation stone" on which the present Web could rise, separating content from presentation and graphical aspects. The RSS technology has as its fundamental aim the feeding on the Web of headlines of articles, news, links and, more generally, any sort of "what's new" of any site. It works as a kind of "announcement" that some new content has been added on a certain site. Blogs combine perfectly with RSS: each blog is equipped in fact with its RSS system that make it possible to keep up-to-date with the new articles that have been posted, without any need of visiting the Website directly. An alternative interpretation of the acronym RSS is *really simple syndication*: the term syndication is borrowed from the press (it would stand for "diffusion through a press office"). Leaving aside definitions and interpretations, the fundamental element is the means to disseminate "What's new" on different Web sites.

Social Bookmarking: Those that once were known as bookmarks, or preferred sites that each user used to save inside the user's own browser are now increasingly shared through specialised Websites. *Social bookmarking*, that is in pooling one's own bookmarks, together with the tags freely supplied by the users. One of the main sites of social bookmarking is http://del.icio.us.

Virtual Learning Environment (VLE): In general, Web systems used for the management of courses in schools and in Universities. They are often also referred to by the acronym LMS (*learning management system*).

ENDNOTES

1 The fortune of Wikis is mostly due to the project *Wikipedia,* the "free " encyclopaedia compiled with contributions from common users (www.wikipedia.org) and based on a wiki system for the compilation of pages (www.mediawiki.org).

2 Amongst the most well known tools for the sharing of photographs stands out Flicker (http://www.flickr.com) or for the videos YouTube (http://www.youtube.com/. For sharing of audio Flickr (http://www.flickr.com) should be mentioned. Main Web sites for the aggregation and sharing of news items are: Digg (http://www.digg.com/), Slashdot (http://www.slashdot.com/).

3 A *Blogger* is the author/owner of a blog.

4 In the world of information searching on the Web two lines of action have gained ground: the first, a feature of "pure" search engines such as Google, based on whole text indexing of pages and the other, first proposed by Yahoo, based on directories, that is on a hierarchical classification through numerous levels of categories and sub-categories.

5 It is well known that Google's fortune might also be due to the use of an almost secret algorithm to establish the relevance of a Web site (and therefore its prominence in the search results). The basic element for the calculation of the so called *page ranking* is the number of direct links to the page, but it is not the only element taken into consideration.

6 One of the first services to be available online was Classmates (www.classmates.com), active since 1995 which made possible the search of old school mates. The true boom of social networking services, however, has

come after 2001, with sites like Friendster (www.friendster.com) MySpace (www.myspace.com), Facebook (www.facebook.com) and LinkedIn (www.linkedin.com)..

7 The aim of FOAF is to free personal details from the relational ones (that is the individual own social network) from the mebership to a certain community or service.

8 The term *hacker is commonly* associated in common usage to computer crimes. On the contrary (according to a distinction that is progressively more difficult to contrast, that confuses them with *crackers,* the real computer criminals) the hacker culture is part of that wide movement, formed almost by students, to whom we are in debt for the many innovations and software that we use daily.

9 http://www.zim.mpg.de/openaccess-berlin/berlindeclaration.html

10 http://www.fsf.org/

11 http://creativecommons.org

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Chapter 1.18
Web 2.0 Social Networking Sites

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ABSTRACT

This chapter describes one of the Web 2.0 technologies, Social Networking Sites (SNS). A definition of SNS is offered, as is a short history of these sites. The existing research is reviewed and organized to summarize what we know about SNS usage (from the perspectives of student use, general population use and organizational use), and what we know about the antecedents and outcomes of SNS use. The chapter concludes with discussion of new developments, challenges and opportunities. There are many opportunities for future research and organizational applications of SNS as SNS adoption grows at incredible rates.

INTRODUCTION

Offline social networks have existed since the beginning of humankind and have been the study of anthropologists and others for many years (Clemons, Barnett, & Appadurai, 2007). Social networks can be groups of people who have interacted in the past for some common purpose or interest, and that have ongoing relationships with members of the group. Membership in networks can be relatively permanent (i.e., family relations) or flexible and short-term (i.e., members come and go as their interests and need for membership changes). The shared experiences and perceived shared values or needs can build trust among members and value, such that members tend to rely on each other and perceive shared information to be reliable and trustworthy (Clemons et al., 2007).

In the past decade or so, advances in technology have made it possible to use electronic communication tools to create social network applications and online social networks. The applications, sometimes called social networking tools, are web-based locations that lets a user create a self-profile and connect to others (who are using the same application) to build and maintain a personal network (Skiba, 2007). This type of application is part of the Web 2.0 evolution toward more collaboration via the web and examples include MySpace, Facebook, and LinkedIn, to name just a few of the largest. While the terminology used to describe these sites

DOI: 10.4018/978-1-60566-272-5.ch005

varies, recently the term Social Networking Sites (SNS) has become the common way to refer to them. The focus of this chapter is on these SNS and the chapter is organized as follows. The next section discusses what SNS are and presents a brief history. The third section describes what is known in the literature about the usage of SNS. This is followed by a discussion of potential business uses and anticipated developments, discussing both opportunities and challenges.

WHAT IS A SOCIAL NETWORKING SITE (SNS)?

In this section, we first define SNS and then describe typical characteristics. The history of SNS is briefly discussed. Two of the current leading SNS are profiled in this history: MySpace and Facebook.

Social Networking Sites Defined

Boyd & Ellison (2007) appropriately defined SNS as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system." (p. 211). They prefer the word network over networking in SNS, although they acknowledge the terms are used interchangeably in the literature, because they argue that networking emphasizes the initiation of relationship, often between strangers and that not all users are doing this. Many users use SNS's to communicate with people that they already know (i.e., the people are already part of their offline social network).

Others argue that "networking" is more appropriate since the term social "network" site would be too broad a term, approaching the same meaning as Web 2.0 (Beer, 2008). Supporting this view, networking is defined by Dictionary.com and MS Word's reference function, respectively, as:

a supportive system of sharing information and services among individuals and groups having a common interest.[1]

the process or practice of building up or maintaining informal relationships, especially with people whose friendship could bring advantages such as job or business opportunities.

Neither of these definitions suggest that networking would have to include creating new relationships (in addition to maintaining existing relationships). Therefore, while we adopt boyd and Ellison's three key characteristics of SNS, we suggest that Social Networking Sites is a more appropriate term for SNS and this terminology will be adopted for this paper. We next expand on SNS characteristics and typical functions provided to the user.

Characteristics of Social Networking Sites

Social networking sites are organized around people. Earlier online communities and their websites were organized around interests and topics. A unique characteristic of SNS is that users can specify their social networks and make them visible to others (boyd & Ellison, 2007). This is done by users developing profiles of themselves and identifying acquaintances (termed Friends[2] in most SNSs). The starting point for a new user is to develop their profile which typically contains a picture of the user, some demographic information such as age, location, school affiliation/history, and personal interests.

Users then identify other system users that they have a relationship with or wish to develop a relationship with. Most SNSs required bi-directional confirmation, where a user requests a Friend connection. The system sends the request to the potential Friend, and if he/she accepts the request, then each other's profile becomes linked. In this way, the social network of a user becomes visible to their Friends and Friends can see overlap in their social networks and invite Friends of Friends to join their social networks, if they choose to. Typically, a powerful database makes every entry field in profiles searchable, making it possible for a user to see who shares interests and backgrounds. Visibility of profiles can vary depending on the system design and user privacy settings.

SNS also typically provide a single point of access to multiple communication tools and support a person's ability to construct a digital identity. To do this, other possible features include things such as instant messaging within members of the network (synchronous communication), semi-public asynchronous messaging (e.g., in Facebook, Friends can post comments on an area in a Friend's profile called the Wall which is visible to all Friends), private asynchronous messaging (email), and blog-like features (called notes in Facebook). Most SNS allow the posting of pictures and videos. The capabilities of SNS can also be extended greatly by adding applications (discussed further below).

A Brief History of SNS, MySpace and Facebook

The first SNS was SixDegrees.com launched in 1997. Over the last decade or so, many SNSs have started and many have failed or declined in popularity (e.g., Friendster). MySpace is currently the largest SNS, with Facebook following and growing rapidly. LinkedIn is another large SNS that specifically targets professional networking. Some Social Networking Sites are very specific, targeted for specific communities of users (e.g., Dogster, a SNS for dogs aimed at dog owners), ethnic groups (e.g., BlackPlanet, iMatter for Arab women) or specific geographic regions (e.g., LifeAt for apartment buildings) or linguistic groups (e.g., Cyworld in Korea). There is even one site, Ning, that provides a platform to host user-created SNSs (boyd & Ellison, 2007; Rosenfeld, 2008). See boyd and Ellison (2008) for a more complete SNS history. Although currently the web has more than 100 popular SNS (Wang, 2008), two of the leaders are MySpace and Facebook and these two SNS are featured more fully below.

MySpace was started in August 2003 and grew rapidly with the 100 millionth account being created in August 2006.[3] By mid-2008, it had grown to a world-wide community, with dedicated communities in over 25 countries using multiple languages. It has a strong artist/band community, with artists being able to post songs on their sites so fans can listen to their music. The company generates revenue through advertising and has a significant agreement with Google for advertising. Anyone can join MySpace and use the various features. The user profiles are highly customizable by incorporating html code or CSS (style sheets). In early 2008, MySpace created a developer platform based on Google's Open Social API to allow developers to build their own applications for MySpace, resulting in expanded functionality for users. Currently, there are over one thousand applications available to choose from, covering a wide range of topics including games, travel, shopping, job hunting, and politics.

Facebook was started in February 2004 using a network model. Facebook was originally designed to help students on college/university campuses network so members had to have a valid educational-institution email address to register. It expanded to high schools and in 2006, opened registration up so anyone could join. Non-educational registrants could join job-related networks or networks based on their geographic area. The network membership determined access to information (depending on how users set privacy on profiles). By May, 2008, there were 55,000 regional, work-related, collegiate and high school networks, and over 60% of Facebook users were outside colleges. Currently Facebook has over 70 million active users, it is the second most-trafficked SNS in the world, and is the number one photo sharing application on the web, with 14 million photos being uploaded daily. In mid-2006, Facebook launched its development platform which enabled outside developers to build applications and offer them to users. Currently, there are over 20,000 applications available and growing at a rate of 140 per day.[4] A key decision that facilitated the development of applications and resulting increased functionality for users was letting developers keep all the advertising revenues they might earn (Anonymous, 2007a).

USAGE OF SOCIAL NETWORKING SITES

This section reviews current knowledge about the amount of usage and the various uses of SNS. Details are based on a review of the academic and practitioner literature conducted in early 2008. Specifically, searches were done in several electronic databases including ProQuest, PsychInfo, and Scholar's Portal. The electronic libraries of three associations were searched since these contain many conference proceedings (as well as journals): ACM, IEEE and AIS. Key words such as social networking, facebook and myspace were used. Other online sources were also used (e.g., CIO.com, Gartner) and targeted searches were done by examining the lists of references in relevant articles. Discussion below is organized into trends with students, the general public and organizations.

Student Usage and Uses

Estimates of the number of US college students using Facebook are very high, varying between 80 and 92 percent (Cain, 2008; Eberhardt, 2007). US students at one college reported spending between 10 and 30 minutes each day on average on Facebook, and having between 150 and 200 Friends (Ellison, Steinfield, & Lampe, 2006).

Student uses in the USA include checking for comments, messages and updates from Friends, arranging events, parties and dates, keeping in touch with people they already know, and checking out people before meeting them (Raskin, 2006). Participants used the SNS to maintain relationships by doing things such as recognizing special events like birthdays and re-connecting with old friends. Developing new relationships was also a use, although users suggested the friendships were superficial (Dwyer, 2007). Generally students use Facebook more to keep in touch with people that they know offline than meeting new people. Consistent with this, survey results from 225 undergraduate US students indicated SNS was as useful for learning about classmates, friends, current or potential romantic partner as other media options, and that they were likely to use SNS for seeking information about these types of people. SNS were not considered useful for seeking information on family members (Westerman, 2008).

The majority of SNS communication appears not to be related to academic activities. For example, a study of 694 Facebook student users in the UK and the postings on their Wall found that only 4% (n=2496) of the Wall interactions were academically-related. This sub-set of Wall posting was analyzed and organized into five topic themes. These were: recounting and reflecting on the university experience (e.g., discussing a recently finished lecture), exchanging practical, logistical information (e.g., scheduling of lectures), exchanging academic information (e.g., course requirements), displays of supplication and/or disengagement (e.g., seeking moral rather than intellectual support), and banter (e.g., humorous, sarcastic and/or ironic exchanges) (Selwyn, 2007).

Not all SNS have the same structure, target audience or history. To examine this, a study of the potential differences between college student users of different SNS on the same US campus found several significant predictors (Hargittai, 2007). Eighty-eight percent of college students were users, and 74% reported using at least one

SNS often. Women were more likely to use SNS, consistent with literature indicating women have higher propensity to communicate online person-to-person. Students who lived at home were less likely to use SNS than those living in residence or on their own. Ethnic group usage also varied for different SNS; specifically, Hispanic students were found to be more likely to use MySpace while Whites were more likely to use Facebook. Asians/Asian Americans were less likely to use Facebook and more likely to use Xanga and Friendster (possibly because these SNS are more popular in some of the Asian countries). Parental education was also found to predict some types of use, with MySpace users having parents with lower levels of schooling and Facebook users having parents with higher levels of education (Hargittai, 2007).

SNS Usage and Uses in the General Population

Research suggests that most SNSs are used to maintain relationships that existed previously offline (boyd & Ellison, 2007). While these relationships may not be very strong (i.e., weak ties), there is some offline connection (e.g., through a previous school or job). Also, part of the motivation for people to join online communities is that people want access to information that interests them (Wise, Hamman, & Thorson, 2006). For example, a study of 226 MySpace and Facebook users suggested that effectiveness and efficiency in developing and maintaining relationships were the main reasons for use. Convenience comes from having the information they want to share with friends in one place, also making the task quicker too (Dwyer, 2008). Significant positive correlations were found between the fit of the site functionality and self-presentation goals (i.e., resulting impression given by profile), the fit between the site and the use to meet people, and the effectiveness of the site to keep in touch with close friends. The results supported parts of the authors' suggested Fit Appropriation Model called the Social Software Performance Model (Dwyer, 2008).

SNS usage is fairly high in the US. More than 50% of US teens have a profile on at least one SNS and close to 25% of US adults use a SNS (Schafer, 2008). However, the US is not the most active country in SNS use. A 2006 international survey found South Korea ranked first in people visiting a social networking site, followed by Brazil, China and Mexico. USA was fifth, with 20% of active Internet users visiting a social networking site within the past 30 days. General uses vary across countries. For example, in China, 80% discuss hobbies and 78% used SNS to meet new people. SNS usage for these activities is lower in the USA (37% and 33%, respectively). In the USA, 36% use a SNS to chat with people they know or connect with people they have lost touch with, 18% discuss work-related topics online, and 23% discuss personal issues online (Russell, 2007).

A second study also explored cross-cultural SNS usage (Chapman & Lahav, 2008). Thirty-six SNS users in the US, France, South Korea and China were interviewed and observed. Results suggest that SNS in the US were used primarily to share personal information, whereas Chinese users were much less likely to post personal information. Chinese respondents used SNS to have personal discussions with people they did not know well, possibly because having these sort of discussions with close friends is difficult in their culture. In Korea, the most common use was sharing of photos. Users in France tended to discuss interests and hobbies and were somewhat less personal than US users. These results demonstrate the need to understand local cultures and preferences in order to successfully introduce a social networking site into a new country.

Several studies have examined SNS usage in specific countries and again found differences, reflective of the differences in national cultures and communication processes. For example, Cyworld is a very popular SNS in South Korea serving nearly 50% of the entire population and nearly 90% of people in the 24-29 age range. Cyworld users have dual motivations for use: maintaining existing social networks (those that pre-existed offline), and reflecting on themselves via a diary-like feature. Users suggested that they could be more uninhibited with their thoughts and self-reflections in Cyworld than they could offline. The Korean culture prefers indirect communication in face-to-face communications. Being able to express feelings more directly in Cyworld, and having the asynchronous benefit of being able to edit expression was seen as very valuable to Cyworld users (Kim & Yun, 2007).

A survey of 55 Orkut (a SNS owned by Google) users in India and Pakistan found that most of these users were IT professionals. Advertising among Friends was extremely unwelcome, reflective of the cultural and religious backgrounds of the countries. The ability to search Friends was a very valuable feature, and a significant percentage of users (45.7%) would find Facebook's feature of no publicly viewable profiles desirable (Wang, 2008).

Interviews with 33 15-24 year old Australian young adults (Arthur, Sherman, Appel, & Moore, 2006) suggest that this group used MySpace for the following five reasons, all of which they value: to express their identities, for social interaction which is fun, for immediacy and constant entertainment, to discover new things, and to be creative and be able to create a record of who they are.

Churn between sites has been high. For example, half of the users regularly visit more than one site and one in six actively use three or more sites. Friendster peaked at 20 million users a few years ago and in late 2006 was down to less than 1 million (Russell, 2007). Helping us understand why churn may be high, a 2007 study of 200 users from four Norwegian online communities investigated why users leave or reduce their participation in online communities. Approximately one-quarter to one-fifth of respondents indicated reasons for leaving or lower use were lack of interesting people/friends attending, low quality content, and low usability in terms of user interface. Other reasons for leaving given less frequently were harassment/bullying, time-consuming/isolating, low trust and over-commercialization. These results indicate that low satisfaction with the nature of the social interaction is the highest factor for reduced use; however, site designers should also be aware of the importance of usability, the danger of over-commercializing, and the need to have some mechanism to police harassment (Brandtzeg & Heim, 2007).

What people put in their profiles and who is in their social networks creates impressions with others. Friend connections helps define one's identity in SNS. People also infer meaning from not only what users post on their profiles, but also what is on their Friends' profiles and what Friends post on their walls (boyd, 2006). A study of the lists of interests in MySpace profiles also found that users were significantly different than their top friends, indicating that users develop their lists of interests to differentiate themselves and that users tend to list interests to assert their prestige (Liu, 2007).

Some SNS allow users to create fake profiles, whereas others require authentic information (to varying degrees). The ability to create false profiles, the inability to authenticate relationships in some SNS, and the tendency to accept almost anyone as Friends, devalues the value of Friend connections because trust can not be assumed (boyd, 2006). Facebook information has been found to be mostly genuine, which may be why users tend to trust Facebook more than some other SNS.

Differences in use based on age was investigated in one study. 240 MySpace profiles were randomly-selected and analyzed. Results indicate that older (60+ years of age) users have fewer Friends (average = 18) compared to teenagers (aged 13 – 19) who had 95 Friends on average. Teenager's Friends were also mostly in their own age range, whereas older users had a wide age distribution among their Friends, likely due to the higher number of life experiences and resulting higher complexity of existing offline social networks (Arjan, Pfeil, & Zaphiris, 2008).

Another use of SNS has been for customer advocacy and activism (Eberhardt, 2007). In one example, a Facebook user connected with several hundred similar investors who were concerned about the status of their investment in non-bank asset-backed commercial paper (since the ability to recover investments was in question). By sharing information, event updates, emotional support, and possible tactics, the group was able to recover their investment (Simon, 2008).

Organizational SNS Usage and Uses

While it is difficult to find conclusive evidence about organizational use of SNS, likely because it is evolving so fast, one study found 20% of employees at large companies said they contribute regularly to blogs, social networks, wikis and other web 2.0 services (Green, 2007). A 2007 global survey by McKinsey of executives (44% of responses were C-level) found that 37% of 2,173 respondents were using or planning to use social networking in their organizations, while 39% said this Web 2.0 technology was not under consideration. Nineteen percent of respondents said their companies had invested in social networks. Of the respondents that used any Web 2.0 technologies, the various way the technologies were being used were: to interface with customers (70%), to interface with suppliers and partners (51%), and to manage collaboration internally (75%). Although respondents indicated calculating returns from the investments in SNS and other Web 2.0 technologies was very difficult, they suggested the benefits were clear in terms of better communication with customers, more efficient collaboration within the company, stronger sense of community, and improved abilities to manage online reputation (Martin, 2007).

The discussion above suggests rapid growth of SNS adoption in organizations. Three major current uses seem to be: recruiting, advertising, and internal collaboration. To assist corporate recruiting, employees can tell their contacts about job openings via their network. Companies can also create Facebook groups at no or little cost, which can help to promote their opening and opportunities (and enhance their brand image). Recruiting companies can also create applications (mini-programs) that users can add to their profiles at no charge. For example, Jobster has created an application that sends a message to a user whenever a job position is created that is potentially of interest to them (Rocha, 2007). Ernst & Young has a very active Facebook service page, and even the CIA recruits on Facebook. Recruiters tend to prefer Facebook over MySpace, even thought it has fewer users, because it is somewhat cleaner and more organized, and has a more mature member-body (Rocha, 2007). Employee-referred hires are more successful (80% versus 50% for non-referrals) (Anonymous, 2007b), suggesting that increasing the number of referrals via avenues like SNS will have significant value for companies.

A survey of executives found that 35% thought social networking sites would be most useful in the recruiting efforts over the next three years (Anonymous, 2008h). A Manpower survey in the UK found that 17% of users use their SNS to research potential employers and 10% use it for networking and generating new business. This suggests that the practice of using SNS to aid recruiting is likely to grow. However, companies should be sensitive to the fact that some potential employees feel the information they put on the SNS profiles should not be used for making recruiting decisions. One study found that over half SNS users would consider it unethical if employers used SNS to learn about potential or existing employees' activities (Anonymous, 2008i). And another study found 60% of students felt that Facebook information should not be used in hiring decisions (versus 28% of employers)

(Cain, 2008). Interestingly, recruiting of high school students by colleges and universities via Facebook and MySpace methods was acceptable to the majority of students (Roach, 2006).

Advertising is the main source of revenue for large SNS like Facebook. Emarketers suggest MySpace and Facebook got 72% of all ad revenues for social network sites in 2007 in the USA (Russell, 2007). Companies can potentially mine profile pages to identify potential customers. Users of SNS represent an important demographic for marketers (Raskin, 2006). There are few studies that have established the effectiveness of this advertising, as of yet.

Using SNS internally to mine in-house expertise, sharing information internally, and save time now spent in mailing documents and emailing comments all has significant potential (more efficient collaboration). Serena Software and Nissan are two other examples that are featured in the literature for their use of SNS.

Serena Software Inc. is a global company with 800 employees that is using Facebook to connect coworkers at various sites. They are making Facebook the company's intranet and encouraging use through Facebook Fridays where employees are encouraged to spend one hour of personal time on their profiles and connect with others. The aim is to let employees get to know each other as people, help them understand the business and products, and help to serve customers, on demand. The corporate culture is evolving to foster a sense of community and fun, which the CEO believes will help them get more done (Anonymous, 2007c).

Nissan launched a social networking site, called N-Square, to connect up to 50,000 of its 180,000 employees globally. Users are able to create online profiles, blogs, communities, discussion groups and share data files. A main reason for launching the site was to provide employees with a way to avoid bureaucratic channels and create new partnerships, hopefully reducing the inefficiency of traditional tools and channels. N-Square may also help employees feel more connected to their jobs, perhaps reducing turnover and facilitating retention of top people. Nissan's initiative was sparked by seeing what IBM was doing with their social networking applications (Anonymous, 2008g).

Companies are also trying various ways to take advantage of SNS potential to reach the users on SNS. For example, companies, such as MTV, Warner Bros and Woolworths, are developing applications for Facebook that push products to users, such as TV shows and album releases. However, the uptake of these applications by users has been very low, typically only a few active users per day, making the recovery of the cost to develop the branded application unlikely (Anonymous, 2008a). A health planner/reminder application to help people keep track of appointments, has been developed by Healthplan provide HAS in the UK (Anonymous, 2008d). And Amazon has developed Facebook applications that make it easy for users to see shopping wish lists and link them through to make a purchase at Amazon (facilitating online social shopping) (Birchall, 2008)

Only one study was found that examined corporate SNS use from the perspective of the user. A study of 68 Facebook users within IBM in 2007 found three different patterns of use. The first (and largest) group, called "Reliving the College Days" had a high number of school contacts and few connections in the corporate network. These were the youngest and appear to have started using Facebook during their college studies, and continued to use it to maintain contact with college friends. The second group, called Dress to Impress, had a mix of school and work Friends, had fewer Friends than the first group, and listed more information about their job. The third group, called Living in the Business World, appeared to have recently joined Facebook and only had Friends within the corporation. They appeared to join to be part of the online community of coworkers. The latter two groups appear to be managing their image recognizing that professional colleagues are viewing their profile, whereas users in the College Days group have profiles with much more personal information, with very little work-related information. The Dress to Impress group appear to manage their profile different than they did in college (more professional), whereas the College Days users appear to not have changed their use of the SNS. The Living in the Business World group appear to have used Facebook to enhance their existing relationships with coworkers by keeping in touch with both local and remote coworkers. It is expected this type of usage will grow in organizations and help people create common ground and mutual interest. This study illustrates the difficulty of using a single site for professional and non-professional use. While it is possible in Facebook to create limited access profiles, this takes extra time to both create and maintain (DiMicco & Millen, 2007).

Antecedents and Outcomes of SNS Use

While the research on what influences SNS use and the outcomes is limited, it is undoubtedly growing fast. Five topics related to SNS use were found in the research: the development of social capital, perceptions created by profile content, student perceptions of faculty due to faculty use, privacy concerns due to use, and productivity impacts of use.

One study examined the relationship between SNS use and social capital. Social capital refers to resources gathered through interpersonal relationships and is seen to generally have a positive impact on people in social networks (via increased trust, mutual support, goodwill, etc.) A study of 286 US undergraduate students found their use of Facebook was a significant positive predictor of social capital, suggesting that using Facebook helped students maintain and strengthen relationships, both weak and close ones. (Ellison, Steinfield, & Lampe, 2007; Ellison et al., 2006). This study supports the proposition that SNS use does strengthen social networks and is beneficial, especially in an undergraduate setting.

SNS users create an image for others via the personal information they choose to share on their profiles and whom they link to as Friends. Several studies have examined the impressions created from different angles, including the number of friends, profile content, and appearance. For example, experimental results with 153 U.S. undergraduate students found that the number of Friends on Facebook can provide a significant cue by which others make social judgements. Individuals who had too few Friends (approximately 100) or too many Friends (greater than 500) were perceived more negatively in terms of social attractiveness, indicating a curvilinear effect. A somewhat similar relationship was found with perceived extraversion, although the negative effect after the 500 Friend level was considerably more level (Tong, Van Der Heide, Langwell, & Walther, 2008). The respondents had an average number of Friends on their Facebook accounts of 395, suggesting that people judge other's social attractiveness on the number of Friends they have and use their own number of Friends possibly as a reference point.

The relationship between number of Friends and profile structure (i.e., which fields are completed) has also been investigated to determine if the completion of certain profile fields predicts Friendship, via creating common ground or signaling (Lampe, Ellison, & Steinfield, 2007). Over 30,000 profiles at a US university were examined. On average, users completed 50% of the fields available in Facebook. Positive associations were found between the number of fields completed and the number of Friends. Causality can not be inferred from this, as there are several plausible explanations including: a more complete profile generates more Friends, more active users could both complete more fields and seek out Friends, and people with more Friends could feel more pressure to add more information to their profiles.

Semi-structured interviews of 19 US students were conducted to examine how the participants used SNS to present themselves to others and manage the impressions created (Dwyer, 2007). Subjects suggested that creating a good impression was important. One subject said: "You can't just completely be yourself, you have to play the game, and have some sort of cool factor [so that] people are interested in speaking to you." (p. 5). Participants were concerned about privacy but suggested that it was up to them to control it by not posting any information they felt was private. Based on these results, the author suggested that key attitudes which influence the management of interpersonal relationships are concerns for information privacy and impression management. SNS technology features that can enable interpersonal relationship management included profile management, visibility management and identity management (Dwyer, 2007).

Impression formation was further studied by examining the impact of how what people write on Facebook walls and the physical attractiveness of Friends affected perceptions about the profile owner (Walther, Van Der Heide, Kim, Westerman, & Tong, 2008). 342 undergraduate US students participated in this experiment. Results suggest that having physically attractive Friends is positively associated with perceptions of the profile owner's physical attractiveness (and had no effect on task attractiveness – the ability to complete work reliably). Prosocial statements by Friends about profile owners was positively associated with social and task attractiveness, as well as credibility. Gender did moderate some of the effects, consistent with the sexual double standard (i.e., some remarks were seen as negative for women and positive for men – e.g., remarks about excessive drinking, promiscuous sexual behaviour).

Two studies have examined the impact of university faculty having Facebook accounts on student perceptions. A 2006 study of 166 US students on Facebook indicated that seeing their professors on Facebook (i.e., viewing their profile, etc.) had neither a positive or negative effect on student ratings (Hewitt & Forte, 2006). However, an effect was found when the content of the professor's profile was studied. An experimental study was conducted with 133 US college students where teacher self-disclosure on Facebook was manipulated via different photos, biographical profile information and Wall postings. High disclosure involved including information about social gatherings with comments, group membership and personal information (the amount of information provided was less in the low and medium disclosure conditions). Students viewing the high disclosure profiles believed the classroom climate would be more positive, anticipated higher levels of affective learning with those teachers, and had higher anticipated motivation levels. Most (84%) of the comments from students viewing the high disclosure profiles were positive, whereas a small number were negative, expressing concerns about loss of professional image (Mazer, Murphy, & Simonds, 2007).

Given the ability to make a considerable amount of personal information available to others (which many users do), privacy is a natural concern in SNS. Early work (Gross, Acquisti, & Heinz, 2005) found that US university students on Facebook disclosed a great deal of personal information on their profiles (e.g., pictures of themselves – 90.8%, birth dates 87.7%, residence addresses – 50.8%, and phone numbers – 39.9%). Analysis implies that almost all of this information is genuine. Only a few percent of people used available privacy settings to restrict the ability to view their profiles within their network, indicating that most users were either unaware or unconcerned about their personal privacy.

Another survey of US college students was conducted to make Facebook users aware of the privacy options available to them and alert them to possible privacy issues. The profiles of participants were then examined after they completed the study to see if they changed the amount of information on their profile (presumably from being made aware of privacy issues and being concerned about the potential privacy problems). Of the 84% of participants that knew they could change the privacy settings within Facebook, less than 48% had made any changes prior to the survey (indicating they left the privacy settings on default which provides visibility of the profile to anyone in their networks). Only a few percent of participants made changes to their profiles within 5 days after the survey was conducted inferring that most users were comfortable with the amount of information they were sharing (Govani & Pashley, 2005).

Another US study of privacy concerns surveyed 294 students found that privacy concerns were stronger in non-users than users of Facebook (although the differences were not statistically significant within undergraduate respondents). Therefore, privacy concerns appeared to be affecting Facebook use in non-undergraduates. For undergrads, even those students who had privacy concerns provided a significant amount of personal information in their profile. The strongest motivation in providing information was to have fun and provide enough information so that people benefit from Facebook (Acquisti & Gross, 2006)

Antecedents of information sharing and the development of new relationships were studied in 117 MySpace and Facebook users. Concerns about privacy, trust in the SNS, and trust in other members of the SNS were proposed as antecedents to sharing and relationship development. Facebook users had higher SNS trust and they disclosed more personal information such as real name and email address. MySpace members were more likely to disclose their relationship status. MySpace users also were more likely to agree that they could easily meet new people with their SNS and were more likely to extend new online relationships by contacting the person via other communication channels (e.g., telephone, F2F, instant messaging (IM), email). Results are consistent with previous research suggesting Facebook users use the SNS to extend existing offline relationship more frequently than initiating new online relationships. However, in MySpace, where trust is lower, there was a fair amount of activity establishing new online relationships. Few significant relationships were found with respect to privacy concerns, the exception being that people with high privacy concerns were less likely to share their IM screen name (Dwyer, Hiltz, & Passerini, 2007).

Time spent on SNS is a growing concern to many companies. With SNS usage growing, organizations see both threats and opportunities. Corporations are creating, and adopting SNSs to stimulate internal usage and are advertising on SNSs to reach target markets. However, companies also see threats in terms of wasted time and security concerns, to the degree that some companies have blocked access to SNSs during work time (e.g., the US Military, the Canadian government) (boyd & Ellison, 2007). Two-thirds of UK companies surveyed are banning the use of Facebook during office hours, although other companies feel this is too extreme since people's working and personal lives are blurring, making it difficult to leave personal life outside when they enter the work site (Brockett, 2007). Another survey, done in July 2007, suggests that approximately 50% of companies are blocking access to SNS at work (Green, 2007).

One poll in the UK estimated that Facebook and MySpace use was costing UK companies approximately 6.5 billion pounds annually in lost productivity, based on a finding that office workers are spending at least 30 minutes per day on social networking (Hathi, 2008). The assumption behind this claim is that the time spent on SNS is of no benefit to the organization. Counterarguments suggest that time spent on SNS can help with recruitment, can improve employee morale and corporate loyalty, and improve company transparency. While IT departments typically would like to ban SNS (for security), use of SNS in organizations is often driven by HR. HR is concerned with team building, recruitment and retention, and corporate culture (Hathi, 2008).

Concern about the time spent on SNS also exists outside the corporate setting. The number of Friends in SNS is typically two to three hundred. The ability to create any real relationships with this many people is the subject of debate, and there is a concern that very close relationships (which typically are just a few) may get weakened as people spend more time and energy maintaining distant relationships (MacLeod, 2008).

NEW DEVELOPMENTS, CHALLENGES AND OPPORTUNITIES

This section is organized into three parts. Challenges and opportunities for using SNS in companies is first discussed. The second part deals with the privacy challenge of SNS use, since this is a major concern in the literature. The last section summarizes some of the recent and foreseeable developments that may lead to new opportunities for SNS use.

Using SNS in Organizations

There are many opportunities for companies to use SNS. Departments that should benefit from SNS include sales (identifying and engaging customers) and operations (so employees can help each other and find more effective ways of working). Research and development could also use SNS to gather ideas and insights from customers (Bernoff & Li, 2008).

Companies could use existing SNS like MySpace and Facebook to reach current and potential customers. While SNS advertising is growing, companies need to interact with customers in meaningful ways, such as creating conversations and affinity-based networks. SNS can potentially be used to reach customers and get advice on new products, feedback on existing products, and ideas about brand building (Webb, 2007). Knowing whom to reach out to is important too. While it is relatively easy to mine existing profiles and the data in fields to segment targets, it would be valuable to also identify what people do on their sites (versus whom they say they are). In this way, marketers could identify the creators and key influencers and target these people based on how they act. So far, SNS operators have not been willing to provide marketers with this sort of data (Klaassen, 2008).

However, companies have to be sensitive to the culture of existing SNS and the receptiveness of members to advertising. Clemons et al. (2007) caution that SNS have risks for advertisers, as the effectiveness of the advertising is largely unproven and is in need of future research. While offline social networks are based on and create trust and credibility, it is unclear how much of an online SNS is built on trust. If SNS are built on trust, there are concerns that commercializing the network via push advertising may undermine that trust. And, as mentioned above, one of the reasons found for leaving a SNS is over-commercialization.

SNS can also help companies collaborate internally. Small companies could use an SNS like Facebook as their collaborative platform and this is starting to happen (Anonymous, 2007b). The email and document management capabilities fit these needs well and could enhance the ability to work in teams and from remote locations. The research showing that students develop social capital through SNS use is encouraging for corporate use. Users could use SNS internally to maintain weak ties with colleagues and to learn about expertise within the organization (like a knowledge management system).

Using an externally hosted SNS can create security and privacy concerns for corporations. Depending on the nature of the business, there may be a need to build safeguards to ensure discussions and document sharing is tracked, to be certain employees meet government regulations and don't create legal problems (Green, 2007). There are SNS options from major software vendors so companies do not have to use externally hosted SNS like Facebook. For example, IBM has a product called Lotus Connections which provides a number of Web 2.0 tools, including profiles and social networking[5] (Everest, 2008). A company could use a product like this to create an internal SNS which would facilitate collaboration internally while controlling security (since the application would be within the corporate firewall and not open to people from outside the company).

Another opportunity for companies is to partner with existing SNS and develop applications that offer customers more value. For example, CIO magazine has partnered with LinkedIn to connect relevant events and articles. LinkedIn widgets and the CIO.com website allow users to see who at a company featured in a CIO article is part of the LinkedIn network. Users can also view want ads and see who is connected to the advertising company. CIO media events are enhanced by LinkedIn's Event service that shows a user who else in the network is planning on attending, as well as manage the networking potential at the event (Anonymous, 2008c).

The Privacy Challenge of SNS Use

SNS are mediated public sites where technology allows people to gather publicly. Unique properties of mediated publics include persistence, searchability, replicability and invisible audiences (Cain, 2008). As previously mentioned, all of these properties can create privacy issues, challenges and concerns. Information is in SNS that is typically not included in resumes or uncovered by general background checks (Cain, 2008). Professional and private lives can blur together, especially if prospective employers see photos of actions that might cause them to question the candidate's judgment.

Digital identities (i.e., profiles and reported activities) are increasingly viewed by third-parties that the profile owner is not aware of. The legality of this is still unclear and undoubtedly will vary across countries depending on privacy legislation (Hodge, 2006-2007). Companies routinely use search engines to do background checks on applicants and police and university authorities have used Facebook profiles to collect evidence and leads. Even if a user removes some potentially compromising information from his/her site, there is always the danger the information has been captured elsewhere, creating a digital record that is out the control of the creator. Users need to recognize that they are not operating in a protected environment (Rosenblum, 2007).

In response to user privacy concerns, SNS companies such as Facebook have developed various privacy settings, such that now it is possible to control what is viewable by whom to a much greater extent than it was several years ago. However, research has found that many users do not change the privacy settings and many users are very open to accepting Friend requests from total strangers, thereby giving the stranger access to the personal information on their profile (Gross et al., 2005). This can lead to data re-identification, where a third party connects information from different sources and has the potential for identity theft and/or fraud. Other risks include damage to reputation, receiving unsolicited message and offers, and being exploited by social predators. The latter is rare but there have been reported cases of sexual predators, stalkers, child molesters and pornographers using SNS to approach minors (Rosenblum, 2007).

Installing applications also causes privacy and security concerns. For example, users should also be aware that installing Facebook applications gives the application access to some of the profile (some information can be restricted). The application developers can then use the information to target ads. There is a fair bit of uncertainty about how the data is kept safe and the potential exists for it to be combined with information about individuals, which could lead to problems such as identity theft or spoofing and phishing (Irvine, 2008). Users should also be aware of the potential for downloading applications on SNS that are malware programs. Although users have become aware of this danger when using email, the same degree of caution is not currently prevalent in SNS use. And many of the young SNS users are fairly inexperienced and naïve about the risks of using electronic media (Douglis, 2008).

Given all these risks, organizational users (as well as individual users) need guidelines to protect the users and the company. For example, guidelines about what information can and can not be posted should be specified. Privacy protection recommendations include assuming anything you post is public so you have to exercise good judgment in what personal information is shared in a SNS, do not have an open profile (i.e., use the available privacy setting to control who has access to information), do not accept Friend requests from strangers, and avoid installing applications (Munro, 2008).

Developments in SNS

While most users stick with a single site (Watson, 2008), they may move from one to another as popularity declines and builds. Maintaining multiple sites takes time and effort since currently sites are independent applications using their own architectures. However, companies are trying to create integration mechanisms that would allow information from different SNSs to be shared via one platform. Developments are coming that will allow users to pull information about friends and colleagues from numerous SNS and other websites. FriendFeed is one of the first of these (Green, 2008). Google is developing an open source framework, OpenSocial and SocialStream, that would allow many of the popular SNS to be connected into a unified social network (Russell, 2007; Weaver, 2008).

Mobile access, via mobile phones, to SNS such as MySpace and Facebook is growing (Anonymous, 2008b; 2008f). Mobile social networking will help put users' content into context since their social interactions will be able to occur in real time (DeJean, 2008). Mobile social networking systems are also developing that, among other things, allow users to be aware in real time of social activities. Slam is one of these systems, and while not a full SNS (given the lack of profile and social network visibility), some of the features and functionality are similar (Counts, 2008).

SNS are also evolving to attempt to offer more value to users. For example, MySpace is developing a music service with Universal, Song BMG and Warner and is working with Merlin on future licencing arrangements (Cardew & Emanuel, 2008). SNS are spreading to new countries and cultures (e.g., MySpace recently launched a dedicated community for Indian users (Anonymous, 2008e)). And given the high level of Facebook use in university settings, it is natural that educators are considering if and how to use Facebook as a learning tool. One developer recently received funding to work on a learning management system based on Facebook (Goth, 2008). Potential other applications include health care (Watson, 2008) where users can get personal health information from SNS like Facebook (Sinnema, 2008).

CONCLUSION

What SNS are and what we currently know about them has been presented. SNS usage is fairly new and growing incredibly fast. There are many possible benefits of use and some significant areas of concern. Research opportunities are also numerous. For example, the focus of research so far has largely been on the SNS user. While the user is obviously very important to the story, and current data is needed as usage and concerns evolve, there are other stakeholders that warrant research attention. This would include designers and operators of SNS and the underlying infrastructures, developers of algorithms, conduct of third parties using SNS, and marketers and advertisers who are trying to strengthen their brands (Beer, 2008). The majority of research has been with students in the US, leaving many opportunities for studies of corporate use (especially as this use grows), and use in other countries. The future of SNS appears to be bright, and the future for SNS researchers should be exciting!

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ENDNOTES

1 Networking. (n.d.). *Dictionary.com Unabridged (v 1.1)*. Retrieved May 19, 2008, from Dictionary.com website: http://dictionary.reference.com/browse/networking

2 Friends is capitalized to designate meaning a person linked to another's profile and distinguish the term from the common meaning

of "friend" since not all Friends in SNSs are necessarily close friends.

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Chapter 1.19
Mobile Social Networks:
A New Locus of Innovation

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ABSTRACT

This chapter discusses how virtual social networks have evolved from their original purpose of being online meeting places where people interact with one another to becoming an important locus for innovation. It delineates the salient characteristics of these networks (both Web-based and mobile) and suggests that the advent of these networks has shifted the balance of value creation away from traditional companies and towards the creation of companies which provide technology platforms and services for user-centric innovation. The chapter discusses how users on these virtual networks have become important sources of innovation in a variety of ways: they develop content which they share with others and participate in virtual community centers; they interact with companies who are developing products and provide valuable feedback; and they are the impetus for the creation of new kinds of marketing tools as businesses try to tap into these virtual networks in order to better understand what products will sell to these users. In addition, the chapter discusses the implications of these developments for managers, especially those in content-intensive industries such as financial services and media. Examples will be given to support these ideas from case studies on Upoc, a New York City-based mobile services company which hosts social networks for a wide variety of users; Dodgeball, another New York City-based company (recently acquired by Google) which is one of the pioneers in the mobile social networking arena; and Tapuz Mobile, an Israeli-based social network.

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INTRODUCTION

During the mid-1990s, the Internet emerged as a robust technological platform and almost immediately gained traction as a value creation engine. Firms in such diverse industries as financial services, media, and healthcare, began to invest their resources in generating unique digital-based products and services into their cadre of physically-based businesses (Andal-Ancion, Cartwright, & Yip, 2003). Indeed, managers at such firms recognized that technology-enabled innovation was now an essential part of their firm's strategy (Freeman & Soete, 1999). These new users of technology also realized that in order to compete with companies that were basing their business models on digital products, they would have to venture beyond their traditional, circumscribed organizational structures which resided in brick and mortar environments and tap into the resources that existed in a larger more networked business environment (Gemunden, Ritter, & Heydebreck, 1996).

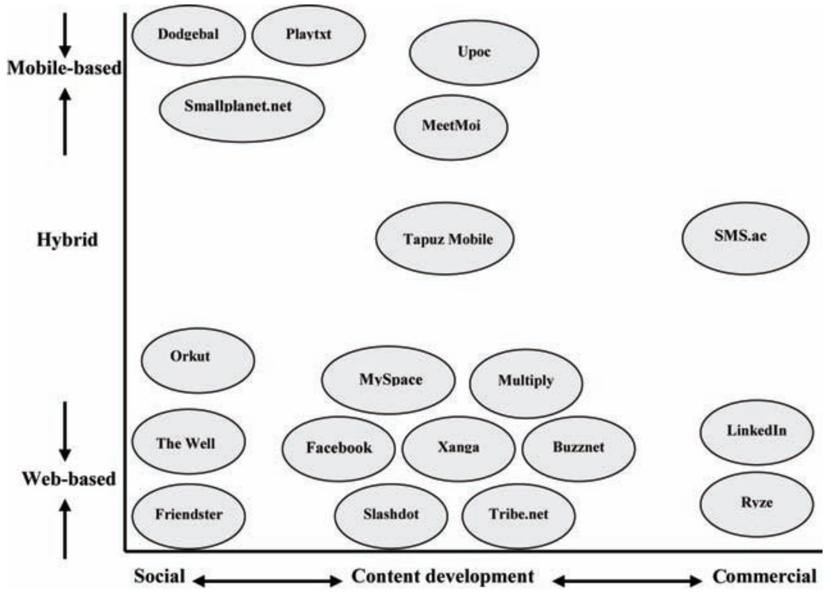
As the locus of innovation shifted from so-called 'brick and mortar' delineated companies to a more networked ecological model, a further organizational shift occurred toward a more powerful user presence within these networks. Various types of online communities appeared including special interest groups such as usenet groups; professional associations and online forums where people could exchange ideas on specific topics of interest to them; portals which provided a single point of entry for individuals and businesses to interact with one another; chat rooms, where users sought new communities and contacts; and short-term groups where users participated in one time events such as online competitions, quizzes and polls (Hamman, 2001). These communities consisted of individuals who might be scattered geographically but used the Internet as a platform for discussion. Howard Rheingold, who pioneered such online communities, defined them as "… cultural aggregations that emerge when enough people bump into each other often enough in cyberspace" (Rheingold, 1994). Some of these communities had moderators and others were more dependent on users to keep them going. For example, The Well which still exists, is essentially an online set of forums which are available to users who pay a monthly fee to participate in discussions on such wide-ranging topics as entertainment and media, computer tools, and politics (www.well.com/aboutwell.html).These online communities were initially only accessible through Web sites and therefore uni-dimensional from a technological point of view.

More recently, there has been growth in companies on the Internet which have focused on the development of virtual social networks. Such networks range in purpose from being purely social in nature to those which are commercially oriented with content development being a key purpose for these networks. Thus, such companies as Facebook and MySpace have reached out to users in the 18-24 year-old range who create their own content, for example, personal profiles, photos, blogs, and journals and share it as well as other aspects of their lives with their friends as well as with the rest of the world (Hansell, 2006). Ryze and LinkedIn have enabled business users to establish networks of business associated and potential clients. While these virtual social networks are intrinsically interesting as places where young people socialize with one another in an online setting and are seen by marketeers as a perfect target for advertising products and services designed specifically for this population (Elliott, 2007), more importantly, they have become a new and fertile locus for innovation.

This chapter will explore the development of mobile social networks, a subset of virtual social networks. In an initial study of online social networks (Ziv & Mulloth, 2006) social networking companies were plotted along two matrices: technological and purpose (Figure 1). On the technological matrix, social networks were plotted along an axis which ranged from Web-based to mobile-based and included a middle ground, that is, a hybrid scenario where social networking companies incorporated both the Web and the mobile platform.

It is clear from this chart that mobile social networks are in the minority in the overall social networking industry as presently constituted. However, this chapter will discuss how this subset of companies is at the forefront of innovation in social networking. It will delineate the salient characteristics of these networks and discuss how users who populate these networks have become significant sources of innovation in several ways:

Figure 1. Social network matrix (partial list)



they have begun to shift the balance of value creation away from traditional companies and toward the creation of companies which provide technology platforms and services for user-centric innovation; as they engage in community building, these users develop new business content and knowledge; and they have been the catalyst for transforming organizations and rethinking managerial competencies.

The chapter is divided into four sections. The first section provides a brief overview of the effect of digital-based innovation on the business environment especially with regard to the changing role of customer/users and the transformation of firms into more networked, ecological organizations. These trends in the business environment have played a significant part in the establishment of virtual social networks. The second section discusses the emergence of the mobile platform and other technologies which enabled mobile social networks to develop. The third section focuses on three mobile social networking companies, Dodgeball and Upoc, New York City-based companies and Tapuz Mobile, an Israeli-based company, and defines the salient characteristics of these companies. Field research was conducted on all three companies. In the final part of the chapter, some conclusions are drawn about mobile social networking organizations, which can serve as a beginning point for further research on the entire universe of social networking organizations. Moreover, these conclusions have implications for managers in technology-enabled organizations who wish to foster an innovative environment in their companies.

The Impact of Digital-Based Innovation

As background for the development of virtual social networks, three major ideas on the nature of innovation with relation to managerial competencies and the development of the firm will be discussed. The first idea concerns business networks of innovation which have emerged as a result of the Internet and have enabled companies to go beyond their traditional 'brick and mortar' boundaries in order to access innovative capabilities from sources such as partners, vendors, experts, universities and most significantly customers/

users. Indeed, until recent developments in digital-based innovation, which have led to a redefinition of how firms compete and are configured, firms were defined by how they made use of "productive resources for the purpose of supplying goods and services to the economy in accordance with plans developed and put into effect within the firm" (Penrose, 1959). The resources that the firm had within its span of control were physical in nature, that is, they consisted of tangible things such as plants, equipment, land and natural resources, and raw materials as well as human resources (Penrose, 1959). This view of the firm also posited that firms had very clear administrative structures with a central management structure which was responsible for the general policies under which the firm's hierarchy operated (Penrose, 1959) and well-defined reporting relationships and job responsibilities (Schoonhoven & Jelinek, 1997). Moreover, firms were thought of as isolated "islands of hierarchical control embedded in a market structure and interacting with each other through the price mechanism" (Teece, 1998).

In the post-industrial business environment, which is characterized by an emphasis on digital-based innovation and hybrid (digital and physical) innovation, the role of the firm and consequently its structure has had to change dramatically. Huber forecasted that this new business environment would be one where there will be more available knowledge, increasing complexity, and increasing turbulence (Huber, 1984). He suggests that because of these three factors, organizational decision making will be faster and more complex and therefore organizational structures will have to change to accommodate this new kind of decision making (Huber, 1984). In this new environment, innovation is characterized by uncertainty, interrelatedness between various sub-systems, and often relies on tacit knowledge accumulated by various members of the organization who may reside in different structural units (Teece, 1998). Instead of residing in a structured hierarchical organization, innovation now takes place with a larger networked environment (Benkler, 2006).

Therefore, for firms to be successful and differentiate themselves in the marketplace, it has become increasingly clear that along with having a set of core competencies, such firms would also need to acquire a network competence, which would enable them to exploit the set of relationships among customers, suppliers, vendors, and other so-called 'nodes' on the network (Ritter, 1999). Managers now understand that developing such relationships is crucial for enabling the continuous transfer of knowledge to their firms thereby providing a richer environment for the creation of innovative products and services (Kodama, 2005; (Rothschild & Darr, 2005). Such networks have enabled various constituencies to become nodal points on the technological platform and interact continually with one another in order to create value.

The second major idea is related to the development of these business networks: it is the ability of customers to provide instantaneous feedback to firms and be so-called co-creators with the members of these firms. While traditional firms had always 'pushed' their products to customers, the Internet has suddenly enabled such customers/users to become significant nodes in the business network of many firms. Thus along with communicating in a new way with businesses, users themselves have become an important source of innovation.

The notion of users as sources of innovation is not new. In his landmark book, *The Sources of Innovation*, Eric Von Hippel discusses how the users he studied had a great advantage over manufacture-centered development because they could create exactly what they wanted and could benefit from exchanges of ideas with other users in the community (von Hippel, 1988). Such users developed new products in order to satisfy their own needs and ultimately offered their innovations to companies who then marketed them. Improvements in software and hardware as well as cheaper tools that enable users to create new products, led to a 'democratization of innovation' in which users not only have the opportunity to make exactly the right products for themselves but also create communities which foster an environment in which creativity and continuous learning take place (von Hippel, 2005). Such communities of user-innovators have been very important especially in the beginning stages of new industries. For example, in the early days of Silicon Valley, informal networks of engineers and other like-minded affinity groups traded ideas with each other in settings outside of the workplace. The ideas which came out of these networks had a significant impact on the development of some of the hardware and software products which made Silicon Valley a hotbed of innovation in the 1990s (Saxenian, 1994).

The third major idea concerns the development of user communities. As the technological platform underlying the World Wide Web became more robust, such communities have become important entities not only with regard to the business networks described above but also as seedbeds of innovation. A prime example of community-based innovation is Linux. In 1991, Linus Torvalds, a computer programmer in Finland, released an operating system kernel and made it available on the World Wide Web for anyone who wanted to view it and/or add to it. Thousands of computer programmers around the world began to contribute to the kernel and the Linux operating system evolved into an alternative to proprietary operating systems such as Windows. Torvalds became the moderator/facilitator of the Open Source project and the Open Source software movement has developed into a global community of software developers who contribute freely and voluntarily to an operating system kernel known as Linux because they derive personal satisfaction and enhance their reputations as software developers from making such contributions (von Hippel, 2001). A recent manifestation of the Open Source network structure is Wikipedia, which is an online encyclopedia to which users contribute voluntarily (Levine, 2006). Another well-known technologically- based user community was started by Shawn Fanning, a college student, whose original aim was to share his music with his circle of friends. His development of a peer-to-peer platform enabled Napster to become an application on which users could send each other music files (Menn, 2003). Later, other companies such as Apple, developed ancillary services to supplement the original file sharing application (Fried, 2003).

In summary, digital-based innovations, in particular the Internet, have led to a significant change in how some industries and firms conduct business. Along with fostering a new mindset among managers about how to create value, the development of networks of innovation has shifted to some degree, the center of creativity and product development into the hands of users who can now drive innovation and play a key role in successful value creation. As users became active participants in networks of innovation, they have formed virtual communities like those in the physical world in which they have created new kinds of knowledge and content. Such communities are slated to play a more significant role in the future of organizations as they become more networked and access a variety of constituents as sources of innovation.

The Emergence of the Mobile Platform

This section will focus on the emergence of the mobile platform and other related technologies which enabled the development of mobile social networks. In the early stages of the social networking arena, mobile social networking did not develop at the pace of Web-based applications. This was in large part due to the static nature of innovation on the mobile platform. Historically, much of the innovation on the mobile platform focused on the development of infrastructure and devices. In the United States, telecommunications carriers such as Verizon, Sprint and AT&T

all invested significant resources into wireless technologies, primarily by building out the telecommunications infrastructure to accommodate the increasing demand for wireless services, and acting as service providers. Other technology companies such as Nokia and Ericsson in Europe and Samsung in Korea developed handsets. Indeed, in the early days of the mobile platform, the emphasis was almost exclusively on technology and making sure that a user could complete a phone call without being ‘dropped’ in the middle of it (Cook & Ghosh, 2001).

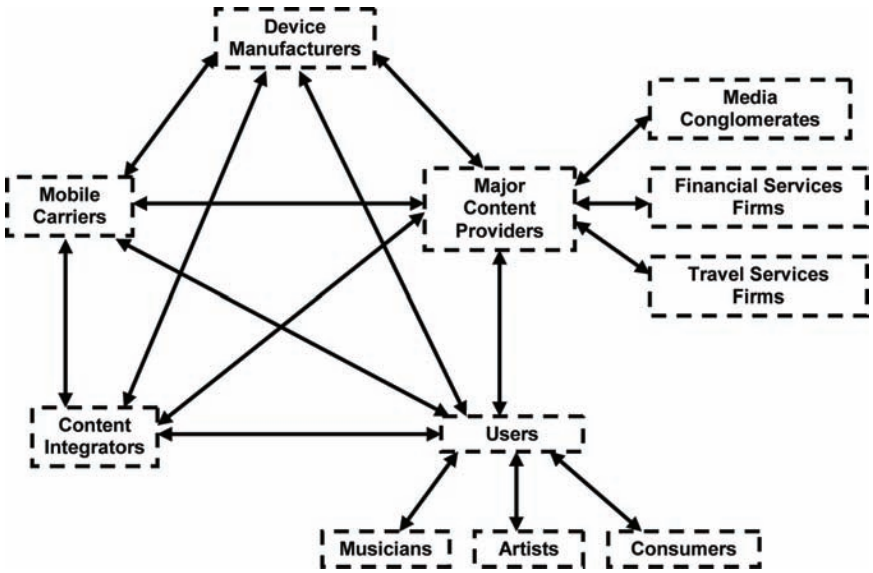
Because of the emphasis on technology, there was not much content available to the general user population and usage was limited to cell phone calls. In many ways, the process of adoption of this technological innovation was very similar to what occurred with the World Wide Web, where initially there was also a dearth of content available to mainstream users. In fact, some analysts contended that the wireless platform was just a ‘watered down Web’ with little content that users wanted to access or pay for (Mobile content, 2000).

As the mobile platform developed, voice traffic became more and more of a commodity and mobile operators looked to new sources of revenue. One of most lucrative appeared to be in the area of content provisioning. Realizing this was an important new trend, mobile operators became the center of a paradigm of innovation in which content providers and handset manufacturers were providing their products to the mobile operators and users of these services had no choice but to access services and content from the operators. In this paradigm, the carriers provide the content and devices and the users have little contact with handset/device manufacturers or content providers. While this paradigm presumably worked in the early days of the platform when technology drove the business, with the development of new kinds of content for mobile devices, it was suggested that this paradigm may stifle innovation for all constituencies and what was needed is a new paradigm that is more networked and porous in structure and is characterized by continual interaction between content providers, handset manufacturers, other device manufacturers, for example, Nokia, Apple and most importantly, users. In addition, so-called content integrators/infomediaries who provide technical- and content-related services to both content providers and carriers as well create their own portfolios of content were deemed to be important constituents in the paradigm (Ziv, 2005).

This shift toward a more ecological and fluid model began to occur. Carriers began to create more equitable partnerships with content providers and allow small companies to use their network for distributing a variety of applications to users. Large content providers also recognized the need to access the expertise of content developers outside of the traditional boundaries of their organizations in order to find creative ways of using the premium content that is their most important asset. Users began to assume a more active role in content creation and the use of the mobile platform (Figure 2).

Along with the advent of an increasingly stable mobile platform and the rapid adoption of mobile devices such as cell phones, gaming machines and handheld computers by a wide variety of users, a new set of technologies, that is, Location-Based Services (LBS) emerged which further provided the impetus for the creation of mobile social networking applications and companies. LBS technologies allow programmers to capture the location of a particular user and integrate the position information into a wide variety of applications (Geier, 2004). Such technologies include GPS (Global Positioning Systems) which allow customers to find their way to their destinations and alert friends and colleagues to their whereabouts and Wi-Fi, which can be used as the basis for determining position and acts like an indoor form of GPS, with access points acting as satellites. With this approach, the server software keeps track of client device positions and also transmits this information to specific clients (Geier, 2004).

Figure 2. Networked model of innovation on the mobile platform



The availability of LBS applications transformed virtual social networking from being a people-to-people phenomenon which exists irrespective of geographical place to one in which individuals use technology to maintain a network of strong social ties within a local geographical context such as a city or a university community (Jones & Grandhi, 2005). Coupled with a more robust mobile platform and better devices, mobile applications began to proliferate. The next section will describe the characteristics of mobile social networks.

Characteristics of Mobile Social Networks

From an analysis of three mobile social networking companies—Dodgeball, Tapuz Mobile, and Upoc—a number of salient characteristics emerged. One of these characteristics in a larger sense defines the entire genre of these companies. It is the overall notion that unlike other organizations whose core competency is based on the development of products which the company decides is important for its customers (Prahalad, 1997), these companies' core competency is to provide services for users who 'create the products'. Thus value creation depends almost entirely on the users themselves and their co-creation with the company which hosts them. A prime example is Dodgeball, a New York-based subsidiary of Google, an early instance of a company which provided a technological platform and some services to its users. Essentially, the service that Dodgeball offers to users is the ability to connect to one another while on the go in an urban environment. In order to make it simple for users to connect to one another, each bar, coffee shop and major place of interest, for example, museum, sports arena, restaurant in a particular city was geo-coded by the company. The major 'product' of the company is the user profiles which are listed on the Web site. Users fill out profiles, post photographs and list their friends and their cell phone numbers. When Dodgeball users 'check in' at a given locale, they send a text message which goes to all their pre-selected friends as well as any friends of friends in a ten block radius telling all these people where the message sender is located. The system then finds other users who have checked in during the last three hours and compares their locations on a virtual map to see if these users are within a 0.8 kilometer radius. Another major 'product' of Dodgeball is the interaction that occurs between the users when they meet or exchange information about one another. In addition, the users themselves create mini Web sites which contain not only their own profiles and pictures of their friends and friends of friends, but also a listing of the places they frequent and their own personal commentary about particular places such as a review of a restaurant (Ziv, 2006).

For Tapuz Mobile, which is based in Ramat Gan, Israel, the major goal is to provide services for its users which they can employ to develop new 'products' and participate in online communities. Thus, the company offers services which enable its users to create communities where they can discuss topics of interest to them. Tapuz has over 1,100 managed forums as well as 5,000 private forums called communas which focus on particular topics related to Israeli politics, culture and society. The company has over 1.6 million unique users per month who participate in the communities. Along with providing platforms for community building, Tapuz also provides its users with a variety of mobile and Web-based applications. One such application is BLOGTV, which enables users to create a live TV show and broadcast it on the Web and on mobile phones. A user entering the BLOGTV site can interact with the broadcaster and contribute to the ongoing text chat. Other applications include Getit, a mobile auction site, and Flix, a video sharing platform, has a Web site which has a video channel with continuously running videos created by users (Ziv, 2006).

Upoc is a subsidiary of Dada, an Italian-based provider of Web and mobile entertainment services. Dada is a fairly large public company based in Florence, Italy which packages and distributes ring tones, wallpapers and Java games in 12 different countries around the world. In addition, they own the equivalent of the online dating personals service, Match.com in Italy and they also own a blogging company—Life—which compares with the U.S.-based company MySpace.com. Upoc hosts social networking groups for New York City-based users, as well as provides ISP services on the mobile platform. Upoc was one of the first mobile social networks established in the United States and today has a user base of 4 million unique users. Upoc has positioned itself as a multi-faceted mobile services provider and has developed a cohesive approach for mobile media, community, marketing and third-party services for its customers and business partners (Ziv, 2007).

The core of Upoc (which means Universal Point of Contact) is the social networking service which enables users to send text messages to their friends and start any number of mobile groups for friends or family on an unlimited range of topics. Currently at Upoc, there are around 40,000 groups with categories such as music and dating being the most popular. There are also religious groups, and groups which discuss controversial topics. Like other mobile social networking organizations, Upoc is very user-centric especially with regard to the products which define the company. In Upoc's case, users define their mobile identities and participate in creating content and establishing permanent communities. Upoc's services are designed to enable the creation of user-based output. For example, Upoc provides a service called Up2 which enables users to microblog and share their thoughts on a real-time basis with their friends and others. In addition, there are subscription services available to users, for example, dating services, which enhance the mobile social networking user experience.

Thus, mobile social networks such as Dodgeball, Tapuz and Upoc provide tools that enable people to collectively construct a range of resources that were too difficult or expensive, or simply impossible to develop previously (Terdiman, 2004). Users who participate in these networks have the opportunity to generate personalized content such as mobile blogs and/or collaborate on the mobile platform to develop exciting new kinds of content.

A second major characteristic of these companies and related to the notion of user-centricity, is that users are not only active members of their communities and participate in them, they also give valuable feedback to their organizations which enables innovation to occur. Tapuz for example, attributes its success to not only offering superior technology but also being very attentive to the requests and needs of their users. The majority of Tapuz users are young people (the average age is 22) who are early adopters of technology and provide continual feedback to the company on a regular basis on Tapuz's applications and services. The Tapuz management team considers these users a prime source of innovation and often implements suggestions from users into the suite of applications on the Web site. Indeed, Tapuz is an example of a new kind of firm which exists in complete partnership with its users.

In addition, Tapuz's communities while overwhelmingly social in nature, have sparked the interest of firms in the mobile product development arena who participate in some of these communities in order to get feedback about the mobile technology arena. Thus, one community which is a group devoted to a discussion of cell phones has among its users members of the cell phone manufacturing industry who listen to the dialogue and incorporate the suggestions and ideas they hear from the community in their designs of mobile devices for the marketplace.

Given that the users are central to the strategy of these companies, one of the most important aspects of these social networking companies is that they are able to provide the technological infrastructure for product development as well as services which will enable such development. Thus, a third major characteristic of these companies is that they are techno-centric, that is, these companies could not exist or provide services without developing a sophisticated technology strategy. For both Dodgeball and Tapuz, this strategy consists of using the mobile platform exclusively or a hybrid model in which a company provides a Web-based product which enables users to sign up for a particular service and then use the mobile platform. Dodgeball, for example, uses mobile services such as Location-Based Services and short messaging services (SMS) in order to reach their customer base. Dodgeball's services include a Web site which was built using off-the-shelf open source tools which were cobbled together to provide a platform that is accessible to everyone who owns a cell phone. While users may sign up initially via a Web site, once they are signed up, the service exists entirely on the mobile technology platform (Geier, 2004).

Tapuz has developed an advanced mobile platform which enables users to interact seamlessly with one another and also has partnered with Israeli telecommunications operators such as Cellcom, Pelephone, and Orange to develop robust applications and enable subscribers of these operators access Tapuz's applications through operator portals which are available on their handsets. However, as the mobile platform has become more robust, hybrid online/mobile communities have emerged with users participating both through a Web site and by using their mobile devices, for example, PDAs, and cell phones. Indeed, Tapuz offers full synergy between the web and mobile devices. Thus, users who are on the web-based chat platform can talk with users who are surfing from their mobile phones as well as send them messages. An example of a major service of Tapuz is Panet, an Arabic Internet portal which has more than 500,000 daily visitors. Tapuz constructed the application so that the mobile portal is a mirror site of the Web-based portal (www.tapuz.co.il).

Upoc is also techno-centric and has a complex technology strategy for servicing both its users and also its partners, for example, the carriers, media companies and marketing organizations As a multi-faceted mobile services provider, Upoc has developed a comprehensive mobile technology solution for carriers, consumers, media companies and marketers to communicate through various applications including SMS (text messaging), WAP (wireless Internet), voice, and MMS (multimedia messaging). Upoc's technology platform integrates text, voice, Web, and wireless Internet and works on any mobile phone, Internet-enabled phone, wireless PDA, two-way or text pager. Upoc was the first company in North America to have direct connections to all the carriers for facilitating text messaging and in the early days of mobile text messaging, the company was actually generating a significant percentage of the SMS traffic in the United States.

In developing their technology platforms, both Upoc and Tapuz recognized that they would need to integrate the capabilities of their organizations with those of the mobile carriers in their respective countries. This integration enabled both organizations to have viable business models which could sustain them and enable them to provide top notch services for their clients. Thus Tapuz has partnerships with Cellcom and other carriers in Israel and has developed revenue sharing models with these companies. Upoc has a complex business model. It has partnerships with all the major carriers including Verizon, Sprint, T-Mobile and Cingular and is the only company in the United States which actually gets paid by the carriers for generating SMS messages. In addition, Upoc provides local subscription services in which users can download Bible quotes and dating services using premium SMS and also provides advertising services for the carriers.

As a result of its acquisition by Dada, Upoc has become the proprietary aggregator of Dada's billing services for Cingular in the United States and for Dada's local TV promotions. As the intermediary services provider, Upoc gets a percentage of the overall profits. Clearly, the role which Upoc plays as a technology intermediary to the carriers as well as a partner to them in revenue generation extends the model of the mobile social networking organizations beyond simply being a platform for its users to create content and communities.

While users participate as individuals in communities or generate their own content using the various services of the companies, they also are members of communities and engage in continual community building. This virtual community building is another very important characteristic of mobile social networking organizations. Each organization tends to attract a different demographic for its communities. Thus Dodgeball's constituents are mostly young urbanites in the 18-24 year-old age range while at Upoc, the service attracts blue collar workers such as truck drivers, firemen, and police officers who do not necessarily spend a lot of time in front of a computer but do see the need to communicate in the mobile environment for a variety of reasons. Upoc's users are generally Black and Hispanic people in the 20 to 40 year-old age group and remain part of the community for an extended period of time. Tapuz attracts a wide range of people who span various ages, interests, and demographics throughout the Israeli community.

Along with socially-oriented communities, a number of business environments have established mobile social networking communities to enhance their employees' communication with one another and build new knowledge. Thus Upoc's multi-platform cross-carrier group SMS capabilities enable groups of real estate agents and sales teams to be in constant communication with one another. Professionals such as doctors and lawyers have also created these on-the-go communities to exchange and share their knowledge with one another (www.upocnetworks.com). Many of these professionals are not necessarily able to access their Web-based fixed line computers but are able to participate in dialogues with fellow professionals while out in the field.

Community building for these different groups of people is challenging. Most mobile social networking communities are self-policing and support open communication among their members. Users have complete control of how they communicate with one another and what type of content they access. Thus users can change their messaging options at any time, block messages from members they do not like, remove people from messaging groups and unsubscribe from any content they do not want.

A key aspect of community building entails having a community manager who moderates the discussions of these communities, keeps the conversation going and makes sure that there is nothing fraudulent or illegal occurring. Mobile social networking services do vary in how they approach the issue of community managers. At Tapuz, after an incident in which a community moderator who was a woman turned out to be a male, the management at Tapuz decided to meet with each moderator in order to make sure they are aware of their responsibilities and guard against misrepresentation (Ziv, 2006a). At Upoc, any user can create a community on any topic and then become the owner and moderator of the community. However, Upoc maintains a staff of community managers who check in on groups to ensure that the discussions are proceeding appropriately. If a person becomes offensive, the company's community managers can step in and either ask the person to leave or blacklist the person from ever joining the community again. An example of someone who could be blacklisted is a person who tries to sell drugs to community members or makes offensive remarks. Unlike a PC, where a user can assume a different identity, the interaction on a mobile phone can be traced to a network identifiable device so it is easy to track down a person and exclude him or her from the conversation.

The importance of community managers in the life of the communities has become apparent to the management team at Upoc. Steve Spencer, the CEO of the company, suggested that without these managers, many of the communities would not be viable. During the 2007 holiday season, themed communities with Upoc community managers were created around such subjects as Thanksgiving, Hanukkah, and Christmas. Community managers moderated these groups to ensure that anti-social behavior was not tolerated. In fact, about 100 people were expelled from the community because of inappropriate behavior. As a result, these communities became social safety nets for new users who knew that the communities would welcome them. For the Christmas themed community, which was entitled 'What do you want from Santa Claus?', the CEO of the company became the community manager and assumed the identity of Santa Claus. He was able to reach out to people across the United States who shared their stories of heartbreak and joy during the season (Ziv, 2008) .Other functions served by community managers include helping people to understand how to use the functions on their mobile phones and reporting errors and glitches in the system (Alleven, 2007).

By participating in the communities, which are the core service of their company, community managers at Upoc and at Tapuz have begun to change the nature of their companies' organizations.

Rather than the usual management team being the focus of the organization's hierarchical structure, the communities of users who populate the technological platforms of each of these companies have in effect, became the most important nodes on a network which includes the management team. Indeed, all three of the companies that were researched had lean management teams. At Upoc for example, the management team consists of the CEO and a small team of managers who oversee operations, engineering, quality assurance, customer service, and business development.

A final characteristic of mobile social networks is that they are multi-locational. By taking advantage of the mobile platform, they can be intensely urban-centric and operate in a very localized manner or they can connect users on a national level who are subscribers in a national wireless network. Thus Dodgeball's social networks are made up of people who interact in densely packed urban environments. Indeed, in New York City and other large metropolises in the United States, the young generation, largely referred to as Generation @, increasingly looks at such networks as a medium through which they can establish their social identities. These social networks act as virtual community centers, a place for the Generation @ to socialize online as well as use it to tap into information, buy books, send flowers or even breakup with a boyfriend. Dodgeball and other services like it depend on people wanting to meet with one another at particular locations in an urban setting.

Tapuz and Upoc operate on multiple levels. Upoc's communities are sometimes localized in one city where local nurses, for example, may communicate regularly with one another. Other times they operate on a national level across the wireless network which enables users whose mobile phones are tied to different carriers to interact with one another. In the case of the themed Christmas community, some of the users were in rural locations and used pre-paid phone cards as a way of communicating with those in urban environments. For Tapuz, there are local communities as well as national communities and because community members can interact with one another through the company's Web site, many Israelis abroad participate in the communities thus enabling such communities to assume a global stance.

CONCLUSION

As demonstrated by the discussion of mobile social networking organizations such as Dodgeball, Tapuz Mobile and Upoc, the mobile social networking arena is a burgeoning one and poised to evolve into a more robust and developed industry sub-sector in the near future. Of the three companies studied, Upoc is most advanced in terms of providing a comprehensive set of services and also having a sustainable business model. It may be that some companies which provide social networking services such Tapuz Mobile will choose to remain purely social and influence the development of the sector in less tangible ways while others will become more commercialized in nature. Indeed, as the sub-sector evolves, there may be a spectrum of social networking organizations ranging from those established purely by users for their own needs to those which offer more substantial products and services.

For managers, it is clear that in this new business environment, where users are a key component of value creation and user-centric companies are proliferating, it is essential to reach out into the larger networked environment in which these users thrive and seek the sources of innovation outside of the traditional organizational structures. While user-based innovation overall is not new, what is new is the increasing importance and centrality of users with regard to the competitive strategy of these companies. Managers need to rethink the core competency of their companies to include a significant set of user-based innovations. Indeed, they may also have to restructure their organizations to incorporate such user communities and the range of innovation that occurs in them. Thus, users may share products that they have developed with the community at large, for example, Upoc, and Dodgeball users generate profiles of themselves which contain personal information that they upload to the technological platform for sharing with the rest of the community. Innovation in this case takes place on an individual level as individual users create value for others. On the community level, users who interact with one another build new knowledge and content which contributes to the overall knowledge base of the community members.

In addition to the social nature of many of these communities, those communities established by professionals become laboratories for learning about how groups of people interact with one another and how knowledge sharing in a corporate setting can be enhanced. In a sense, community building and sharing of ideas and knowledge becomes a new form of R&D in the corporate environment where users/customers who represent another community node on the larger network interact with internal communities of the organization and continually create new knowledge and ideas. As the economy becomes more service-based, such interaction between external and internal communities becomes essential for the optimal development and deployment of products and services.

Beyond providing a source of innovation, these user communities also provide excellent opportunities for the business community as they enable firms to directly tap into markets and better understand what products will be successful for particular customers. Companies that recognize the importance of community-based innovation include Proctor and Gamble which recently launched two Web sites which are designed to serve as platforms for the creation of user communities made up of their customers (Vranica, 2007) and Cisco, which is providing a variety of services for its customers aimed at helping them bring their users together in online communities (Stone, 2007). The recent partnership forged by Microsoft to provide advertising services for Facebook.com and Google's deal to be the exclusive provider of search capabilities for MySpace.com indicates that major players in the software arena have recognized the importance and potentially lucrative nature of these user communities (Seelye, 2006).

Along with recognizing the value creation done by users, this chapter suggests that these mobile social networking companies represent a significant change in how companies organize themselves and that they are at the leading edge of organizational transformation. Formed to service communities, such companies have a minimalist organizational structure, and a rich technological environment which is designed to encourage customers, that is, the members of these user communities, to innovate. In the future, managers who once headed traditional hierarchical organizations may have to assume new roles which are more in line with the community manager of these social networks who acts as a facilitator of the members of the organization. While making sure the community functions properly, the 'manager' lets the members of the community freely interact with one another to create innovative products and services. For many companies such radical changes may come about in incremental stages. For example, one way such user-centric organizations can help larger organizations become more innovative and competitive is to become an important 'subsidiary' within a larger organization. Companies such as Newscorp have recognized the power of these user-centric organizations and have acquired MySpace.com, a social networking site (Siklos, 2007).

One aspect of mobile social networking which needs further exploration is the locational issue. Services such as Dodgeball show that digital networks actually make cities more attractive than ever before, as opposed to a widely held belief that the technology platform now in place which provides connectivity for vast numbers of users who are not necessarily in the same place or even time zone, and especially the mobile platform which encourages people to be dispersed, were going to make the whole idea of densely packed urban locations obsolete. Instead, such mobile social networks promote the positive aspects of interaction and add credence to the Porterian notion of clustering of individuals and businesses in geographical proximity in order to achieve economic success (Porter, 1998) as well as to the idea that groups of people using mobile social networks will find new ways of organizing and interacting, and in doing so, will in some way change the nature of the social order (Rheingold, 2002). In the spectrum of mobile social networking organizations, more dispersed communities especially on the national level, can bring various people together in powerful groups which can unite for a common purpose or serve as a national sounding board for a company seeking to reach a customer base that is nation-wide and solicit ideas from this base in order to create products and services that will be successful beyond the local business environment.

While mobile social networking companies as described above continue to develop on the national level, it is clear that innovation is now viewed as a global endeavor and companies which want to compete successfully must learn to operate within this new environment. This is especially true in industries which rely on the collection, distribution and processing of information such as the music industry where the value chain has been reconfigured to reflect new modes of delivering products and services (Mol, Winjberg, & Carroll, 2005). Such reconfiguration calls for firms to have new approaches to creating value and to use the technology platform, that is, the Internet, as a tool for developing and accessing sources of innovation around the world. This might entail reaching out beyond the bounds of the traditional corporation to access the R&D talent that is dispersed globally in order to solve technological problems (Moitra & Krishnamoorthy, 2004) or restructuring the process of gathering knowledge about a new product or service by creating a 'web of innovation' which will facilitate the optimal interchange of ideas from experts in various locations (Farris, Hartz, & Whitwell, 2003). As a result of its acquisition by Dada, Upoc has ventured into globalizing its offerings. Its plans include developing mobile social networking applications in Brazil, Italy, and Spain (Ziv, 2008).

As the mobile social networking arena evolves, challenges clearly remain. Although a variety of personal computing devices enable users to stay connected to the community through the Web, limitations such as small screens on mobile devices, poor connectivity and issues of privacy and security will continue to be of concern to users who employ the mobile platform exclusively. New advances in technology both on the infrastructure side and the device side are needed in order for the mobile social networking industry to advance. Clearly more research needs to be done to understand how the mobile social networking arena is evolving, and its potential impact on the future environment of a variety of industries and on managerial imperatives.

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This work was previously published in Social Networking Communities and E-Dating Services: Concepts and Implications, edited by C. Romm-Livermore; K. Setzekorn, pp. 44-59, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.20
Mobile Social Networks and Services

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ABSTRACT

Mobile social networks allow users to connect with each other, share information, and create technologically enabled mobile communities. With the introduction of the iPhone in 2007, the public dream of the likelihood of mobile computing was realized. This chapter reviews mobile social networks ranging from early examples to current services; and, it identifies and categorizes them according to a specific media type, mode, and code. The challenges of categorization in light of technology convergence are discussed. Issues of privacy, compatibility, and pricing are presented as they relate to mobile social networks. Potential strategies are suggested for dealing with these challenges. Finally, future trends of mobile social services are identified.

BACKGROUND

Mobile communication is becoming ubiquitous in many parts of the world today with over 3 billion mobile phone users worldwide (Tsai, 2008; Wolverton, 2008). Over 255 million mobile subscribers live in the U.S. (CTIA, 2008), which means more Americans own a mobile phone than have an Internet connection (*On the Move: The Role of Cellular Communications in American Life*, 2006). Considerable research has explored the social effects of mobile phone use (e.g., Goggin, 2006; Ito, Okabe, & Matsuda, 2005; Katz, 2003; Katz, 2006; Katz & Aakhus, 2002; Ling, 2004, 2008). Some have argued that mobile phones may lead to the atomization and privatization among users by discouraging face-to-face communication in urban environments (Banjo, Hu, & Sundar, 2006; Bull, 2004; Puro, 2002).

As mobile technology advances, however, new services for mobile phones have been developed which allow people to create, develop, and strengthen social ties. Similar to social networking sites on the Internet (Benkler, 2006; Boyd, 2004; Boyd & Ellison, 2007; Castells, 2000; Rheingold, 2002; Rosenbush, 2005; Saveri, Rheingold, & Vian, 2005), these mobile services may help users to build valuable networks to share information and resources (Ziv, 2009).

DOI: 10.4018/978-1-60566-368-5.ch003

One of the first mobile social devices to appear was the Lovegety in Japan (Iwatani, 1998; Reuters, 1998). The Lovegety was a stand-alone device that would fit in the palm of the hand and beep when it was within 5 meters of another device. There were "pink girl" devices and "blue boy" devices each with three settings: "let's chat", "let's karaoke", or "get2". The devices beeped and flashed green when two co-located devices were on the same setting (e.g., both devices were set to "let's chat"). The devices would beep and flash red when they were on different settings. According to one account, users would turn down the volumes, hide the devices, and pretend they did not have a device if they did not want to contact another Lovegety user (Iwatani, 1998).

There were two kinds of information exchanged using the Lovegety. First, information regarding the identification of people who were interested in using a mobile device to meet other people; second, information regarding what kind of social interaction each person was looking for. The information exchanged was rather simplistic, but it allowed people to have interactions with strangers in public spaces mediated by mobile devices without divulging personal identifying information, such as mobile phone numbers or even names.

MIT's Media Lab and Intel Corporation each developed two other early mobile social networks. Social Serendipity was MIT's Bluetooth-based social service meant to harness the power of mobile technology and social information (Eagle & Pentland, 2005). Social Serendipity facilitated social interaction among geographically proximate users by matching user profiles and then exchanging profile information with similar matches. Intel's Jabberwocky sought to monitor and broadcast a user's movement to identify "familiar strangers" and encourage a sense of urban community (Paulos & Goodman, 2004). Both of these technologies relied on the mobility of the devices to ascertain locational information to facilitate social connections among users.

Early versions of mobile social services, such as the Lovegety, Seredipity, and Jabberwocky, were often made as stand-alone mobile devices. As mobile phones have advanced, however, there has been a movement away from separate mobiles devices that facilitate social connectivity and towards mobile social services that work on mobile phones. The mobile phone has joined the ranks of keys and wallets as items most people do not leave home without (Lohr, 2005). Therefore, most publicly available mobile social services have been developed to be used with mobile phones. The present chapter reviews a range of mobile social services, from the early examples to most current, and identifies and categorizes various mobile social networks and services.

Mobile Social Services

Mobile social services refer to software, applications, or systems for mobile phones that allow users to connect with other people, share information, and create technologically enabled mobile communities. Many different terms are used to describe these kinds of services including: *mobile social network*, *mobile social software*, *mobile social network service*, and *mobile blog* (or *mo-blog*).

The term *mobile social network* has evolved in reference to the rise of such social networking services (SNS) as Facebook, MySpace, and Friendster. Boyd and Ellison (2007) define *social network sites* as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system." The most obvious difference between a mobile social network and a SNS is that the latter is web-based and the former is primarily mobile phone-based.

Boyd and Ellison's (2007) definition also is helpful to differentiate between mobile social networks and mobile social software (MoSoSo). Mobile social networks give users the ability both to identify those users with whom they are connected and to traverse the list of connections within the system. Sometimes this navigation occurs via an application on the mobile phone and sometimes it occurs on an affiliated website accessed through a computer. (As mobile technology is advancing, however, the ability to access more information through mobile devices is increasing; thus more and more of these services will be entirely mobile phone-based.) MoSoSo differ from mobile social networks in that MoSoSo are typically downloaded to one's mobile device (or pre-installed on the phone prior to purchase) whereas a mobile social network does not require a special application or program running on the phone in order to work. Sometimes mobile social networks rely on text messaging, multimedia messaging services, or voice transmissions. MoSoSo also do not necessarily meet the three criteria of a SNS that Boyd and Ellison (2007) identify. Mobile social software may not have articulated lists of social connections among users. The purpose of mobile social software is to support social interactions among interconnected mobile phone users. For example, both Jabberwocky and Social Serendipity would be classified as mobile social software, not mobile social networks. Both facilitate the exchange of social information between groups of mobile users, but do not articulate users' various social connections.

Howard Rheingold's book, *Smart Mobs,* (2002) was one of the first attempts to identify and describe the power of mobile connectivity among groups of users. He details the integral role of mobile phones in organizing the overthrow of President Joseph Estrada in the Philippines and the 1999 World Trade Organization (WTO) protests in Seattle. Mobile technology allows for rapid exchange of information through the devices that people carry with them everyday which in turn allows them to socialize in ways previously unavailable. Mobile social services or MoSoSo can help people to connect with new people as well as to connect with old friends. Ellison, Steinfield and Lampe (2007) found that most of the connections on Facebook were among people who had offline ties (i.e., they had not "met" online). Similarly, mobile social networks can connect people who are already friends or acquaintances. In fact, most mobile social networks brand themselves as helping friends to connect with friends and not necessarily to make new relationships.

Media, Modes, and Codes

There are a myriad of new mobile social services, but there are differences between these systems. Using traditional media typology, three broad factors can be identified to categorize these mobile systems: media, modes, and codes (Gross, 1973).

The first factor of mobile social network categorization considers the *media* through which these systems operate. The term *media* is defined here as a means of communication, such as a mobile phone, computer, or wireless device. Despite an overall trend towards technological convergence, some mobile social networks solely rely on mobile phones to provide the technological means of connection between users. Some wireless devices use Bluetooth to connect users. Most mobile social networks, however, also allow for Internet-based connections. Often there is a web component of the mobile social network and it is not solely mobile phone-based.

By identifying the particular media used in a variety of mobile social networks, one can begin to differentiate between the systems. It is also important to note that the media of mobile social networks facilitate the exchange of messages from one-to-one (interpersonal) to one-to-many (broadcasting). The mobile phone is often perceived as an interpersonal means of communication through which one person communicates via text message or voice to another person. The ability of mobile social networks to broadcast information to many people represents an important shift in mobile communicative practices. The mobile broadcast ability of messages is an important factor in mobile social networks because it allows *groups* of users to communicate quickly and easily.

The second factor with which to categorize mobile social networks is the mode of communication. The *mode* of communication refers to the various forms of communication by which members are able to interact with one another, including text, image, voice (or audio), and video. Some mobile social networks facilitate communication via limited modes whereas others offer a variety of modes through which to interact. The mode of communication shapes the kinds of interactions that members have on mobile social networks. For example, sometimes there are limits on the number of characters that users can send over mobile social networks. Each of these modal differences shapes the kind of communication that occurs over the mobile social network.

The third factor that differentiates mobile social networks is its code. The *codes* of communication are the symbolic systems of communicating social connections. Mobile social networks have various means through which members communicate their social network connections. Some systems display the particular relations of the users, while other mobile social networks display member profiles but not in relation to others. If no connection is displayed, the system would be classified as a mobile social service or software rather than a mobile social network. Another differentiating code is whether these systems require mutual connections or one-way connections. For example, some mobile social networks allow users to send messages to certain people but receive them from other people. Some services call this *watching* or *following*. A user might watch the messages of a small number of users, but might be watched by a larger number of users or visa versa. For example, Malcolm Gladwell, an author and writer for *The New Yorker Magazine*, is followed on Twitter by 421 users but follows one user (Gladwell, 2008). A mutual network system does not allow this one-way messaging. For these mutual systems, users send and receive messages to and from the same people. The code of a mobile social network differentiates a variety of different services, all of which help users to connect with other members based upon common interests or geographic proximity.

Table 1 categorizes the following mobile social services according to the type of media, mode, and code: Pownce.com, Twitxr, Twitter, Jaiku, MySay, Utterz, Crومple, Facebook Mobile, MySpace Mobile, Dodgeball, Socialight, Loopt, Kyte, and Radar. As such, Gross's (1973) typology becomes a helpful tool with which to describe these services. For example, there are important differences in the mode of communication. Early mobile social networks, such as Dodgeball, were primarily text-based (Humphreys, 2007). Increasingly, these services are multi-modal, offering users the ability to broadcast text, images, audio, and video. For example, MySay and Utterz try to differentiate themselves from the other mobile social networks by allowing users to record their voices on their mobile phones and then broadcast them to the web.

This categorization of networks also highlights the convergence of media. Increasingly, designers of mobile social networks are developing specific application-versions of their services, which can be integrated into other websites such as blogs or social network sites. For example, no longer do people have to go to the Twitter website to join, but they can download the application from the Facebook website itself. Thus not only are these services increasingly multi-modal, but they are also multi-media. This points to the convergent nature of communication technology (Jenkins, 2006). The lines between various modes and various media are blurring. Social network sites, for example, Facebook and MySpace, have added distinct mobile components to their services. In fact, MySpace is the largest mobile social network in the U.S. with a mobile audience of 3.7 million

Table 1. Categorization of mobile social services

Name	Description	Media	Mode	Code
Kyte	"Share pictures & video online or from your mobile"	Web, mobile phone	Text, video, images, audio	No public display of social connections
MySay	"Talk to the web"	Mobile phone, web	Audio (voice), text, images, video	No public display of social connections
Cromple	"Keep friends updated with this simple blog system"	Web, mobile phone	Text	One-way friend networks
Jaiku	"Your conversation"	Web, mobile phone, Internet (IM)	Text, images	One-way friend networks
Pownce	"Send stuff to your friends"	Mobile, web, IM	Text, images, video, audio	One-way friend networks
Twitter	"What are you doing?"	Mobile, web, IM	Text, images	One-way friend networks
Twitxr	"A picture is worth a thousand word"	Mobile, web	Images, text	One-way friend networks
Utterz	"Share your news"	Mobile, web	Image, video, audio, text	One-way friend networks
Dodgeball	"Connect with your friends"	Mobile phone, web	Text	Mutual friend networks
Facebook Mobile	"Use Facebook on the go"	Mobile phone primarily (supplement to Facebook.com)	Text, images	Mutual friend network
Loopt	"Turn your mobile phone into a social compass"	Mobile phone (GPS), web, IM	Text, image	Mutual friend networks
MySpace Mobile	"A place for friends"	Mobile phone primarily (supplement to MySpace.com)	Text	Mutual friend networks
Radar	"Instant picture conversations with your favorite people and no one else"	Mobile, web, IM	Images, video, text, audio	Mutual friend networks
Socialight	"Discover right here right now information about places all around you"	Mobile phone (GPS), web	Images, text	Mutual friend networks

users (Minney, 2007). Facebook is the second most popular mobile social network in the U.S. with a mobile audience of 2 million users (Minney). The numerical success of these mobile platforms on MySpace and Facebook may have less to do with the need for mobility of the social network service than it does with the sheer success of these sites on the web. MySpace Mobile and Facebook Mobile are popular because their web services are popular. They each have developed a massive base of users, which is necessary for the success of all social media whether they are web or mobile based.

The question then arises as to whether the term *mobile social network* is an appropriate way to describe multi-media social network services that are accessible on a variety of technological platforms? Despite the convergence of media, *mobile social network* is still a helpful term because it highlights the mobility, individuality, and accessibility of mobile device-based systems. Mobile phones are defined by their mobility. They are not confined to the kitchen, office, or even the phone booth, but can be found in all kinds of spaces. Unlike landlines, mobile phones are also primarily assigned to a particular body. Individuals often have their own mobile phones as opposed to private landlines which are typically assigned to a particular place (Wellman et al., 2003). Mobile phones are also often nearby and accessible. In fact, users have described being away from their mobile phones as anxiety inducing events (Cohen & Lemish, 2004; Humphreys, 2003; Rainie & Keeter, 2006). The accessibility, individuality, and mobility of mobile phones make them particularly powerful communication technologies which differ from more traditional PC technologies.

ISSUES AND CHALLENGES

While much hype surrounds mobile social networks (e.g., Goodale, 2007; B. Johnson, 2007; Klaassen, 2006), several challenges regarding the development and use of mobile social networks persist.

One of the largest challenges for mobile social networks is privacy. Some mobile social services allow and even encourage users to share copious amounts of information about themselves with those in their networks. Sometimes these services involve sharing locational information about where people are at certain points in time. Inevitably, concerns arise regarding who has access to this information and what is it being used for. For example, stalking may become a concern. Generally speaking, however, most of the services require users to actively identify who is in their network and will receive their messages, thus allowing users of mobile social networks to control their flows of information. Users can easily block other users from seeing their personal messages. Privacy issues, however, concern not only which *users* have access to information through these systems, but corporate surveillance of users as well. For example, when members use Dodgeball, they do not just tell everyone in their Dodgeball networks their location; they tell Dodgeball who tells everyone in their network. Dodgeball is owned by Google, which means members are also telling Google where they are whenever they check in with their friends using Dodgeball.

Another challenge for mobile social networks in the U.S. concerns media and model capability. Some mobile social services in the U.S. are only available on certain kinds of phones. For example, Loopt, a mobile geosocial networking services compatible with most Nextel and Sprint cellular phones in the U.S.; however, it is only compatible with AT&T's Blackberries and iPhones. The reason that Loopt is not compatible with most AT&T phones is that Loopt relies on Global Positioning System (GPS) technology, which is not standard on most AT&T mobile devices as it is on Nextel and Sprint mobile phones. Therefore, the majority of AT&T mobile customers cannot use Loopt. This is certainly a challenge to Loopt's growth and development. Until nearly all mobile phones in the U.S. have GPS, mobile social networks which rely on this satellite technology will be hampered. Similarly, while cameras on mobile phones in the U.S. have become increasingly standardized, mobile video is less common. Thus mobile social services (e.g., Kyte, Pownce and Radar), which encourage the sharing of mobile video, may have less of a market for their services until mobile video becomes more available.

A final challenge for mobile social networks in the U.S. is the pricing for mobile services. Most mobile phone users in the U.S. have ongoing subscriptions or contracts with the mobile service providers rather than pre-paid mobile phone service, which is more common in the rest of the world (CTIA, 2008; Kokko, 2004). Therefore most people in the U.S. pay for their mobile phone use about 30 days after they have incurred the charges. (This is sometimes referred to as a *post-paid system*.) All of the mobile social services discussed here are "free" to use. "Free" here refers to the fact that users do not pay the mobile social service to join or to send messages through their system. This, however, does not mean that the mobile social services are entirely free to use.

Mobile phone users incur charges for each minute they speak, each text message they send, and each data bit they download. What sometimes can happen is that new mobile social network users will not realize how much they will use these services and how much it might cost them, especially if they go over their voice, text or data limits. Sometimes users do not realize they have gone over their limits until they receive their bills the following month at which point it is too late. They receive a mobile phone bill much larger than they expect and are required to pay for their use. This can sometimes lead new mobile social network users to change their plan to unlimited or at least increased voice, text or data services. In some circumstances, an exorbitant mobile phone bill can lead new users to stop using the mobile social network altogether (Humphreys, 2008). Despite warnings from the mobile social networks, this kind of opaque billing system may discourage mobile social network adoption and use.

SOLUTIONS AND RECOMMENDATIONS

Mobile social network adoption and usage are increasing despite challenges (Minney, 2007). There are several steps that users, developers and regulators can take to further encourage the growth of mobile social networks. In the past, privacy campaigns by privacy advocates and government regulators have helped to encourage a shift in privacy policies of Google (C.Y. Johnson, 2007). Similar public advocacy could encourage more transparency in privacy policies of mobile social networks. There has also been a recent move among colleges and universities in the U.S. to create recommendations for information management on social network sites. For example, the University of Wisconsin-Madison, recommends that students be "conscientious" when posting messages on Facebook and MySpace and encourages students to reset the privacy settings to "avoid having your contact information given out to other companies" (University of Wisconsin-Madison, 2008). Similar privacy awareness campaigns may help mobile social network users to be conscientious about their privacy and mobile communication practices.

With any emerging technology, technical features take time to develop and standardize. Companies that provide GPS-based mobile social services are betting that a GPS (Global Positioning System) will become an increasingly standardized feature on mobile phones. Pew's Internet and American Life Project found that mobile mapping was one feature that most mobile phone users wanted but did not yet have (Rainie & Keeter, 2006). Given the demand for mapping features, GPS is likely to become a more common feature on mobile phones. For example, when Apple introduced its second generation of iPhones, it had added GPS to the phone's capabilities. Another change to the iPhone 3G signifies a second potential trend in mobile communication which may help with standardization and compatibility. iPhone 2.0 software update added an App Store – an application which allows users to quickly and easily download files (German & Bell, 2008). The iPhone App Store which offers applications designed for iPhone may encourage further innovation, development, and adoption of mobile social services.

As mobile social services gain in popularity, pricing will become increasingly important. From 1998 until 2007, the average monthly mobile phone bill in the U.S. ranged between $40 and $50 (CTIA, 2008). In February 2008 both AT&T and Verizon began to offer unlimited voice for $99 (AT&T, 2008; Verizon, 2008). Unlimited data are an additional charge. Therefore the unlimited plans are a significant increase in price from what mobile phone users have been typically paying for service. That said, these unlimited mobile services have decreased in price. While it is still greater than the average monthly mobile bill, the lowering of costs to $99 per month for unlimited voice suggests that unlimited services may become a more popular plan among U.S. mobile phone users. Unlimited mobile services for a set price is likely to encourage the adoption and use of mobile social services because people could use the services as much as possible and would know exactly how much it will cost them.

FUTURE TRENDS

There are several important areas for both the development and research of mobile social networks. With GPS technology and the triangulation of cell phone towers, the location of mobile phone users is identifiable. This opens up possibilities for the collection and use of location-aware services, which could be quite helpful for mobile social network users to communicate and access new kinds of information. Location-based services are a growing area of mobile technology development. Mapping services and geotagging allow users to interact with the physical space around them in new mediated ways. Socialight is one early example of a mobile social network with location aware messaging.

Another potential area for the future development of mobile social networks is among specific populations. Already the use of mobile social networks at high-tech conferences has begun to rise (McCarthy, 2007). Mobile social networks can improve information flow efficiency among groups of people trying to connect with one another. One could also imagine that mobile social networks could be helpful to the elderly and youth populations as a means of maintaining family communications. An at-risk population constitutes another potential group that might benefit from the use of mobile social networks. For example, experimental research suggests that Alcoholics Anonymous members are less likely to fail when they use mobile phones to contact their support networks in time of need (Campbell & Kelley, 2006).

CONCLUSION

With the introduction of the iPhone in June 2007, the public imagination of the possibility of mobile computing blossomed in the U.S. People suddenly had a tangible example of a mobile phone through which one could easily access the web. As mobile hardware and software become more advanced and user-friendly, mobile social networks will continue to grow. These services will increasingly become useful communication tools through which people manage their social relations.

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KEY TERMS AND DEFINITIONS

Bluetooth: A wireless protocol which allows short-range connections to be made between mobile phones, laptops, and other portable devices.

Global Positioning System (GPS): A satellite-based navigation system used to triangulate particular points on Earth using longitudes and latitudes; increasingly, GPS is used to identify mobile phone users' locations, so as to access and share location-based information.

Micro-Blog: A personal chronological log of thoughts, activities, or reflections which are limited in size (for example, to 140 characters).

Mobile Blog (or Mo-Blog): A personal chronological log of thoughts, activities, or reflections sent from one's mobile phone to either a website, blog, or mobile device; depending on the system, mo-blogs may include text, audio, still images, and video; mo-blogs are often micro-blogs

Mobile Social Network: A mobile phone-based service that allows individuals to construct a public or semi-public profile within a bounded system, articulate a list of users with whom they share a connection and view and traverse their list of connections and those made by others within the system.

Mobile Social Service: Mobile Internet systems that allow users to connect with others and create virtual communities.

Mobile Social Software (or MoSoSo): A mobile phone application which supports social interaction among interconnected mobile phone users.

Multimedia Messaging Service (MMS): Video or picture messages sent over mobile phone networks.

Short Messaging Service (SMS): Text messages sent over mobile phone networks.

Social Networking Services (SNS): Online services that facilitate social interaction and networking.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 22-32, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 1.21
Mobile Social Web:
Opportunities and Drawbacks

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ABSTRACT

As mobile Internet usage continues to grow, the phenomenon of accessing online communities through mobile devices draws researchers' attention. Statistics show that close to 60 percent of all mobile Internet traffic worldwide is related to the use of mobile social networks. In this chapter, the mobile social Web is defined, categories of mobile communities explained, and success factors and drawbacks discussed from the technical, social, and economic perspectives. Challenges, including low transmission rates, changes in usage patterns, search for new revenue sources, as well as the need for development of original mobile Web content and applications are addressed. The technical requirements for the mobile use of online communities are identified. The chapter closes with a summary of potential economic and social prospects of the emerging mobile social Web.

DOI: 10.4018/978-1-60566-368-5.ch002

INTRODUCTION

Until recently, the Internet was a domain restricted to stationary computers, but nowadays it can also be accessed through mobile devices equipped with web browsing capabilities. Now it is not only possible to surf the web using wireless access and mobile devices, but there is also a growing number of mobile Internet applications and services. Increasingly, mobile social networking applications have been made available to a large number of mobile phone users.

Internet users have accepted online communities and internalized the concept of the Social Web also referred to as Web 2.0 (Koesch, Magdanz, & Stadler, 2007). Private as well as business users have become familiar with various online communities (Patrzek, 2007; von Tetzchner, 2008). On the one hand, mobile social networks are becoming more widespread because of the increasing dissemination of new wireless communication technologies

(Heng, 2006, p. 5). On the other hand, a large number of devices are designed to implement new communications technologies, for example, the Universal Mobile Telecommunications System (UMTS) in Europe (Heng, 2006, p. 1).

Studies conducted by Opera Software, an Internet software and services company, demonstrate that 40 percent of all mobile Internet traffic worldwide is related to the use of online communities. In some countries the share is as high as 60 percent: for example, in the United States, South Africa, and Indonesia (von Tetzchner, 2008). Research into the various ways of using the Social Web in a mobile context is now of paramount importance. In this chapter, *mobile social web* is defined, categories of mobile online communities and their success factors explained, and selected opportunities and drawbacks of the mobile online communities discussed from a technical, social, and economic perspectives.

BACKGROUND

The Social Web can be viewed as a concept and a platform that utilizes social software (e.g., forums, wikis, blogs, etc.) to fulfill or support some of the important human needs, such as: self-realization, acceptance, social connectedness, and safety (Maslow, 1943, p. 372-383). The purpose of the Social Web is to support human communication and facilitate social contact. The Social Web encompasses numerous Internet applications, such as social networking sites, massively multiplayer online role-playing games, photo and video sharing, online stores and auction houses, virtual worlds, and wiki collaborations. The most popular and widespread actualizations are online communities (e.g., MySpace, Facebook, StudiVZ or XING). The term "Social Web" is often used in everyday language as well as in scholarly literature as a synonym for "virtual" and "online communities" (Hummel, 2005, p. 5), although these terms do not differ greatly (Fremuth & Tasch, 2002, pp. 5-6).

In the past years many academic disciplines have dealt with the Social Web. Various attempts to provide a definition have resulted in three different approaches: technical, social, and economic. The technical approach focuses on the Internet as a medium or platform for a community. The sociological point of view stresses the forming and functioning of communities, whereas the economic perspective examines potential gains and intended profits (Hummel, 2005, p. 8-11).

These three perspectives have led to a variety of definitions of online communities with differing points of emphasis. A detailed overview of common definitions is given by Fremuth and Tasch (2002), Hummel (2005) and Markus (2002). In identifying an *online community* one perspective emphasizes that it is formed by a group of people, while another stresses its web platform. The definition used in this chapter combines both approaches, for an *online community* is seen as a social group that interacts through a web platform over an extended period of time.

An online community can be characterized by four elements (Gebert & von Rosenstiel, 1992, p. 122-123; Hamman, 2000, p. 225):

- group of people with shared objectives (e.g., interests, goals)
- interaction over an extended period of time
- closeness due to bonds and relationships
- shared space for interactions governed by certain rules (for example, role definitions).

Without shared objectives there would be no interaction and relationship and, subsequently, no community at all (Markus, 2002, p. 36). Interactions within the community are seen as topic-oriented communication as well as the execution of actions (Kim, 2000, p. 5). Both can take place independently of time and location (Winkler & Mandl, 2004, p. 14). The process of founding and maintaining such online communities usually takes place on the Internet (Eigner & Nausner,

Table 1. Success factors on online communities (adopted from Koch, Groh, & Hillebrand, 2002; Leitner, 2003)

Users' point of view	Corporations' point of view
• Advantages of usage, for example in the form of problem solving or entertainment • Simple compilation of contributions • Easy technical access, usage and adequate stability • Equality, credibility and trust • Non-commercial orientation	• Personal network and personal characteristics of entrepreneurial team • Product or service idea in business model • Available resources and capabilities • Marketing strategy with viral emphasis • Potential for speedy marketing

2003, p. 58). The second defining characteristic is the web platform, which can be seen as an Internet communication system which acts as an intermediary. It enables and facilitates meetings, the maintenance of the community, and its interaction with other people (Reichwald, Fremuth, & Ney, 2002, p. 8).

There are different ways of categorizing online communities (Brunold, Merz, & Wagner, 2000, p. 30-37; Fremuth & Tasch, 2002, p. 21; Hummel, 2005, p. 46). A reasonable approach is to categorize them according to similarities, for they play a major role in online communities. Therefore, an online community can be geographic (bound to an area), demographic (classification according to nationality, age, gender), or based on shared interests or activities (Kim, 2000, p. 5).

Online communities can be viewed as social systems. Relationships and interactions can only develop once a web platform has been established, which makes it difficult to start a community (Leitner, 2003, p. 36). The network-effect character of online communities shows this very clearly. There will only be accelerated growth once a critical amount of relationships and interactions between users has been achieved. This is due to the fact that users do not benefit before this point is reached (Reichwald, Fremuth, & Ney, 2002, p. 8). Even though this development is difficult to predict, an operator is able to influence the development of an online community by making it more attractive (Reichwald, Fremuth, & Ney, 2002, p. 9-10). The success factors that have been identified are listed in Table 1.

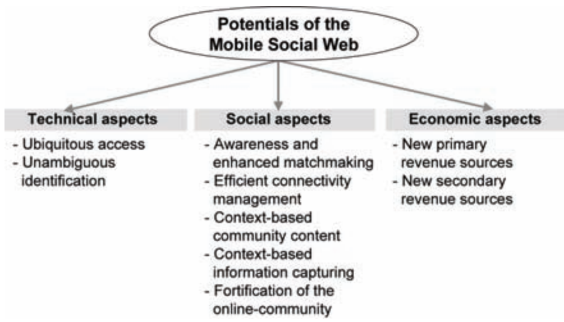
THE MOBILE SOCIAL WEB

The mobile use of online communities can be referred to as the *mobile social web*. In this context, *mobility* is understood as the unrestricted transfer of text, voice or data independent of user's physical location (Kurose & Ross, 2005, pp. 536-538). Therefore, mobile online communities are free of interruption caused by the movement of the user from one location to another. The devices employed can be either wireless or wired (Kurose & Ross, 2005, p. 504). Suitable types of devices are mobile phones, smart phones (Michelsen & Schaale, 2002, p. 51) and personal digital assistants, as these can always stay switched on and do not need to be booted. Although mobility does not necessarily require wireless connections to these devices, wireless mobile networks are used most commonly (Gerum, Sjurts, & Stieglitz, 2003, p. 145). European standards, for instance, include the Global System for Mobile Communication (GSM) extensions, Enhanced Data Rates for GSM Evolution (EDGE) standard (Herzig, 2001, p. 399), General Radio Packet Service (GPRS) protocol (Stader, 2001, p. 37), and the 3rd generation Universal Mobile Telecommunications System (UMTS) technology (Kurose & Ross, 2005, pp. 534-535). The mobile social web involves opportunities as well as drawbacks, as will be discussed below.

Opportunities of the Mobile Social Web

The features of mobile communities generally correspond to those of traditional online communities. They are enhanced by a new way of accessing the community-web-platform through mobile, wireless devices. On closer examination,

Figure 1. Overview of the mobile social web potentials



these communities do not only seem to benefit from mobile access, but also from additional potentials resulting from mobility and localization possibilities. Furthermore the question arises, whether this newly opened potential encompasses not only technical and social aspects but economic aspects as well (see Figure 1).

Technical Aspects

Mobile wireless devices facilitate ubiquitous access to online communities (Koch, Groh, & Hillebrand, 2002, p. 2). The user is able to gain access anywhere and any time, while being liberated from the world of stationary Internet and permanently installed devices (Reichwald, Fremuth & Ney, 2002, p. 6). Furthermore, users benefit from being reachable at all times by being armed with mobile wireless devices (Wiedmann, Buckler, & Buxel, 2000, p. 86). Therefore, the users can stay online and be accessible continuously and without interruption. No time is lost: for example, by turning the devices on or logging in. Thus, interaction becomes more spontaneous and expressive.

Mobile wireless devices make it possible to identify the user via his PIN and SIM card, both of which are requirements of mobile communications (Tasch & Brakel, 2004, p. 4). This explicit possibility of identification can be used to identify the user in an online community. The user's mobile device then serves as a membership card or an individual entrance ticket (Reichwald, Fremuth, & Ney, 2002, p. 7). Identifying the user can be automated, making it more reliable. It is also more authentic and results in more confidence within the community (Hummel, 2005, p. 72).

Social Aspects

A local context can be defined by identifying a user's current whereabouts (Koch, Groh, & Hillebrand, 2002, p. 3). A user's whereabouts could be presented to other users through geomapping or textually. Furthermore, an awareness service could be employed in addition to existing information services, such as "buddy lists" (Tasch & Brakel, 2004, p. 7). Contacts and friends in the vicinity of the user can be shown on the mobile device. Mobile online communities could thus improve interactions between community members and extend social ties. For example, people with similar interests can get together spontaneously. Contexts can be used to find out about the accessibility of mobile community users (Groh, 2003, p. 9). Depending on the user's current whereabouts a service can provide information about if and how a person may be contacted and the user can decide how to do this. The contact information can simply rely on such area aspects as availability of UMTS. Personal preferences can also be used for this purpose.

Another potential feature is to filter content according to current contexts (Groh, 2003, p. 9). A personal information service can select information about places of interest in the vicinity of the user's current location and report it to the user (context specific presentation of information). Moreover, context specific capturing of content is conceivable (Groh, 2003, p. 8). Metadata (e.g., location data or location names) and information and news services form the basis for this idea. For example, an entry reviewing the quality of food and drinks in a local café could be generated automatically by entering the name of the café or its location.

Personal meetings can be organized more easily as the awareness of a person's location increases, matching the users' interests is extended, and the management of accessibility becomes more efficient. Stronger relationships between persons will typically result when they are geographically close and have personal encounters (Larsen, Urry, & Axhausen, 2006, pp. 12-13). These aspects are not available in stationary online communities because they depend on time and location. Face-to-face communication can lead to an improved quality of relationships because interactions become closer and more intense. All of the above will result in the strengthening of a community (Schneider, 2003, p. 99).

Economic Aspects

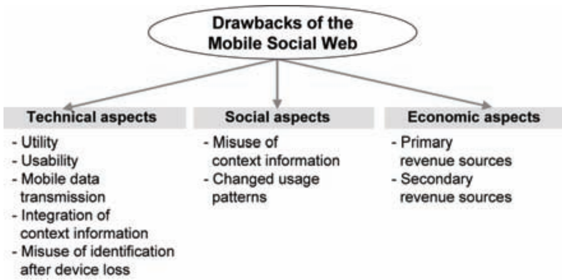
Mobile communities allow an opportunity for spontaneous, affective, and meaningful community activities, which may result in closer relationships between community members than in the case of traditional online communities. Data input and output can be accomplished more easily through context specific services (Diekmann et al., 2006). Therefore, community mobile operators assume that users will be more willing to pay for participation in mobile communities than in stationary online communities (Reichwald, Fremuth, & Ney, 2002, p. 12). The following list provides details of primary and secondary revenue sources for mobile operators (Reichwald, Fremuth, & Ney, 2002).

Primary revenue sources arise from operating a mobile online community (Reichwald, Fremuth, & Ney, 2002, p. 11). Three possibilities can be identified:

- *To levy usage fees:* Users pay for the usage of mobile information and interactivity services and for community content. The fees depend on the usage of the services or they are usage-independent (Reichwald et al., 2002, pp. 24-25). Users pay either for the usage of each single service or for using services during a certain period of time. Both approaches have proved unsuccessful in the case of non-mobile online communities (Reichwald et al., 2002, pp. 23-24). It may be expected that the advantages of mobile communities and their improved attractiveness are great enough to generate an increased willingness to pay (Reichwald, Fremuth, & Ney, 2002, p. 12). Moreover, users are generally accustomed to paying for mobile services.
- *Advertising and sponsoring:* Even now, non-mobile online communities allow the generation of advertisements tailored for special target groups by analyzing user profiles. In comparison to mass advertisements, this approach involves less wastefulness (Schubert & Ginsburg, 2000, pp. 51-52). For example, depending on the user's current location, advertisements can be provided. Companies willing to sponsor certain activities are another potential source of revenue (Reichwald et al., 2002, p. 20).
- *Data transmission fees:* Fees for using telecommunication (TC) services have to be paid to the TC companies. The operator of a mobile online community could negotiate a share of the revenues. For this revenue sharing purpose, cooperation between the TC company and the community operator is needed, and accounting models have to be developed.

The users themselves can become the potential generators of possibilities to earn money for the community. Their content contributions can be used for market research as well as ideas about new services and products. Documented behavior, usage patterns, and preferences can be used to filter properties of target groups. The main potential for community operators has to be made up by selling

Figure 2. Overview of the drawbacks of the mobile social web



the gathered knowledge as consulting services or by using it for themselves (Reichwald, Fremuth, & Ney 2002, p. 12). Mobile communities can facilitate activities at a higher level of utility and quality, as data are potentially more differentiated and reliable compared to stationary activities.

Drawbacks of the Mobile Social Web

Mobile online communities have drawbacks, as summarized in Figure 2.

Technical Aspects

The utility of a service is a success factor as well as a challenge. It has to be decided which services should be accessible in a mobile community to make it attractive (Yom, 2002, p. 177). Not only information and interaction services have to be selected, content needs to be chosen, too. Restricted possibilities of data presentation and device handling as well as limited capacities of mobile devices affect the utility.

Other factors influencing usability are data transmission costs, low data transmission rates, device handling problems, and inconvenient data input and output possibilities (Bliemel & Fassott, 2002, p. 14). The fees of mobile network operators are mostly based on data volume. Therefore, a community user will have to pay fees depending on the intensity of his or her usage.

Low data transmission rates are often a problem for mobile device users. Established GSM services, such as Short Message Service (SMS), provide an adequate transmission rate; however, there are only limited possibilities for data presentation. Consequently, it makes more sense to opt for 3rd generation technologies like GPRS and UMTS, especially as the increasing dissemination of these technologies renders this alternative increasingly feasible.

An appropriate localization technology must be integrated in order to realize enhanced mobile services and provide new functionalities of mobile online communities, such as contextual community content, context-oriented information collection, or efficient connectivity management. The localization of end devices connected to cellular networks via their radio cell is currently still expensive. However, free and precise localization using Global Positioning System (GPS) is not yet feasible, as the vast majority of users do not have GPS-compatible end devices.

The possibility of unambiguous identification poses another problem. In case a mobile device gets lost, unauthorized persons may pretend to be the original user, as mobile devices usually have only a very low degree of security (Reisinger, 2007). This is especially a problem when users believe in the trustworthiness of the identification using mobile end devices.

Social Aspects

The electronic capturing and processing of the user context as well as the opening of communities for mobile usage can lead to negative consequences. Publishing the actual location of a user means an intrusion into his or her privacy and a limitation to intimacy. Being spied upon undiscovered could be the result of using contextual services. Parents could use these services to locate their children. Partners in a relationship could use it to track each other. The risks involved may lead to a fear of misuse or limited intimacy, resulting in the merely conditional use of contextual services. In stationary online communities, we observe that little emphasis is put on intimacy - users publish a multitude of personal data (Gross & Acquisti, 2005, p. 4-8). Hence, it remains open whether the added value of contextual services or the fear of misuse and limited intimacy will prevail.

At present mobile radio services, including SMS or telephony, are preferably used for contacting persons one already knows (Tasch & Brakel, 2004, p. 4). Stationary online communities are commonly used to create new relationships: i.e. contacting persons hitherto unknown to the user (Fremuth & Tasch, 2002, p. 24). The projection of mobile radio usage patterns onto stationary online communities could lead to the change from a preferably theme-oriented usage towards a person-oriented or communication-oriented usage of mobile online communities (Reichwald et al., 2002, p. 13). Mobile community activities would then be realized preferentially with already known persons. Such trends could jeopardize the establishment of theme-orientated mobile online communities.

Economic Aspects

A commercial design of mobile online communities has to identify primary and secondary revenue sources for their operators. Commercial intentions should be declared and openly communicated to the community (Leitner, 2003, pp. 43-44). This is the only way to grant trust and authenticity from the very beginning. Using primary revenue sources involves the following challenges:

- **Collection of usage fees:** So far, the stationary Internet largely provides free content and services (Reichwald, Fremuth, & Ney, 2002, p. 11). Internet users are accustomed to free services. There is a possibility that this factor will have a negative impact on the willingness to pay for mobile services. Users already pay for mobile data services such as SMS or mobile Internet access (Reichwald et al., 2002, p. 27). Fees for the use of services or content would increase these costs.
- **Advertising and sponsoring:** Advertising in online communities was often frowned upon in the past (Leitner, 2003, pp. 41-42). Even now, although an increased number of advertising banners are placed, the acceptance of advertising does not seem to be self-evident. Moreover, advertising messages on mobile devices are still fairly uncommon. It is unclear whether a satisfactory advertising effect can be achieved by mobile advertising in online communities. It is assumed that the perception duration of advertisement tends to drop with mobile usage compared to the stationary Internet (Heinonen & Stransdvik, 2007, p. 610; Reichwald et al., 2002, p. 22). Even when advertisements are noticed, little space for advertising messages is available due to the small displays of mobile devices (Michelsen & Schaale, 2002, p. 20).
- **Mobile data transmission fees:** As yet volume-billing models for the use of the mobile Internet are widespread; this could be a restriction to the time-consuming use of a mobile online community (Reichwald et al., 2002, p. 28). This can lead to lower data volumes, resulting in fewer payments to mobile radio operators. As a consequence, these operators would be less willing to forward payments to a community operator. It remains to be seen how this revenue potential develops through billing models for mobile Internet usage and cooperation.

There are also new challenges for the secondary revenue sources: Using a mobile online community as an instrument for market research can be profitable for an operator, but it seems reasonable that the users need to know that this is drafted on the basis of content and the analysis of their usage habits (Leitner, 2003, p. 43-44). This could especially affect success factors of an online community like equality, credibility and trust. Sharing part of the revenues with users could be a solution.

FUTURE TRENDS

A growing number of Internet services make their applications available to mobile users. This can be attributed to the increasing proliferation of mobile broadband Internet access (especially UMTS in Europe). Three variants of mobile implementation are available. Users can browse profile pages and photo albums via WAP and add new images and texts by means of SMS and Multimedia Message Service (MMS). The ShoZu service,[1] in contrast, performs as an integration platform and allows mobile users to upload and download content at multiple online communities with a single message. One Connect™ provided by Yahoo is another illustration which integrates social communities (e.g., MySpace, Dopplr, Facebook or Last.fm), instant messaging services (e.g., Yahoo! Messenger, MSN Messenger), and the ordinary communication channels of mobile phones. Finally, as the example of the COSMOS project[2] shows, a comprehensive use of mobile technical and social opportunities appears to be no so distant future—the COSMOS project integrates contextual services into the existing mobile social web. Users are informed about the geographical distance between them and may send messages to contacts within their own vicinity. The above-mentioned trends are expected to advance in the future; yet, the possible dominance of one of them cannot be predicted.

CONCLUSION

The analysis of the potentials of mobile online communities leads to the conclusion that the social significance of the mobile Internet goes further than providing communities with an additional access channel. Besides mobile access and instant connectivity, unambiguous identification and contextual services can also be realized.

The mobile web platform gains efficiency and facilitates not only flexible, spontaneous, and emotional interactions, but also credible and intensive ones. Reckoning with these possibilities, a community mobile operator can take an economic perspective and identify revenue sources that make the commercialization of mobile communities feasible.

However, the specific technical and social characteristics of mobile communities can cast doubt upon their prospective potentials. Commercialization appears less promising as the willingness of users to pay fees is rather low. Mobile advertising poses additional problems despite its context-relatedness. Moreover, the realization of secondary revenue sources can lead to problems of trust.

The assumption that the social significance of the mobile Internet will go beyond providing an additional access channel to online communities has so far only partially been confirmed. Many challenges to mobile communities remain to be resolved in the future for the economic perspective to gain relevance and the commercial interpretation to become a success.

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KEY TERMS AND DEFINITIONS

COSMOS: The Community-Driven Systems Management in Open Source (COSMOS) project is a collaboration of software developers aimed to create standards-based tools for system management.

Mobile Internet: Use of TCP/IP based services and protocols with mobile devices via wireless communications technologies.

Mobile Social Web: Refers to mobile social networks and other Web 2.0-based applications in which people access and form online communities by using mobile devices.

Mobile Wireless Devices: Handheld electronic devices with wireless capability to connect to the Internet. Examples include mobile phones, smart phones, and personal digital assistants.

Mobility: Unrestricted transfer of text, voice or data independent of user's physical location.

Online Community: A social group that interacts through a web platform over an extended period of time.

Social Web: Refers to Web 2.0-based technologies and applications that are used to support communication and facilitate social contact, such as, social networking sites, massively multiplayer online role-playing games, photo and video sharing, online stores and auction houses, virtual worlds, and collaborative wikis.

ENDNOTES

1 http://www.shozu.com

2 See http://www.eclipse.org/cosmos

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 11-21, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 1.22
Social Software (and Web 2.0)

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INTRODUCTION

Social software is a class of information systems supporting the establishment and management of online communities for people in performing certain tasks. One of the first application types were bulletin boards. Social software may provide different services for community members such as finding members with similar interests, finding information on interesting subjects, discussing common problems, or simply the storing of private or publicly-accessible documents. Another similar term, *collaborative software*, applies to cooperative work systems, and is applied to software that supports working functions often restricted to private networks. *Web 2.0* is a term coined only recently, and with this concept promoters try to focus on the change of use of the Internet. While Web 1.0 was a medium where few users published information in Web sites and many users read and surfed through these publications, in Web 2.0 many users also publish their opinions, information, and documents somewhere in the Internet. By motivating large communities for submissions and by structuring the content, the body of the aggregated information achieves considerable worth. A good example for such a community project is Wikipedia, where thousands of contributors deliver millions of articles, forming an encyclopaedia that is worth millions of dollars.

MOTIVATIONS

The term *social software* was created only recently; however, applications that follow this paradigm are much older. Due to different reasons, there is some hype about these applications now. Thus, new start-up companies offering such information systems achieve a very high financial rating through their large number of users and the large body of information. However, this is only one group of social software that achieves very high volumes of users. Social software is also used to build smaller communities with a restricted access. Thus, a company may invite its customers into such a community for online support on products and services of the company. Social software is also used to support knowledge exchange between employees of companies (Wenger, 2004).

DOI: 10.4018/978-1-60566-014-1.ch178

Technical Issues

The increasing number of social software applications is partly motivated by the progress of computer hardware, broadband communication, and the number of Internet users. Especially, progress in Internet standards, standard software, and new Internet browser technologies helped to attract a larger audience.

Web 2.0 subsumes a number of new technologies making Web browser user interfaces more user-friendly and, at the same time, reducing traffic load in the Internet. The basic HTTP-protocol that is used to fetch HTML pages from servers to clients is stateless (i.e., the client cannot store a state such as some user preferences). This means, if a user enters anything in a Web page and sends this data to the server, and the server sends in response a new page to the client, then the client software has no knowledge about what the user has entered. In recent years, different technologies were developed to hold either a state at the client by means of cookies or by managing the state at the server side. The problem with both kinds of technologies is that, after each user action, the server has to resend a new page.

New technologies of Web 2.0 support richer clients in the Internet. Thus, more control logic can be executed at the client. JavaScript was one the first solutions to control a Web client's logic. It may be used, for example, to check for correct input syntax of online forms. XML and the processing of DOM structures (the tree structure of well-formed XML or HTML documents), where the structure of XML as well as HTML documents can be changed on-the-fly, enable a more sophisticated control. *AJAX* (Asynchronous JavaScript and XML) is an approach to develop rich clients using recent HTML browsers and the XMLHTTPRequest Api (Raymond, 2007). This means that some requirements (XML, JavaScript and DOM support, Cookies and CSS) have to be met by the client to use the rich HTML client interface. The AJAX approach avoids loading the complete HTML page for every action. Layout information is loaded just once, and only the data required due to the user's action is transferred from the server to the client. This transfer may also happen during the time when the user is already reading the new page. *Web services* are a further technology applied to enable an easy integration of software components to build larger applications. One prominent example is Google Earth that can be used to translate addresses into coordinates (i.e., geo-coding) and to construct maps around a certain coordinate on-the-fly. The latest service is that a user can create his/her own maps where existing maps are enriched by user data. Geographical information systems and its components are very illustrative examples for the construction of social software systems from existing reusable components (Scharl & Tochtermann, 2007). Systems constructed from such building blocks are called *mash-ups*.

Social Issues

Communities are built around common interests. Often, it is, however, unclear what the common interests are and whether all community members share the same interests. For example, Wikipedia has only a small group of writers and a very large number of readers. For the success of Wikipedia, there are enough writers, but this may not always be the case in new community systems.

This problem is also investigated in *knowledge management* theory. A company should be interested that information is shared between its employees. Knowledge management systems have to be designed in such a way that individual members of the staff are motivated to share relevant knowledge through these systems. Davenport and Prusak (1998) describe three motivations that lead to successful knowledge sharing: reciprocity (if I submit something, then other community members are also obliged to share information), reputation (if I submit much information, I will be accepted as an expert), and altruism (I want to support this highly-relevant community without any immediate benefits). These motivations are also valid for social software applications. A fourth motivation for participating in social software systems is the provision of special services such as data storage, e-mail management, and others.

For user acceptance of such systems, the ease of use is also very important. Technological improvements as described above address this issue. Thus, these technologies allow Web browser applications to behave in the same way as standard personal computer software systems.

On the other side, providers of such information systems must also get some revenue to provide these services. The number of users is most important for financial evaluation of such companies. Google, for example, is the company having one of the largest user groups at the moment. Thus, a provider is motivated to attract as many users as possible with good services. One of the most important services on the Internet seems to be the provision of relevant information. And the easiest way to provide such information is to let the users create the content. Google uses, on the one side, Web pages created by its users and, on the other side, the behaviour of Internet users to decide which content is most relevant. The users are, in this case, not aware of what services they deliver to Google. Someone who writes a submission for Wikipedia is aware of the value of his service to the community and will provide this service only in the case that some of the mentioned motivations are present and services are designed accordingly.

A further issue is the behaviour of community members. *Netiquette* (Internet etiquette) is a term for the conventions of politeness and respect in such virtual communities. These conventions address the relationship between personal behaviour and community interests, and outline a dynamic set of guidelines. Examples of these guidelines are not posting spam mails, avoiding commercial advertising outside business groups, and many more (Hambridge, 1995). Using emoticons (emotional icons) are a result of such virtual communities to show, with limited character sets, a kind of emotion in text-based communication.

Trust and Privacy

An important aspect of social systems in general is the *trust* that members of a community have in participation of other members. This is an issue discussed especially for Wikipedia and similar projects. An encyclopaedia has the expectation that descriptions of things of the world are objective and not subjective presentations that try to favour certain technologies or concepts in contrast to others. For example, people may present themselves as very important researchers in the Wikipedia, or a company may describe its products as superior to others.

On the one side, it is argued that the large community is an adjustment factor that corrects, in a very short reaction time, any subjective malpractice. On the other side, Wikipedia has introduced a new group of users that has greater privileges than conventional users. Moreover, new projects arise that try to focus on a more expert-based encyclopaedia. Nevertheless, there are also strong arguments for open communities. For example, recognized experts might use a different (more formal) language or a jargon that simple users do not understand.

Trust in the provider of such community systems becomes sensible if certain private documents such as e-mail or pictures are stored on a server. Access control with passwords avoids certain misuses; however, a misuse by the provider cannot be assured. Therefore, really critical documents will never be stored unless some kind of encryption is supported in these systems.

CLASSIFICATION OF SOCIAL SOFTWARE APPLICATIONS

In the following section, some specialized groups of social software applications are outlined to show the manifold of concepts. The names used in the following classification describe a kind of information system, but often also some kind of software, which can be used to create such an information system. Differences in the systems are:

- the type of the objects exchanged in the community (text, structured documents, audio, pictures, etc.);
- push or pull service (who starts the communication);
- the rules for access (open or closed communities); and
- whether senders know recipients.

Newsgroups

First approaches of such online communities were *newsgroups*. Usenet was established before the World Wide Web was introduced and the general public had access to the Internet. Besides mail and file transfers, it offered announcements through the news software. Submissions that users post are organized into newsgroups, which are organized into hierarchies of subjects. For example, comp.ai (artificial intelligence) and comp.lang (computer languages) are within the comp hierarchy, for computers. A user may subscribe to one or more newsgroups, and the news client software keeps track of which articles this user has read. Newsgroups are organized in threads, a submission with a number of responses to the original posting.

The importance of newsgroups has diminished in respect to other community tools. The current format and transmission of news articles is very similar to that of e-mail messages. However, news articles are posted for general consumption, and a user has access to all newsgroups, in contrast to e-mail, which requires a list of known recipients. Newsgroups have the advantage that they require no personal registration and that archives are always available. Due to the problem of spam mail, however, newsgroups are often moderated so that only fitting submissions are accepted.

Internet Forum

An *Internet forum* is a system supporting discussions and posting of user-generated content. A forum provides a similar function as newsgroups and is usually also structured in threads. A spirit of virtual community often develops around forums that have regular users such as forums on computer games, cooking, healthcare, or politics. Internet forums support the specification of different privileges for user groups.

Internet forums are also commonly referred to as Web forums, message boards, discussion boards, (electronic) discussion groups, discussion forums, or bulletin boards.

Wiki

A *Wiki* is a Web site that allows the visitors to easily add, remove, and otherwise edit and change available content in a similar way as a blackboard at school. Wiki software usually supports the differentiation between registered and unregistered users. For a wiki page, different access rules may be specified. Wikis have their own language for specifying links and certain layouts. This ease of interaction and operation makes a wiki an effective tool for mass collaborative authoring and knowledge management. Since the problem of vandalism may be an issue, wikis support a function to protocol and archive each change, which can be restored.

Web Syndication

Web syndication integrates different sources of structured Internet resources. RSS (Really Simple

Syndication) is a specification of formats used to publish frequently-updated digital content, such as Weblogs, news feeds, or Podcasts. A client program is used to subscribe to one or more feeds. This client then checks if any of those feeds have new content since the last time it checked. RSS formats are specified in XML. RSS software delivers its information as an XML file called "RSS feed" or "RSS channel."

Weblog

A *Weblog* (or blog) is a user-generated Web site where entries are made in journal style and displayed in a reverse chronological order (Powers, Doctorow, Johnson, Trott, Trott, & Dornfest, 2002). They often provide commentary information or news on a particular subject, such as politics or local news. Weblogs are often used as personal online diaries. A typical Weblog combines text, images, and links to other Weblogs, Web pages, and other media related to a topic. Readers may leave comments in an interactive format in a Weblog.

Podcast

A *Podcast* is an audio file that is distributed by subscription over the Internet using syndication feeds for playback on mobile devices and personal computers. The author of a podcast is often called a podcaster. The term "podcast" is derived from Apple's portable music player, the iPod. A podcast can be downloaded automatically, using software capable of reading feed formats such as RSS.

Instant Messaging

Instant messaging (IM) is a form of real-time communication between two or more people based on typed text (chatting). The text is transmitted over the Internet. Instant messaging requires the use of a client program that subscribes to an instant messaging service and differs from e-mail in that conversations are then able to happen synchronously. Most services offer a feature, indicating whether people on a user's contact list are currently online and available for chat. A user may also set a status message indicating further states.

Social Tagging and Bookmarking

Social bookmarking systems store, classify, share, and search links in the Internet or Intranet. Besides Web page bookmarks, services specialized to a specific kind of object or format such as syndication feeds, books, videos, and more can be found. In a social bookmarking system, users store lists with links to Internet resources that they find useful. These lists are either accessible to the public or a specific network. Other community members with similar interests can view the links by category. Some allow for privacy restrictions.

Social bookmarking systems categorize their resources by the use of informally-assigned, user-defined keywords or *tags*. This aggregation of keywords is also called *folksonomy* in contrast to an ontology that would be created by one or more experts in a certain area. Most social bookmarking services allow users to search for bookmarks which are associated with given "tags" and rank the resources by the number of users that have bookmarked them. Many social bookmarking services cluster particular keywords by analysing relations between them. Further services supplied are rating of contents, commenting, the ability to import and export, add notes, reviews, e-mail links, automatic notification, and create groups.

Prediction Markets

Prediction markets are virtual markets where users buy virtual goods or vote for certain decisions in order to predict which goods are successful. Assets are created whose final value is tied to a parameter (e.g., total sales of product in the next year) or to a particular event (e.g., who will win the next election). The current market prices can then be interpreted as predictions of the probability of the event or the expected value of the parameter.

Members buying low and selling high are rewarded for improving the market prediction, while those who buy high and sell low are punished. Prediction markets seem to be at least as accurate as other institutions predicting the same events with a similar pool of participants (Surowiecki, 2004). Prediction markets are rapidly becoming useful decision support tools for companies. Also online role *games* are sometimes classified as social software systems. For example, Second Life, where people can invent a second virtual life for themselves, is such an online community system. In this virtual world, users can buy almost the same things as in the real world. Well-known companies are using this online world to evaluate whether customers will accept certain new products. At the moment, there is a great hype in using these systems; however, the future is uncertain because the users of the system represent only a small group of consumers and, moreover, it is not clear whether certain investments in development in Second Life will be secure since there is no guarantee how long this virtual world will remain.

FUTURE TRENDS

Web 2.0 is a relatively new buzz word, but the successor is already in development. Web 3.0 embraces different ideas from the Semantic Web approach (Berners-Lee, Hendler, & Lassila, 2001). By using semantics (e.g., ontologies), the classification and retrieval of Internet resources can be improved. Moreover, certain processes such as configuration of complex objects (processes, products, and services) may be automated. Ontologies may also support social communities. Folksonomies as used in actual systems may be replaced by ontologies. However, this is also a question of ease of use and user acceptance. In principle, an ontology developed by experts may be more accurate, but users may have different backgrounds which let them communicate with different terms than those of the experts.

Another future trend will be the integration of further media. Thus, we will see the integration of digital television, voice communication, and also communication media for handicapped persons, such as Braille, into such systems. Many existing systems already incorporate mobile clients (e.g., for finding other people in the streets); however, this may be extended further in the future (Eagle & Pentland, 2005).

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KEY TERMS

Folksonomy: A collection of tags (terms) to describe objects of a domain; these are created by a community and not as taxonomies, which are created by experts of a domain.

Mash-up: A social software application that uses components of other applications to offer new aggregated services to its members.

Social Bookmarking: A kind of collaborative indexing of Web pages where users share their Web bookmarks with other members of a community.

Social Software: Software for a certain class of information systems that support the creation of virtual communities.

Social Tagging: Collaboratively defining tags as a meta-information on shared Internet resources.

Syndication: An activity to monitor and feed an application from a number of structured Internet sources.

Web 2.0: A number of recent Internet technologies used to improve the interactivity of Web browsers and the user-friendliness of current Web information systems.

Web Service: A software component or procedure in the Internet that can be called by other software programs; the component and its usage conditions may be announced in a registry. Input and output arguments, as well as service level agreements, are described with XML.

Wiki: An Internet blackboard system where users collectively create a number of interlinked Web pages.

This work was previously published in Encyclopedia of Multimedia Technology and Networking, Second Edition, edited by M. Pagani, pp. 1327-1332, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.23
Self-Organization in Social Software for Learning

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INTRODUCTION

The Internet has long been touted as an answer to the needs of adult learners, providing a wealth of resources and the means to communicate in many ways with many people. This promise has been rarely fulfilled and, when it is, often by mimicking traditional instructor-led processes of education.

As a large network, the Internet has characteristics that differentiate it from other learning environments, most notably due to its size: the sum of the value of a network increases as the square of the number of members (Kelly, 1998), even before aggregate effects are considered. Churchill (1943) said, "We shape our dwellings and afterwards our dwellings shape us." If this is true of buildings then it is even more so of the fluid and ever-changing virtual environments made possible by the Internet. Our dwellings are no longer fixed but may be molded by the people that inhabit them. This article discusses a range of approaches that make use of this affordance to provide environments that support groups of adult learners in their learning needs.

BACKGROUND

Darby (2003) identifies three generations of networked learning environments used in adult education. First-generation systems are direct analogues of traditional courses, simply translating existing structures and course materials. Like their traditionally delivered forebears, they are dependent on individual authors. Second-generation systems tend to be team-built and designed for the medium from pedagogical first principles, but still within a traditional course-based format. Third-generation systems break away from such course-led conventions and provide such things as just-in-time learning, guided paths through knowledge management systems, and personalized curricula. This article is concerned primarily with such third-generation environments.

Saba's interpretation of Moore's theory of transactional distance predicts that in an educational transaction, as structure increases, dialogue decreases and vice versa (Moore & Kearsley, 1996; Saba & Shearer, 1994). What is significant in differentiating learning experiences is not the *physical* distance between learners and teachers, but the *transactional* distance, measured by the degree of interaction between them. Highly structured educational activities have a high transactional distance, while those involving much discussion have a lower transactional distance.

In a traditional learning environment, the structure of the experience is provided by the teacher or the instructional designer. However, learners will not benefit equally from any given structure, as different learners learn differently. It would be better if learners could select appropriate approaches for their needs—to choose whether or not to choose, to control or to be controlled (Dron, 2007a). Without a teacher, help with this might be provided by the opinions of other learners. However, eliciting those opinions, assessing their reliability/relevance, actually finding the resources in the first place, and once found, fitting them into a structured learning experience is difficult. Several approaches to these problems are available, but first it is necessary to introduce a few concepts of self-organization.

SELF-ORGANIZING PROCESSES

Self-organization processes are emergent: the interactions of many autonomous agents lead to structure, not due to central control, but to the nature of the system itself. Such processes are very common in nature and in human social systems. Two in particular are of interest here, *evolution* and *stigmergy.*

Based primarily on work following that of Darwin (1872), evolution is one of the most powerful self-organizing principles, whereby a process of replication with variation combined with natural selection (survival of the fittest) leads to a finely balanced self-adjusting system. It is important to note that "fittest" does not mean "best" by any other measure than the ability to survive in a given environment.

Stigmergy, a form of indirect communication through signs left in the environment (Grassé, 1959), leads to self-organized behavior—examples range from ant trails and termite mounds to forest footpaths, money markets, and bank-runs. For example, ants wander randomly until they find food, after which they return to the nest, leaving a trail of pheromones. Other ants are more likely to wander where such pheromone trails mark the route. When they too find food, they too leave a trail. The stronger the trail, the more other ants are drawn to it. This positive feedback loop continues until the food runs out, after which the trail evaporates.

A full discussion of the many factors that result in a successful self-organizing system is beyond the scope of this article. However, the following brief discussion should give a flavor of what is involved.

Self-organizing processes occur through local interactions. For systems to develop any sort of complexity, it is necessary for these interactions to occur at a number of scales. For instance, the interactions of bacteria in an ant's gut affect the ant, groups of ants can affect tree growth, tree growth can affect climate. Local interactions should form small clusters, which in turn interact with each other, leading to ever-increasing scales of self-organization. However, in general, the large and slow-moving affect the small and fast far more than vice versa, which is a common feature of self-organizing systems, from forests to cities (Brand, 1997). Parcellation is also an important feature of such systems (Calvin, 1997). As Darwin found in the Galapagos Islands, isolated populations tend to develop differently and more rapidly than their mainland counterparts. Any self-organizing system relies on interactions between more or less autonomous agents. The precise level of interactivity varies, but it is interesting to note that, for a system which teeters at the edge of chaos, neither too stable to change nor too changeable to develop, the average number of connections between interacting agents tends to stabilize around just over two (Kauffman, 1995). Systems must be capable of change, being in a more or less permanently unfinished state. Already perfect systems cannot evolve (Shirky, 1996). Equally, systems in perpetual flux can never achieve the stability to achieve self-organization.

SOCIAL SOFTWARE AND THE IMPORTANCE OF THE GROUP

Social software has been defined by Clay Shirky as that in which the group is a first-class object within the system (Allen, 2004). Early social systems such as discussion forums and mailing lists tended to provide a means of supporting individual interactions, with little consideration of the combinatorial effects of the behavior of the many. Typically, they scaled badly, suffering equally from too many as from too few users. In newer social software that underpins the hype-laden term 'Web 2.0', emergent patterns are capitalized upon and reified. For example, tag clouds provide a snapshot of aggregates of classifications by many individuals, social networking software provides structured webs that are generated from individual links between users, wikis gain their structure from individual decisions to link pages, and clusters of linked blogs give texture to the blogosphere. In all cases, the primary determinant of structure is the bottom-up, local behavior of the many. This means that (in general) social software gets better as more people use it.

Interactions within an e-learning environment have previously only considered agents such as the individual learner, the teacher, and the software with each other and with others of the same kind (Anderson, 2003). If the group is a distinct entity from the individuals of which it is composed, then there are more potential interactions to consider. In particular, the group may be seen as, in some ways, a potential teacher within the system (Dron, 2006a).

SOME EXAMPLES OF SELF-ORGANIZED LEARNING IN PRACTICE

For many knowledge-seekers, the starting point is often Google (*http://www.google.com*), perhaps the largest and most pre-eminent example of social software available today. Google's PageRank™ algorithm (Brin & Page, 2000) is based on the assumption that most Web pages provide links to other sites when those sites are considered in some way valuable. Implicitly, the more links that point to a given site, the higher its approval rating. Combined with a content-based search for keywords, documents returned therefore should have a high degree of relevance and reliability. This approach is self-organized, incorporating evolution as unlinked sites "die" and stigmergy as more-visited sites get more links pointing to them (Gregorio, 2003). It is social, not relying on a central controlling authority to provide decisions on resources' usefulness or give a structure to the content that is returned. However, limited parcellation, problems with term ambiguity, and the lack of a support for identifying relevant resources for specific learner needs beyond content-based searching make Google a relatively poor learning tool.

Social navigation, which explicitly capitalizes on stigmergy to enable the navigation or classification behavior of previous users to influence those who follow, is becoming almost ubiquitous on social sites. Tag clouds of the sort found on del.icio.us (*http://del.icio.us*), Flickr (*http://www.flickr.com*), or MySpace (*http://www.myspace.com*) emphasize popular tags by increasing the font size relative to those that are less popular and limiting the display to popular tags, providing a constantly changing map of a community's interests. Applied in an educational setting, such systems offer many benefits, but at the cost of many distractions, inappropriate content, and a breadth of focus that is as likely to discourage as to enthuse learners.

Wikis allow anyone, or sometimes a more closed community, to edit any page. The potential for chaos is enormous, and yet Wikipedia (*http://www.wikipedia.org*), an encyclopedia generated by thousands of volunteers with little central authority, is hugely successful. At the time of writing, the English version of the site had well over a million articles. Soft-security (Cunningham, 2006) allows the wisdom of the crowd to override intentional or unintentional errors introduced by the individual: the fact that it is easier to undo changes than to make them, combined with a large community, leads to a highly reliable and comprehensive source of knowledge (Giles, 2005), which is widely used by learners as a means of tapping into collective expertise. Wikipedia's success is in part due to its strong structure and simple policies. Interestingly, it makes use of a meta-wikipedia where Wikipedians may discuss issues relating to articles to be posted. This scaled parcellation contributes greatly to the evolution of ideas.

Blogging communities form through links between blogs. These may occur inline, or through trackbacks (two-way hyperlinks between blog postings) or blogrolls (explicit lists of links to related sites), which together generate emergent webs of related blogs. As links between blogs grow, they start to form small, stigmergic clusters (Gregorio, 2003). As long as an appropriate cluster can be found, such networks provide a powerful means of finding structure in a subject. This may be facilitated through a recommender system or dedicated blog search tool such as Technorati (*http://www.technorati.com*), which itself uses social navigation in the form of tag clouds. Blogs usually offer interaction and can enable learners to discover and actively participate in relevant communities to help them to learn.

Collaborative filters are recommender systems that make use of implicit and/or explicit preferences to provide recommendations based on similarities between user models. Collaborative filters are very useful for matching users' preferences, but tend to be less successful when seeking learning resources, because to learn is to change. My previous preferences for particular resources will be a less reliable guide to my future needs than preferences for books, movies, or Web sites because the act of using a learning resource will (if successful) change me in ways that are likely to differ from how they have changed you. Nonetheless, systems such as Altered Vista (Recker, Walker, & Wiley, 2000) and RACOFI (Anderson et al., 2003) have achieved some success in this area.

Social networking sites, which are concerned with finding like-minded or otherwise related people, offer another means of structuring the environment from the bottom up. Sites such as MySpace, Orkut (*http://www.orkut.com*), Ecademy (*http://www.ecademy.com*), and FriendsReunited (*http://www.friendsreunited.co.uk*) are concerned with establishing webs of links between people. Again, no centralized controller determines the structure, which forms because of local links provided by individual users. When used to seek fellow learners or experts, such systems offer promising benefits for the learner.

EXPLICITLY EMERGENT LEARNING ENVIRONMENTS

Some social software explicitly exploits self-organizing principles for learning. The selection presented here is a relatively small subset that indicates how this area is developing.

An exception to the rule that collaborative filters cannot cope well with changing needs is CoFIND (Dron, Mitchell, & Boyne, 2003), which combines both evolutionary and stigmergic principles to provide both social navigation and collaborative filtering. Rather than simple good-bad ratings, it employs a multi-dimensional matrix of "qualities," which loosely translate into those things that learners find useful about a resource—for instance, if it is good for beginners, detailed, exciting, and so on. Because qualities are created by learners and used by other learners to provide explicit ratings, they provide a kind of footprint of the learning needs that led to a particular resource being recommended. This remains even after the learner has moved on. By basing its recommendations on an explicit metadata model, rather than a user model, it overcomes the problem of changing user needs that afflicts other collaborative filters. In keeping with evolutionary principles, not just the resources in the system but the metadata which describe them are in competition with each other. Combined with positive feedback loops generated by social navigation using stigmergy, this means that each CoFIND instance develops into a unique ecosystem composed of smaller, interacting ecosystems.

Elgg (*http://elgg.net*) is a powerful social networking system that enables learners to blog, podcast, share resources, and find other users with similar interests. Like many systems, it uses tags and stigmergic tag clouds to identify shared interests. With a focus on the educational sector, every resource, be it a file, a podcast, a blog entry, or a comment, offers fine-grained user control over the permissions to view or change it that are offered. It thus supports strong parcellation as communities can be as private or public as their members wish, while always providing weaker connections between clusters of interest. It has been used extensively around the world in educational settings (Anderson, 2006; Campbell, 2005; Dron, 2006b) as a means of breaking free of the strictures of more top-down learning management systems and of giving control to the end user.

Wiki-based systems for education are becoming increasingly sophisticated. For example, Sloep, van Rosmalen, Kester, Brouns, & Koper (2006) describe an application of latent semantic analysis to automatically generate wiki pages from a knowledge base in response to questions which may then be edited by humans to become more relevant, thus creating a hybrid combination of the strengths of automation with those of human experts. OurWeb (Miettinen, Kurhila, Nokelainen, & Tirri, 2005) overlays footprints and annotations on a wiki page, providing stigmergic social navigation to structure a constantly evolving environment. Emergent patterns of use lend structure to temper the potential chaos of unconstrained wiki growth.

The Knowledge Sea II uses navigation behavior to identify resources of interest to a community of C programmers, using a combination of explicit and implicit ratings to generate a visualization resembling a sea, with greater depth of color representing greater levels of interest. Again, stigmergic self-organization develops through individual interactions with the system (Brusilovsky, Chavan, & Farzan, 2004).

EDUCO (Kurhila, Miettinen, Nokelainen, & Tirri, 2002) uses social navigation to provide not only visual indicators of the relative popularity of documents within the system, but also real-time indicators of who is currently viewing them. This is combined with a chat system that enables interactions between users, providing a powerful incentive to visit pages that are currently being viewed. A similar technique is employed in Dron's (2005, 2007b) Dwellings, which makes use of stigmergic self-organizing principles suggested by Jacobs (1961) in *The Death and Life of Great American Cities.*

The Comtella system uses peer-to-peer protocols to enable its users to share documents, and thence to find documents that others have found useful. Incorporating a ranking system partly inspired by self-organizing market mechanisms, Comtella is replete with emergent structure based on the aggregated behavior of individuals (Vassileva, 2004). Comtella is extensible and has spawned an interesting discussion forum that uses similar mechanisms to help find relevant people and postings (Webster & Vassileva, 2006).

FUTURE TRENDS

The tensions between bottom-up design and the top-down needs of educational institutions and organizations make it uncertain that, despite widespread use, self-organizing, social software will notably impact existing institutional education structures. The large and slow will always dominate the small and fast. Darby's third generation of learning environments already exists, but the majority of effort is still being expended on first- and (occasionally) second-generation systems. However, as the need for lifelong, just-in-time learning becomes ever more significant, it is certain that software combining the wisdom of crowds will have an important role to play in all walks of life.

With a trend towards meaningful metadata being appended to resources using tags or standards such as RDF (Resource Description Framework), the relevance of search results may be improved over the coming years. However, to turn such information into useful knowledge and learning, social software is needed that combines the knowledge of many people, effectively amplifying intelligence and operating in some senses as a kind of group mind. The massive growth in the use of social software and the technologies of Web 2.0 seems irrepressible, offering structure through dialogic processes, with many consequent benefits, enabling the learner to choose whether to be in control or to accept control by the emergent systems that arise (Dron, 2006a).

Interoperability is central: increasing use will be made of mashups, combinations of Web services, and RSS feeds that merge content from many sources (O'Reilly, 2005). Applications that are composed of constantly changing hosted services are quick to build and therefore easy to evolve as needs and communities change. This merging of parcellated populations offers many opportunities for cross-fertilization between systems and communities, as can be seen in sites such as Mappr (*http://www.mappr.com/*), The Daily Mashup (*http://dailymashup.com/*), or Doggdot (*http://doggdot.us/*). Evolutionary change in systems employing mashups occurs on a different scale from that of its individual components, potentially enabling richer and more complex structures to develop at more hierarchical layers. Exactly how this will be adopted in educational settings remains to be seen, but there are already some effective uses of the principle. Elgg, for example, integrates RSS feeds from other sites seamlessly into the local environment, allowing local, parcellated, evolutionary processes to transform the structure from another site into one that is more relevant to a given community's needs.

CONCLUSION

The World Wide Web is becoming ever-more dynamic. Because of social software, the generation of resources to learn from is moving away from rule-based machine- or human-governed information to a more symbiotic relationship, where the strengths of machines and the strengths of people are combined and, in the process, mutually enhanced. In the process, the high transactional distance of resource-based learning is reduced by glimpses of the footprints of others. In a world where roles are changing faster than the traditional course-based approaches to the delivery of learning can address, the resulting group mind can adapt itself more readily and effectively than any single person to the needs of individual learners.

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KEY TERMS

Collaborative Filter: A form of recommender system that uses implicit or explicit recommendations of others to provide advice based on similarities between user models.

Emergent Behavior: Behavior that arises out of the interactions between parts of a system and which cannot easily be predicted or extrapolated from the behavior of those individual parts.

Latent Human Annotation (LHA): The unintentional communication of a recommendation or other information as a by-product of another process, for example the provision of hyperlinks in a Web page that are then used by search engines to provide rankings of the linked pages.

Recommender System: A computer program that recommends some sort of resource based on algorithms that rely on some sort of user model, some sort of content model, and some means of matching the two.

Social Navigation: The transformation of an interface (usually Web based) by using the actions of visitors.

Social Software: Software in which the group is a distinct entity within the system.

Stigmergy: A form of indirect communication whereby signs left in the environment influence the behavior of others who follow.

Transactional Distance: A measure of the relative amounts of dialogue and structure in an educational activity. Of necessity, as one increases, the other decreases and vice versa. More autonomous learners require less dialogue than more dependent learners.

This work was previously published in Encyclopedia of Information Science and Technology, Second Edition , edited by M. Khosrow-Pour, pp. 3413-3418, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.24
Living, Working, Teaching and Learning by Social Software

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ABSTRACT

This chapter explores emergent behaviours in the use of social software across multiple online communities of practice where informal learning occurs beyond traditional higher education (HE) institutional boundaries. Employing a combination of research literature, personal experience and direct observation, the authors investigate the blurring of boundaries between work/home/play as a result of increased connectivity and hyper availability in the "information age". Exploring the potentially disruptive nature of new media, social software and social networking practices, the authors ask what coping strategies are employed by the individual as their online social networks and learning communities increase in number and density? What are the implications for the identity and role of the tutor in online HE learning environments characterised by multiple platforms and fora? The authors conclude by posing a series of challenges for the HE sector and its participants in engaging with social software and social networking technologies.

DOI: 10.4018/978-1-60566-208-4.ch015

Wholly new forms of encyclopaedias will appear, ready-made with a mesh of associative trails running through them… there is a new profession of trailblazers, those who find delight in the task of establishing useful trails through the enormous mass of the common record. The inheritance from the master becomes, not only his additions to the world record, but for his disciples the entire scaffolding by which they were erected….

–Vannevar Bush (1945)

INTRODUCTION

Online social networking is to some extent a cultural phenomenon. As emerging social web-based technologies are being explored and adopted by educators and learners, we are beginning to witness the emergence of new forms of cooperation and collaboration across boundaries of time and space. Much learning takes place beyond institutional boundaries, instead through social interaction across multiple online 'communities of practice' which Wenger, McDermott and Snyder (2002: 4) define as 'groups of people who share a concern, a set of problems, a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis'. The speed with which information is produced and accessed in an increasingly networked society, and the ease with which communications can take place across multiple platforms and fora, give rise to what Barnett (2000) refers to as 'supercomplexity' where the professional judgement of HE teachers involves using multiple data sources, and often conflictual decision-making choices. The vast amount of information available online, and the ease and speed with which learners and tutors can communicate in the co-construction of knowledge, both require productive boundary making processes in order to lessen the risk of information and communication overload. Alongside the inherent tensions of informal learning taking place across online social platforms which stand apart from the formalised structures of traditional institutions, questions are often raised regarding the authority of knowledge and the legitimacy of participants. These challenges require learners and tutors to demonstrate ongoing reflexivity in terms of the practice of educational interaction in dynamically changing environments and constantly changing information sources.

The use of social software in higher education, such as blogs, wikis and social networking services, has seen a surge in the number of active online learning communities and networks for both staff and students, where members are easily connected and engaging in the social construction of knowledge. Much learning is decentralised (the individual being the locus of control as opposed to the HE institution) and often informal in the sense that it is not prescribed or assessed. There is a resulting tension between the informal or 'feral' nature of social software-enabled learning webs, and the formal teaching accountability of HE institutions in terms of 'what is learned' and the respective assessment practices.

Within the context of his 'communities of practice' analytical tool, Wenger (1998: 267) describes such a tension as the 'interaction of the planned and the emergent - that is, the ability of teaching and learning to interact so as to become structuring resources for each other'. The authors have adopted Wenger's concept of a community of practice to characterise social networking processes as informal and organic 'constellations of inter-related communities of practice' (Wenger, 2000: 229) whereby communities of practice emerge across multiple online social platforms via the ways their participants use the virtual spaces on offer. Within such environments 'members have different interests, make diverse contributions to activity, and hold varied viewpoints… participation at multiple levels is entailed in membership in a community of practice. Nor does the term community imply necessarily co-presence, a well-defined, identifiable group, or socially visible boundaries. It does imply participation in an activity system about which participants share understandings concerning what they are doing and what that means in their lives and for their communities' Lave and Wenger, (1991: 98). Community membership is a matter of mutual engagement which does not necessarily entail homogeneity but diversity. Furthermore, 'since the life of a community of practice as it unfolds is, in essence, produced by its members through mutual engagement, it evolves in organic ways that tend to escape formal descriptions and control' (Wenger, 1998: 118).

These communities of practice can have different levels of expertise that can be simultaneously present, fluid peripheral to centre movement that symbolises the progression from being a novice to an expert and authentic tasks and communication (Johnson, 2001: 45). In effect, these online communities of practice can be conceptualised as 'shared histories of learning' (Wenger, 1998: 86) where both staff and students can participate in multiple communities at once and in doing so may portray different identities. Within these communities learning is a 'social phenomenon, reflecting our own deeply social nature as human beings capable of knowing' (Wenger,1998: 3) and is underpinned by the idea of 'situated cognition' where 'situations…co-produce knowledge through activity' given that 'learning and cognition… are fundamentally situated' (Brown, Collins and Duguid, 1989: 1). Therefore, knowledge is situated and results from the activity, context and culture in which it is developed and employed. Learning arises through 'legitimate peripheral participation' which Lave and Wenger (op cit: 29) characterize as an enculturation 'process by which new learners become part of a community of practice' and thereby 'acquire that particular community's subjective viewpoint and learn to speak its language' (Brown and Duguid, 1991: 48). Furthermore, joining a social networking community of practice involves entering, not only its internal configurations and interactions but also, by hyperlinking its relations with the rest of the digital world.

The ability of the learner to actively engage in dialogue with others in socially interactive online learning communities is seen to be democratising and empowering, echoing the ideas and implementations of radical pedagogical thinkers such as Ivan Illich (1971) and Paulo Freire (1993). Illich (op cit) put forward the idea of self-directed education, supported by intentional social relations, in fluid, informal arrangements - ideas which are found in today's cultures of lifelong and informal learning and the increasing emphasis which is now being placed on learner autonomy; in calling for the use of advanced technology to support 'learning webs', Illich demonstrated a pedagogical vision which is becoming a reality of our learning landscape. In contrast to institutional VLEs, the content of which is most often characterised by standalone modules and learning objects, students can roam freely across the web, accessing vast amounts of information, engaging in social interaction and metacognition through dialogue with others in online communities and participating in blog-based discussions which are characterised by commentary and hyperlinks; learning both formally and informally, and playing a dualistic role of both consumer and producer on the read/write web.

Traditional conceptions of learning, teaching and the role of educational institutions themselves are being challenged by new web-based pedagogies which are by their nature distributed and decentralised. As the use of online social networking services and other forms of social software have reached critical mass in mainstream society, an increasing number of learners and educators are using blogs, wikis and virtual worlds as spaces for communication and collaboration, complemented by faster forms of asynchronous discussion via instant messaging or chat (e.g. Skype, MSN) and now 'microblogging' (e.g. Twitter, Jaiku). Many of these technologies are applications which run outside of the virtual boundaries of the institution. Educators and learners will need to renegotiate shifting paradigms and boundaries such as formal vs. informal; VLE vs. PLE; and centralised vs. distributed interactions across multiple communities of practice. These boundaries may also be constantly shifting according to the level of participation within each community, while communication itself necessitates a degree of reflexivity due to expectations when using multiple and increasingly convergent technologies which are characteristic of a high-speed, always-on culture.

In an educational culture where online learning across multiple, hyper-connected communities may be energising as a result of seemingly never-ending opportunities for dialogue-based learning, there may also be a risk of communication and information overload. New boundaries need to be negotiated in order to allow for quality thinking time – time away from communication and information in order to reflect. If such boundaries are not set, the negative socio-emotional effects of information and communication overload may adversely affect the individual's ability to function and participate effectively within their multiple online communities and networks. Information and communication overload, coping strategies and boundary-setting within multiple online communities of practice (based on the authors' experiences of online social networking, social software and mobile technologies) are the focus of this chapter.

BACKGROUND

Information Overload: Myth or Reality?

Information overload is generally accepted to be "that moment when the amount of available information exceeds the user's ability to process it" (Klapp 1982, 63) and is commonly viewed as being a symptom of living in a high-tech age. Despite this, it is far from being a modern-day phenomenon; the concept of information overload has been traced back to ancient times (Bawden et. al. (1999) Nevertheless, as the means of communicating and disseminating information have increased through the ages, from the arrival of the printing press, through to the advent of telecommunications and now the internet, so too has the risk of feeling overwhelmed due to the ability to process information being limited as a result of cognitive and temporal constraints. The effects are further exacerbated in networked electronic environments by the speed and ease with which information may be accessed through multiple electronic devices in an increasingly networked culture (Castells, 1996), and complaints of information and communication overload have increased in line with the growth in information and communication devices and fora. Bawden et. al. (*op cit*) describe large scale reports from the 1990s which appear to confirm that information overload is becoming a very real problem, leading to feelings of being overwhelmed and resulting in damage to health.

Much recent literature on information overload has focused on the use of email in workplace and the effects of instant electronic communications on worker productivity (Levy, 2006; Zeldes, 2007). Mobile technologies and web-based communications have resulted in the boundaries between work, home and play being broken down due to the ease with which people can communicate; as web-based communication becomes the norm, work-related discussions via email may be entered into during leisure time, while users are able to use web-based technologies to engage socially online in the workplace. The accelerated nature of electronic communication is not without its consequences as people are both easily reached and immediately available. A pattern of behaviour emerges whereby rapid response times (to emails) breed rapid response times; meetings are arranged easily and rapidly, the irony of which is that through partaking in such rapid communications in order to arrange and negotiate tasks, actual output in terms of productivity may be reduced (Levy, *op cit*). Zeldes et al (*op cit*) state that "field research demonstrates that restoring daily segments of contiguous "Quiet Time" can have a major effect of increasing productivity in development teams (Perlow, 1999). Additional research shows a correlation between a fragmented work mode and reduced creativity (Amabile, 2002)." In relation to organisational networks, Watts (2004, p.274-275) discusses limitations in production and information processing, noting that "from a production perspective, efficiency requires that an organisation constrain the non-productive activities of its workers… network ties are costly, in terms of time and energy… individuals have finite amounts of both, it follows that the more relationships one actively maintains at work, the less actual production-related work one can do…"

MAIN THEMES

Considering Information Overload in the Context of HE

As the emerging social web-based technologies are explored and adopted by educators and learners, new forms of cooperation and collaboration are emerging across boundaries of time and space. Taking the 'blogosphere' as an example, growing numbers of groups, networks and communities are able to share and scaffold knowledge with increasing velocity as a result of the lack of physical and temporal barriers when communicating across cyberspace. Connections of thoughts and concepts, of individuals and networks, are formed at a seemingly exponential rate; a societal shift which is both energising and exciting, and yet can rapidly become exhausting as increased connectivity and hyper availability results in a culture which is information rich, yet time poor[1]. One of the concerns of living in a high-speed, always-on culture which is defined by immediacy and seemingly infinite amounts of information is the risk of spending so much time communicating and actively seeking information that little time remains to reflect (Levy, 2006; Eagleton, 2006). One of the paradoxes of the blogosphere is that blogs are commonly seen as a reflective medium, yet without setting boundaries it is quite possible to follow links ad infinitum from blog to blog, accessing seemingly unlimited amounts of information without taking time out to engage in reflection. A further consideration is that of much of the learning within blog-based communities coming from not only the posts themselves, but the comments that are left by others. Through following the ensuing dialogue within the commentary, participants are exposed to multiple viewpoints which, when viewed as a whole, serve as diverse and rich sources of new knowledge. This does however have implications for blog-based community participation, as members may be faced with considerably more information than is contained in the original post.

Many educators are exploring ways to harness the potential of social-software enabled 'feral learning' (Nunan 1996) and decentralised learning networks within formalised educational structures. The ability of tutors and students to roam freely among multiple online learning communities and seemingly never ending and constantly updated web-based information requires new skills in time and information management. Multiple fora and tools with which to communicate mean added complexity; when faced with more information that can be processed in the time available; the resulting overload may be a significant cause of stress (Bawden et. al. *op cit*; Klapp *op cit*; Savolainen *op cit*). This is not a phenomenon which is seen as being a result of the use of social software per se; more as a result of technological advancement as a whole, (McLuhan 1967; Poster 1995; Virilio 1995; Erikssen 2001).

The challenge for learners and educators is to harness the power of the network without becoming overwhelmed by the sheer volume of communication and information within the network itself. Just as businesses are beginning to designate 'quiet time' for their employees, away from email in order to focus on productivity (Wakefield, 2007); networked learning requires participants to agree on boundaries and employ methods to manage information and communication expectations in order to avoid both information and communication overload.

Multiple choices within multiple fora create supercomplexity; learners often use a variety of social networking sites (Facebook, MySpace), instant messaging clients (Skype, MSN) and have multiple email addresses independently of education. The introduction of online social tools into the learning process means that learners have additional networked information and communication technologies to negotiate which increases the likelihood of information overload. Learners and educators in a networked society adopt strategies for avoiding or coping with information overload, and commonly employed methods involve either filtering or withdrawal (Savolainen, 2007). Filtering is a characteristic of sound information and digital literacy, while withdrawal is more affectively oriented and may involve actions such as avoiding checking emails and logging into social networking sites, disguising online status and switching off mobile phones in an attempt to remove oneself from the perceived onslaught of communication. While filtering and withdrawal are common strategies for coping when bombarded with information and communications, it is important for learners and educators to ensure that the right sort of 'noise'[2] is filtered out, or that essential communications are not missed as a result of withdrawal.

One common paradox which has been noted by the author(s) is that whereby useful technologies are so heavily used that their usefulness is lessened in some way. Zeldes et. al. (*op cit*: 2007), describe a state where:

"Rapid communications (first order effect) mean more distractions and overload (second order effect) which reduces people's ability to react. This paradox causes people to adopt various strategies to communicate less (third order effect). The outcome is that people are less responsive to many messages than they were a decade ago, when communications were much slower."

This pattern, whereby a useful technology is used so heavily that it's usefulness is diminished, occurs frequently and rapidly with many web-based technologies; for example coping with email overload by 'chunking' and checking less frequently in order to focus on the task in hand reduces the validity of email as a rapid communications tool. The practice of 'chunking' is so widespread that email is now seen by many as a 'slow' technology in comparison to live chat applications such as Skype and MSN. In turn, as increasing numbers of people adopt these 'faster' communication technologies so the likelihood of noise is increased. Coping strategies are again adopted which often take the form of disguising one's online status or turning off messaging alerts in order to filter out noise.

A further example of this paradox in terms of useful technologies is that of RSS (Really Simple Syndication or Rich Site Summary). RSS feeds are used to bring relevant web content to the user, with the intention of creating more personalised information streams with reduced noise, thereby increasing efficiency and filtering out less-relevant information. One of the key uses of RSS is its role in blog aggregation; users can subscribe and follow multiple blogs easily. However, this tool which is designed to filter out noise is then used so much that it becomes a source of noise in itself, with an increasing number of bloggers complaining of RSS and blog overload (Richardson, 2007; Dawson, 2007; Hughes, 2004).

Information and communication overload may be more of an issue for those whom these technologies have appeared in later life, while the 'net generation' may be more at ease living in a culture which is characterized by multitasking, the use of multiple media simultaneously and constant digitally-enabled communication (Barnes et. al, 2007; Oblinger & Oblinger, 2005). Nevertheless, there may well be implications for the introduction of new and emerging technologies into education, due to the exponential nature of the viral-like growth of the network.

Essentially any individual is limited in the amount of networks within which they can actively participate at any one time, and as educators striving to bring communities of learners together through social software, tutors may be competing with online communities within which learners are already engaged informally such as MySpace and Facebook. While the 'net-generation' are generally perceived as being comfortable communicating across multiple platforms simultaneously, the ease with which users can participate within, and move between, online communities and the potential blurring of the boundaries between work and play as institutions try to engage learners through moving in to the realms of popular social networking sites has implications in terms of both student/tutor identity and the risk of information 'grazing', where learning becomes surface as a result of 'too many networks, too little time'.

How this translates in terms of pedagogy remains to be seen, but as an increasing number of educators introduce social software into the classroom it is not difficult to envisage a point at which some learners may feel 'blogged down and blogged out' (Richardson, *op cit*; Dawson, *op cit*.), drowning in a sea of communication and collaboration and reacting by withdrawing from the very learning communities to which they belong. The challenge for learners and educators using social software is the need to negotiate new pedagogies and educational boundaries (time, space, cultural differences) in a global web which is characterised by exponential growth and constantly changing information sources, in contrast to the relatively static nature of the local institution and the requirements of a HE system which requires transparency, accountability and easily measurable outcomes. Learner empowerment must involve a more equal relationship between the tutor and student, with the acknowledgement that, in the more open and global contexts, the tutor is not the sole provider of subject knowledge. That said, there is likely to remain a responsibility on the tutor to provide an enabling structure within which learners, especially those new to subject domains, are likely to develop learning independence.

Tutor as Educational Broker and 'Bridge': Searching for a New Identity within Dynamic Multiple Systems

Communication and social interaction lie at the core of web-based social constructivist pedagogies and communities of learners can be well-supported by new forms of social software; however, the majority of educators in everyday practice are subject to institutional constraints and accountability mechanisms which pose a real challenge to new forms of social and online learning. The role of the tutor in supporting learners through new forms of online learning may be one of guidance; helping learners to explore their own needs and navigate their personal learning pathways. However, many tutors are working in an educational climate characterised by reduced funding and the corresponding pressure to recruit in order to increase student numbers. The tension between what participants in online learning communities believe to be democratic and empowering, and the requirements of a HE system which emphasises easily measurable outcomes, is tangible. Accountability is key: institutional audits, benchmarking, league tables – such frameworks do not lend themselves easily to decentralised models of education and new conceptions of learning which are student-centred as opposed to autocratic, where the role of the tutor is that of a mentor or guide, as opposed to the authoritarian voice.

The exponential rise of social networking sites as informal environments for HE raises issues of teachers' identities and roles given their growing participation within multiple virtual communities of complex interactions. For example, Rheingold (1993: 61) foresaw enormous cultural changes of Internet usage on the individual: 'are relationships and commitments as we know them even possible in a place where identities are fluid?... We reduce and encode our identities as words on a screen, decode and unpack the identities of others'. On a grander scale, Anthony Giddens (1991) describes the over arching features of a dynamic modern society as being the separation of time and space, the disembedding of social systems and the reflexivity of institutions and individuals. Applied within the context of social networking processes we can see that the concept of space has undergone a transformation in that we can be in the same virtual space but not necessarily in the same locale. Furthermore, social relations within

HE learning contexts can no longer be limited to the local face to face interaction whereby we are faced with the 'lifting out of social relations from local contexts and their re-articulation across indefinite tracts of time-space' (Giddens, *op cit*: 18). Both these conditions require in particular not only the 'reflexive monitoring of action' (Giddens, *ibid*: 20) but the need for say teachers and learners in online environments to constantly collect, store and interpret ever larger amounts of information within the dialectic of the local and the global interaction of knowledge. This reflexivity of modernity involves a 'fundamental uncertainty about the truth of the new knowledge, because we cannot be sure that this knowledge will not be revised' (Kasperson, 2000: 89). Not only does this undermine the certainty of knowledge but Giddens also argues that it may also be 'existentially troubling' for individuals and thereby threaten their 'ontological security' which he defines as 'a sense of continuity and order in events, including those not directly within the perceptual environment of the individual' (*ibid*: 243).

In an environment of multiple virtual communities of practice; time-space distanciation and faceless commitments may undermine one's sense of self-identity and trust in both the authority of the knowledge and the legitimacy of the participants. Within these dynamic, changeable, and volatile conditions there will be a constant need to undertake a form of recurrent 'mental housekeeping' or 'sense-making' as new information and contributions come to light. Giddens (1990: 139) likens the dynamic features of modernity to 'riding a juggernaut' which 'sometimes seems to have a steady path', [but] 'there are times when it veers away erratically in directions we cannot foresee'. Such a scenario can be imagined within the context of different social networking tools where one has the ability to operate in multiple environments and make use of unfettered hyperlinking possibilities in the pursuit of authoritative knowledge construction.

Within multi-scenario and collaborative virtual communities of practice, there is a need for teachers to engage in ongoing reflexivity in how to practice educational interaction in dynamically changing environments and constantly changing information sources. This may involve developing productive 'boundary making' processes and negotiating with each other new cultural forms of managing online interaction. The very concept of a community of practice implies the existence of a boundary (Wenger, 2000: 232). That said, participation in an online community of practice involves engaging not only in its internal configurations but also with its external relationships, particularly given the many hyperlinking possibilities. Wenger (2000: 233) argues, that boundaries are important within learning systems because they connect communities and provide opportunities for learning. Practice boundaries are often informal and fuzzy and do not have to be disciplinary specific. Boundaries are the 'edges of communities of practice, to their point of contact with the rest of the world…no matter how negotiable or unspoken -refer to discontinuities, to lines of distinction between inside and outside, membership and non-membership, inclusion and exclusion (Wenger, 1998: 119).

Wenger, McDermott and Snyder (2002: 153) state that interacting across different practices and their respective boundaries initiate a 'deep source of learning' given that boundaries are 'learning assets in their own right'. However as Hayward (2000) points out, in her study of power, social boundaries (such as laws, rules, norms, routinised procedures, institutional arrangements) can constrain as well as enable participants within different social practices. In the context of social networking communities and their respective educational practices, agreed boundaries may on the one hand; provide a structure for neophyte learners, define what constitutes knowledge, create a space for action, establish the nature and urgency of problems and generate a collection of identities, whilst on the other hand, they can exclude participation, limit the further co-construction of knowledge and hamper innovation.

The key here is to connect boundary crossing and knowledge interaction between different virtual communities of practice some of which may be formal like institutional VLE's such as Blackboard and some of which may be informal such as social networking tools like Facebook. Wenger (2000: 235) offers three kinds of connections with regard to knowledge transfer: brokering, boundary objects and a variety of forms of interactions among people from different communities of practice (multi-membership). The focus here is on brokers who according to Wenger (1998:109) are people who are: 'able to make new connections across communities of practice, enable co-ordination…and open new possibilities for meaning'. Brokering can take various forms: such as 'roamers' who are able to create connections and move knowledge from one community to another and 'outposts' where community members can bring back news from the 'forefront' and explore new 'territories'.

Within the context of HE, this will involve - to different degrees - individuals such as tutors belonging to, and participating in, multiple virtual communities of practice simultaneously. Fox (2007) has drawn attention to students' use of social networking tools such as Facebook and compared it to their lack of participation within formalised institutional VLE's. Social networking sites like Facebook display informal, unmoderated and emergent participation with relatively open and fluid boundaries with virtual spaces used by students for socialising and learning - not controlled by the university whereas VLE's, such as Blackboard tend to have formal, tutor moderated and designed participation with relatively fixed and closed boundaries and hierarchical virtual spaces for structured learning - publicly owned, controlled and surveilled (Land and Bayne, 2001) by the University under licence.

Fox (*op cit*) notes that the popularity of the former was leading to her increasing lack of success in getting student interactions going in the latter. When she browsed Facebook, she found it a useful way of getting to know her students through their profiles. She reports that she was eventually invited to join the social networking group they had formed, associated with her module, and used it to integrate discussions for her seminars. She continues by saying: 'it is a tricky relationship to negotiate, you have to be sensitive because it is a personal space for students, so they don't want it to be too interactive' In effect, tutors must have 'legitimacy' with students whereby the tutor is not seen to be invading their virtual space. This example shows how 'tutors as brokers' are able to make new connections across virtual communities of practice, enable cross participation and open up new possibilities for knowledge co-construction within a more egalitarian HE learning context.

It may be that the tutors of the future will have to develop the skills of translation, co-ordination, and alignment between different perspectives and establish their participatory 'legitimacy' whilst undertaking simultaneous multi-membership of many virtual online social networking learning spaces. As Wenger (1998: 110) argues: 'Brokering therefore requires an ability to manage carefully the existence of membership and non-membership, yielding enough distance to bring a different perspective, but also enough legitimacy to be listened to'. Thus, the HE 'tutor as broker' will have to display the negotiating skills - and feel comfortable enough - to operate between informal and formal virtual communities and within, in particular, multiple informal ones. The challenge is thus to negotiate information and communication boundaries and expectations across the tensions between traditional HE institutions and formalised educational structures, and informal decentralised social learning platforms.

Saunders (2006: 17) in considering relationships between education, learning and work offers additional perspectives on boundary crossing processes. He emphasises the importance of two-dimensions: firstly, moving across boundaries 'yields the potential for learning as sense making processes' and secondly, 'informal learning is given impetus to produce 'ontological security' in the new environment'. He highlights the need for a wide range of 'bridging tools' to help learners, and those supporting them to navigate these transitions from one environment to another. The term 'bridging' is used as the relevant metaphor, because 'it implies a journey and a connection between places in two senses: just as a bridge takes an individual or group from one point to another, it also joins one place to another. This narrative has a strong vision of the world learners inhabit overwhelmingly characterised by rapid change' (Saunders, op cit: 18).

CONCLUSION: FUTURE TRENDS AND CHALLENGES

New forms of online learning, with social interaction and metacognition at their core, pose a significant challenge in terms of the volume, authority and legitimacy of information, relatively unbounded communications, traditional assessment practices and the role of the tutor. Within many online communities of practice learning is fluid and informal, while through participating in such communities tutors can observe learning 'as it happens', guiding students along the way. However, when faced with large student cohorts (which are increasingly commonplace as a result of reduced funding and widening participation in HE) tutors may need to explore alternative methods of monitoring and measuring learning within such communities, such as peer assessment, Summative self-reporting and more intentional uses of technology in ways designed to capture students' knowledge and what is learnt. Tensions between the formal and the informal, and centralised versus decentralised models of education, must be managed effectively, while boundaries need to be negotiated across communities of practice and information networks in order to avoid participants becoming overwhelmed by information and communication.

More pressingly, our conclusion offers a series of challenges for the HE sector in networking with these new forms of learning and social interaction:

1. How are HE institutions going to participate in these informal settings without 'disrupting' students' informal and voluntary engagements in them?
2. HE institutions are going to have to address issues around 'curricular control', assessment strategies, quality assurance, accountability and ownership of process and product within informal social networking groupings.
3. HE tutors, in particular, are going to have to develop as 'educational brokers' and 'information guides and nurture their own professional reflexivity and increased empathy with students operating within their own organically developing informal social networking communities. This may involve a more equalised teacher-learner relationship where teachers may have to concede some 'designing curricula' power within these contexts. That said, tutors may have to provide the 'bridging' function between the formal learning environments of HE practice and the informal learning environments within social networking contexts and their infinite hyperlinking possibilities.
4. Individuals are going to have to construct coping strategies in addressing 'information overload within the work/life, teaching/learning balance and engage in productive boundary making and negotiating across multiple and dynamic social networking communities.
5. Within the context of these informal and organic 'constellations of interconnected practices' and their relationships with the rest of the digital world, we are going to have to

develop what Gee (2000: 522) calls 'reflective communities of practice' and acquire 'reflection literacy' (Hasan, 1998) where both teachers and learners 'engage in both subject-centred design knowledge and the world-building design knowledge through which they imagine and enact new more moral worlds and futures'. This according to Gee (op cit: 517) is 'knowledge about how to design and transform environments, relationships…and identities'.

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KEY TERMS

Blogs: Shortened term (weblogs) describing online journals displayed in reverse chronological order.

Boundaries: Practice boundaries are the 'edges' of communities of practice which can be fluid and fuzzy but offer the point of contact with other practice communities and provide lines of distinction between membership and non-membership.

Boundary Crossing: Different forms of interaction among people from different communities of practice.

Brokering: Those who are able to make connections and move knowledge across different practice communities by for example, introducing elements of one practice into another.

Communities of Practice: Organic developments composed of social and informal learning processes which revolve around joint enterprise, mutual engagement and produce a shared understanding and repertoire of communal meaning and resources.

Information Overload: When an individual is faced with more information than can be processed with available time and resources.

Ontological Security: An individual's sense of order, security and continuity within a rapidly changing perceived environment.

Reflexivity: The recurring examination and formation of self identity and social practices within a social environment of ever changing information.

Social Networking: Joining and participating in interconnected Internet communities (sometimes known as personal networks).

Social Software: Web-based applications which are characterised by personal publishing and the sharing and remixing of user-generated content (commonly referred to as 'Web 2.0').

ENDNOTES

1 There are fundamental concerns about the effects on the individual as a result of the increase of 'fast' time at the expense of 'slow' time (Eriksen, 2001). Paul Virilio (1986, 1995) is known for his explorations of the cultural implications of instantaneous digital communications, suggesting that the notion of real-time technology management shows an instrumental disregard for lived time and human experience, although it may be argued that Virilio misses the democratizing aspects of new computer and media technologies.

2 The signal-to-noise ratio is an often-used metaphor for describing information overload… In the context of the Information Age, the term is used to describe the proportion of useful information found to all information found' (Carslon, 2003)

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 208-221, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.25

Mailing Lists and Social Semantic Web

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ABSTRACT

Electronic Mailing lists are a key part of the Internet. They have enabled the development of social communities who share and exchange knowledge in specialized and general domains. In this chapter the auhtors describe methods to capture some of that knowledge which will enable the development of new datasets using Semantic Web technologies. In particular, the authors present the SWAML project, which collects data from mailing lists. They also describe smushing techniques that normalize RDF datasets capturing different resources that identify the same one. They have applied those techniques to identify persons through the mailing lists of open source communities. These techniques have been tested using a dataset automatically extracted from several online open source communities.

DOI: 10.4018/978-1-60566-272-5.ch004

INTRODUCTION

Early forms of electronic mailing lists were invented almost as soon as electronic Mail (e-Mail) and are a cornerstone of Internet, allowing a lot of people to keep up to date on news related with their interests. Besides direct messaging between individuals, mailing lists exist as private or public forums for information exchange in communities with shared interests. Mailing list archives are compilations of the previously posted messages that are often converted into static HTML pages for their publication on the web. They represent a noteworthy portion of the contents that are indexed by web search engines, and they capture an impressive body of knowledge that, however, is difficult to locate and browse.

The reason for this difficulty can be traced back to the translation procedure that run to transform the e-mail messages into static HTML pages. This task is fulfilled by scripts that create static HTML pages for each message in the archive. In addition, some indexes (by date, by author, by thread) are generated and usually split by date ranges to avoid excessive growth.

On the one hand, this fixed structure reduces the flexibility when users explore the mailing list archives using their web browsers. On the other hand, most of the meta-data that were associated to each e-mail message are lost when the message is rendered as HTML for presentational purposes.

We propose to use an ontology and RDF (Resource Description Framework, Klyne 2004) to publish the mailing list archives into the (Semantic) Web, retaining the meta-data that were present in the messages. Additionally, by doing so, the information can be merged and linked to other vocabularies, such as FOAF (Brickley and Miller, 2005).

The rest of the chapter is organized as follows: in section 2 we describe the main developments of Social Semantic Web related with mailing lists. In section 3, we explain several techniques to collect RDF datasets from mailing lists and other social sources. Section 4 contains a description of the SWAML project that collects those RDF datasets from mailing lists. In section 5, we describe several applications that consume that data. In section 6, we discuss some experiments that we have done over those datasets. Finally, in section 7 we present some conclusions and future work.

SOCIAL SEMANTIC WEB

The Semantic Web vision tries to develop new ways to integrate and reuse the information published on the web. To that end, the W3C has developed several technologies, like RDF, which enable to add metadata descriptions that contain meaningful values and global properties to resources. The resulting metadata forms a graph model which can be easily linked with other graphs (Berners-Lee, 2006) incrementing the knowledge represented by the original graph. Those values and properties formalize the knowledge of a particular. In 2004, the W3C consortium developed OWL (Patel-Schneider et al, 2004), a web ontology language which facilitates the definition of those formalizations, called ontologies. Based on description logics, OWL has been adopted as the standard ontology language with several available editors, reasoners and tools. There have been also a number of ontologies developed in OWL for different purposes and with different level of detail, from generic to domain-specific ones.

On the other hand, in the last years, the concept of Web 2.0 has attracted a lot of interest. One of the key aspects of Web 2.0 applications is the social part of the web. Users are not considered as mere consumers of information, but also as producers. People want to share knowledge, establish relationships, and even work together using web environments. It is necessary to develop people-oriented web technologies which can represent people interests and that enable the integration and reuse of people related information in the same way that the semantic web vision advocates. These technologies can be seen as social semantic web and we expect that there will be more and more applications making use of them.

One of the first developments is the FOAF vocabulary, which represents basic properties of people, like their name, homepage, etc. as well as the people they know. FOAF descriptions are very flexible and can be extended to other domains.

There are already web portals which export their user profiles in FOAF format and the number of FOAF applications is increasing.

Apart from FOAF, there are other ontologies related to the social semantic web. In particular, SIOC (Semantically-Interlinked Online Communities), provides a vocabulary to interconnect different discussion methods such as blogs, web-based forums and mailing lists (Breslin 2005, Breslin 2006). Although we will apply mainly SIOC to mailing-lists, it has a wider scope than just mailing lists, and generalizes all kinds of online discussion primitives in the more abstract sioc:Forum concept. Each forum represents an online community of people that communicate and share a common interest. The goal of SIOC is to interconnect these online communities.

Other relevant concepts of the ontology are sioc:User and sioc:Post, which model respectively the members of the communities and the content they produce. Instances of these three classes (forums, users and posts) can be linked together using several properties.

The SIOC ontology was designed to express the information contained both explicitly and implicitly in Internet discussion methods. Several software applications, usually deployed as plug-ins, are already available to export SIOC data from some popular blogging platforms and content management systems. The effort, however, is focused on web-based communities (blogs, discussion forums), while little has been done so far to extend the coverage to legacy non-web communities, such as mailing lists and Usenet groups.

SIOC classes and properties are defined in OWL, and their instances can be expressed in RDF. Therefore, they can be easily linked to other ontologies. The obvious choice here is FOAF, which provides powerful means to describe the personal data of the members of a community.

Mailing lists can be easily described by instantiation of the SIOC classes and properties. Each mailing list can be represented by an instance of sioc:Forum (a subclass of Forum might be used instead, although it is not required). Messages sent to the list and their replies become instances of sioc:Post.

Finally, people involved into the list are instances of sioc:User. The SIOC ontology provides a property to link forums and users, namely sioc:has_subscriber. We argue that being subscribed to a mailing list is just one of the roles a user can play with respect to a forum. Moreover, the list of subscribers is often available only to the system administrator for privacy reasons. On the other hand, it is easy to collect the set of people who post to the list, i.e., the people actively involved in the forum. Depending on the settings, the latter may be a subset of the former, in particular in those mailing lists that forbid posting privileges to non-subscribers. Ideally, these two different semantics would be captured using new properties. However, for practical reasons, and to avoid privacy issues, we consider just the already existent sioc:has_subscriber property, and we populate it with the set of active members of a forum. Consequently, inactive members of the forum remain hidden, but this does not represent a problem due to the open world assumption.

Additionally, the Dublin Core (Dublin Core Metadata Element Set, Version 1.1, 2006) and Dublin Core Terms vocabularies are used to capture meta-data such as the message date (dcterms:created) and title (dc:title).

Given the distributed nature of RDF, it is expected that there will be different RDF datasets describing aspects of the same resources. The term *smushing* has been defined as the process of normalizing an RDF dataset in order to unify *a priori* different RDF resources which actually represent the same thing. The application which executes a *data smushing* process is called a *smusher*. The process comprises two stages:

First, redundant resources are identified; then, the dataset is updated to reflect the recently acquired knowledge. The latter is usually achieved by adding new triples to the model to relate the pairs of redundant resources. The OWL property owl:sameAs is often used for this purpose, although other properties without built-in logic interpretations can be used as well (e.g.: ex:hasSimilarName). Redundant resources can be spotted using a number of techniques. In this chapter, we explore two of them: (1) using logic inference and (2) comparing labels.

COLLECTING DATA INTO THE SOCIAL SEMANTIC WEB

Since SIOC is a recent specification, its adoption is still low, and only a few sites export SIOC data. There exist a number of techniques that can be used to bootstrap a network of semantic descriptions from current social web sites. We classify them in two main categories: intrusive and non-intrusive techniques.

On the one hand, methods which require direct access to the underlying database behind the social web site are **intrusive** techniques. The web application acts as the controller and publishes different views of the model in formats such as HTML and RSS. In terms of this pattern, publishing SIOC data is as simple as adding a new view. From a functional point of view, this is the most powerful scenario, because it allows a lossless publication due to the direct access to the back-end database. The SIOC community has contributed a number of plugins for some popular web community-building applications, such as Drupal, WordPress and PhpBB2. Mailing lists are also covered by SWAML, which is described in the next section. There is, however, a major blocker for this approach. All these software components need a deployment in the server side (where the database is). This is a burden for system administrators, who are often unwilling to make a move that would make it more difficult to maintain, keep secure and upgrade their systems. This is particularly true when there is no obvious immediate benefit of exporting SIOC data.

On the other hand, methods which do not require direct access to the database and can operate on resources already published on the web are **non-intrusive**. One technique is the use of cooked HTML views of the information, the same ones that are rendered by web browsers for human consumption. An example could be RSS/Atom feeds, which have become very popular in the recent years. They can be easily translated into SIOC instances using XSLT stylesheets (for XML-based feeds) or SPARQL queries (for RSS 1.0, which is actually RDF). Unfortunately, these feeds often contain just partial descriptions. Another technique is the use of public APIs. The Web 2.0 trend has pushed some social web sites to export (part of) their functionality through APIs in order to enable their consumption by third-party mash-ups and applications. Where available, these APIs offer an excellent opportunity to create RDF views of the data. A shared aspect of these sources is their ubiquitous availability through web protocols and languages, such as HTTP and XML. Therefore, they can be consumed anywhere, and thus system administrators are freed of taking care of any additional deployment. In contrast, they cannot compete with the intrusive approaches in terms of information quality, as their access to the data is not primary.

SWAML PROJECT

SWAML (Fernández et al, 2008) is a Python tool that reads mailing list archives in raw format, typically stored in a “mailbox” (or “mbox”), as defined in RFC 4155 (Hall 2005). It parses mailboxes and outputs RDF descriptions of the messages, mailing lists and users as instances of the SIOC ontology. Internally, it re-constructs the structure of the conversations in a tree structure,

Figure 1. SIOC post example in RDF/XML

```
<rdf:RDF
  xmlns:dcterms='http://purl.org/dc/terms/'
  xmlns:sioc='http://rdfs.org/sioc/ns#'
  xmlns:rdf='http://www.w3.org/1999/02/22-rdf-syntax-ns#'
  xmlns:dc='http://purl.org/dc/elements/1.1/'
  xml:base='http://example.org/swaml-devel/'>
  <sioc:Post rdf:about="2006-Sep/post-52">
    <dc:title>Re: [swaml-devel] Changing SWAML ontology</dc:title>
    <sioc:has_creator rdf:resource="subscriber/s10"/>
    <dcterms:created>Wed, 6 Sep 2006 20:14:44 +0200</dcterms:created>
    <sioc:content><!-- ommitted --></sioc:content>
    <sioc:has_reply rdf:resource="2006-Sep/post-69"/>
    <sioc:previous_by_date rdf:resource="2006-Sep/post-51"/>
    <sioc:next_by_date rdf:resource="2006-Sep/post-53"/>
  </sioc:Post>
</rdf:RDF>
```

and it exploits this structure to produce links between the posts. This script is highly configurable and non-interactive, and has been designed to be invoked by the system task scheduler. This low-coupling with the software that runs the mailing list eases its portability and deployment.

SWAML could be classified as an intrusive technique because it requires access to the primary data source, even if in this case it is not a relational database but a text file (for instance, the approach followed by mle (Michael Hausenblas at al., 2007) is considered completely non-intrusive). Anyway, it is worth mentioning that some servers publish these text files (mailboxes) through HTTP. Therefore, sometimes it is possible to retrieve the mailbox and build a perfect replica of the primary database in another box. In such cases, SWAML can be used without the participation of the system administration of the original web server.

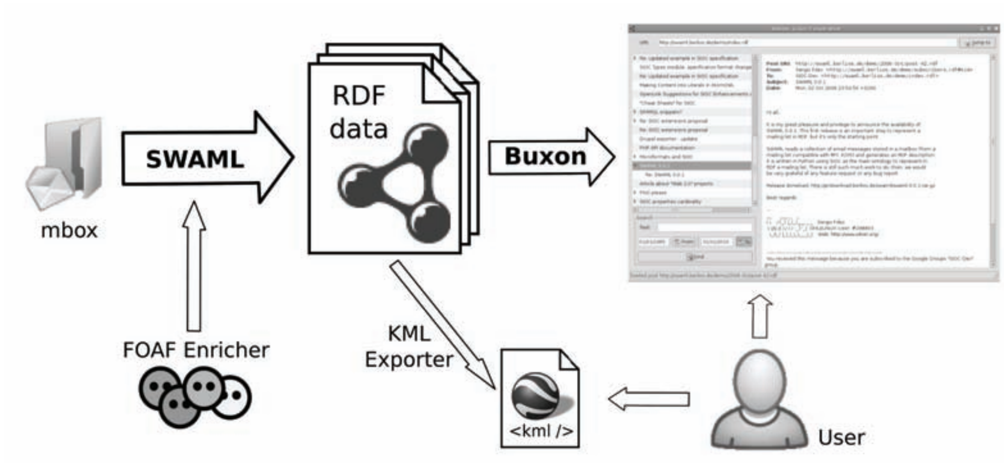
There are many ways in which a mailing list message might be related with other messages. However, we consider just two scenarios. The first one links a post with its replies (sioc:has_reply). Actually, due to sequential layout of the messages in the most widely used format to store mailing list archives (mailbox), it is easier to generate the inverse property (sioc:reply_of). Anyway, the has_reply property can be generated either by a description logics reasoner or by performing two passes over the sequence.

The second link among messages is established between a post and its immediate successor (or predecessor) in chronological order. It is worth to note that this link is not strictly necessary, because the following (or preceding) message can be obtained by sorting by date the sequence of posts. However, this is a rather expensive operation, because the whole set of posts is required in order to perform the sorting. The open world assumption makes this query even more challenging. Therefore, considering that browsing to the previous or next message is a common use case, and the complete set of posts can be very large or even unavailable, we introduced two new properties, next_by_date and prev_by_date. These properties where eventually accepted into the SIOC ontology. An RDF representation of a sample message is shown in Figure 1.

SWAML is essentially a mailbox parser and translator implemented in Python. Its output is a number of SIOC instances (Forum, Posts and Users) in a set of RDF files. SWAML can be invoked by the system task scheduler.

Parsing the mailbox and rebuilding the discussion threads may be sometimes tricky. Although each mail message has a supposedly unique iden-

Figure 2. Buxon is an end-user application that consumes sioc:Forum instances, which in turn can be generated from mailboxes using SWAML.



tifier in its header, the Message-ID, defined by RFC 2822 (Resnick, 2001), in practice its uniqueness cannot be taken for granted. Actually, we have found some messages with repeated identifiers in some mailing lists, probably due to non-RFC compliant or ill-configured mail transport agents. Therefore, SWAML assumes that any reference to a message (such as those created by the In-Reply-To header) is in fact a reference to the most recent message with that ID in the mailbox (obviously, only previous messages are considered). Using this rule of thumb, SWAML builds an in-memory tree representation of the conversation threads, so sioc:Posts can be properly linked.

Actually, SWAML goes further than just a format-translation tool. A dedicated subroutine that runs as part of the batch execution but may be also separately invoked on any sioc:Forum, tries to find a FOAF description for each sioc:User.

One important requirement of the semantic web is to be an extension (and not a replacement) of the current document-based web. Ideally, each user agent must be able to retrieve the information in their format of choice. For instance, current web browsers prefer (X)HTML documents, because they can be rendered and presented to the end user. However, semantic web agents require information to be available in a serialized RDF format, such as RDF/XML or N3. Furthermore, different representations of the same information resource should share a unique URI. Fortunately, the HTTP protocol supports this feature by using "content-negotiation". Clients of the protocol can declare their preferred formats in the headers of an HTTP request using the Accept header. Web servers will deliver the information in the most suited available format, using the Content-type header of the HTTP response to specify the actual format of the returned delivered content. MIME types such as text/html and application/rdf+xml are used as identifiers of the requested and available formats.

Setting up the content negotiation in the server-side usually requires some tuning of the web server configuration. It also depends on some choices made by the publisher of the information, such as the namespace scheme for the URIs or the fragmentation of the information. In (Miles et al, 2006) there is a list of some common scenarios, which are described to great detail, and configuration examples for the Apache web server are provided. The most suitable scenarios (or recipes,

Figure 3. A sample htaccess configuration file for Apache generated by SWAML. These two rules redirect the request to the proper file based on the content negotiation field of the HTTP request. Some lines have been wrapped for readability.

```
RewriteEngine On
RewriteBase /demos/swaml-devel/
AddType application/rdf+xml .rdf
Options -MultiViews

RewriteCond %{HTTP_ACCEPT} text/html [OR]
RewriteCond %{HTTP_ACCEPT} application/xhtml\+xml [OR]
RewriteCond %{HTTP_USER_AGENT} ^Mozilla/.*
RewriteRule ^/([0-9]{4})-([A-Za-z]+)/post-([0-9]+)$
            $1-$2/post-$3.xhtml [R=303]

RewriteCond %{HTTP_ACCEPT} application/rdf\+xml
RewriteRule ^/([0-9]{4})-([A-Za-z]+)/post-([0-9]+)$
            $1-$2/post-$3.rdf [R=303]
```

as they are called) to publish mailing list metadata are the fifth and sixth, i.e., multiple documents available both in HTML and RDF.

The fifth scenario is extensively described in the referred source, and it has been implemented in SWAML. At the same time RDF and HTML files are written, SWAML also produces htaccess local configuration files for Apache. One of these configuration file is shown in Figure 3, while a sample request/response negotiation is depicted in Figure 4.

RDF metadata generated by SWAML can grow to a large size for lists with a high traffic and several years of operation, where there are tens of thousands of messages. The partition of the information might be an issue in such cases. On the one hand, information chunks are preferred to be small so any conceivable use case can be satisfied without retrieving a significant overload of unneeded information. However, scattering the metadata across a myriad of small files has some disadvantages. For instance, the number of resources that must be retrieved to fulfill a single query is greatly increased. Therefore, storing the RDF graph in a specialized database is an appealing alternative.

Fortunately, a common protocol to access semantic repositories using SPARQL as the query language is available (Clark 2006) and is gaining support by the RDF databases. This protocol

Figure 4. An HTTP dialog with content negotiation

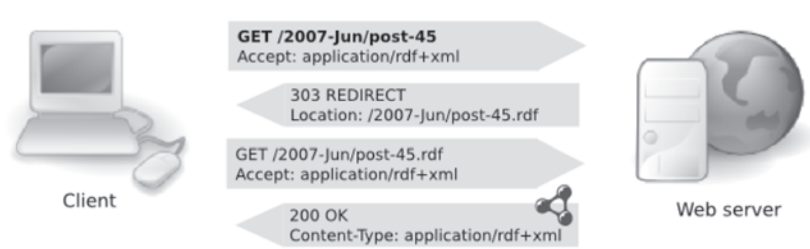


Figure 5. Sample Apache web server rewrite rule to translate HTTP request into SPARQL queries using a Sesame RDF repository. The last line has been wrapped for readability.

```
RewriteEngine On
RewriteBase /lists/archives

RewriteCond %{HTTP_ACCEPT} application/rdf\+xml
RewriteRule ^mylist/(.+)
      http://internal-server/sesame-server/repositories/mylist-rep/
      ?query=CONSTRUCT+{<http://example.org/lists/mylist/$1>+?y+?z}
      +WHERE+{<http://example.org/lists/mylist/$1>+?y+?z}
      &queryLn=sparql [R=303]
```

exposes a simple API to execute and retrieve the results of SPARQL queries (at the present moment, SPARQL is a read-only query language, although there are proposals to extend it with full CRUD capabilities such as those of SQL). This abstract query API may be realized by different means, such as SOAP bindings (described by a WSDL 2.0 interface) and HTTP bindings. The former enables interoperability with web service frameworks, while the latter can be exploited without the full-blown web service machinery.

Web service endpoints which implement the SPARQL protocol are sprouting on the web, some of them pouring huge amounts of data into the semantic web. We argue that metadata of large mailing lists can be conveniently exposed as SPARQL endpoints. That means to effectively translate the decision on data selection to the client (Pan 2006), and therefore minimizing the number of requests and the data overload. For instance, the client agent can retrieve all the headers of the messages in a given date range, but skip the body of the messages, saving a considerable amount of bandwidth.

However, non SPARQL-aware agents still need to access the information. This is the scenario of the sixth scenario (recipe) of the above cited document, but unfortunately this one is still being discussed. We propose a simple solution based on URL rewriting of the requests in order to translate conventional HTTP requests for resources into SPARQL queries that dynamically generate an RDF subgraph that contains the requested information about the resource. The rewriting mechanism, the SPARQL query and even the presence of a data repository instead of static files is kept completely hidden to the client. At the same time, by avoiding the undesirable data replication, this technique helps to keep the information consistent. The most representative feature of our proposal is that it does not require any kind of server side script or application to translate the queries, because the data repository can serve the information directly in the format desired by the client.

We have implemented this technique using the Apache web server and Sesame 2.0 RDF repository (Broekstra et al, 2006). Figure 6 reproduces the hand-made htaccess file (as opposed to the ones that are automatically produced by SWAML). Unfortunately, Of course, the rewrite rule must be fired only when RDF data is requested, while requests for HTML must go through it.

We note, however, that our proposal presents some security-related issues. In particular, it is easily vulnerable to SPARQL-injection. Therefore, we strongly discourage the use of this technique in production environments. Nevertheless, some changes in the regular expressions are possible in order to prevent this kind of attack.

There is another different approach to publishing metadata: to embed it into the HTML content. W3C is pushing two complementary technologies, RDFa (Adida & Birbeck, 2007) and GRDDL (Connolly, 2007), which respectively encode into, and extract RDF data from XHTML documents.

Figure 6. A single message rendered as XHTML code with RDFa and GRDDL markup by SWAML.

```
<html xmlns='http://www.w3.org/1999/xhtml'
      xmlns:dcterms='http://purl.org/dc/terms/'
      xmlns:sioc='http://rdfs.org/sioc/ns#'
      xmlns:dc='http://purl.org/dc/elements/1.1/'>
    <head profile='http://www.w3.org/2003/g/data-view'>
    <link href='http://www-sop.inria.fr/acacia/soft/RDFa2RDFXML.xsl'
          rel='transformation' />
    <title>[swaml-devel] CfP: FEWS2007</title>
  </head>
  <body>
    <div about='http://example.org/swaml/post/2007-May/5'
         typeof='sioc:Post'>
      <h1 property='dc:title'>[swaml-devel] CfP: FEWS2007</h1>
      <p>strong>From: </strong>
        <a href='http://example.org/swaml/subscriber/s2'
           rel='sioc:has_creator'>Diego Berrueta</a>
      </p>
      <p><strong>To: </strong>
        <a href='http://example.org/swaml/forum'
           rel='sioc:has_container'>SWAML Devel</a>
       </p>
       <p><strong>Date: </strong>
         <span property='dcterms:created'>
          Tue, 15 May 2007 19:24:49
         </span>
       </p>
       <pre property='sioc:content'><!-- omitted --></pre>
       <p>Previous by Date:
         <a href='http://example.org/swaml/post/2006-Sep/4'
            rel='sioc:previous_by_date'>previous</a>
       </p>
       <p>Next by Date:
         <a href='http://example.org/swaml/post/2007-Mar/6'
            rel='sioc:next_by_date'>next</a>
       </p>
    </div>
  </body>
</html>
```

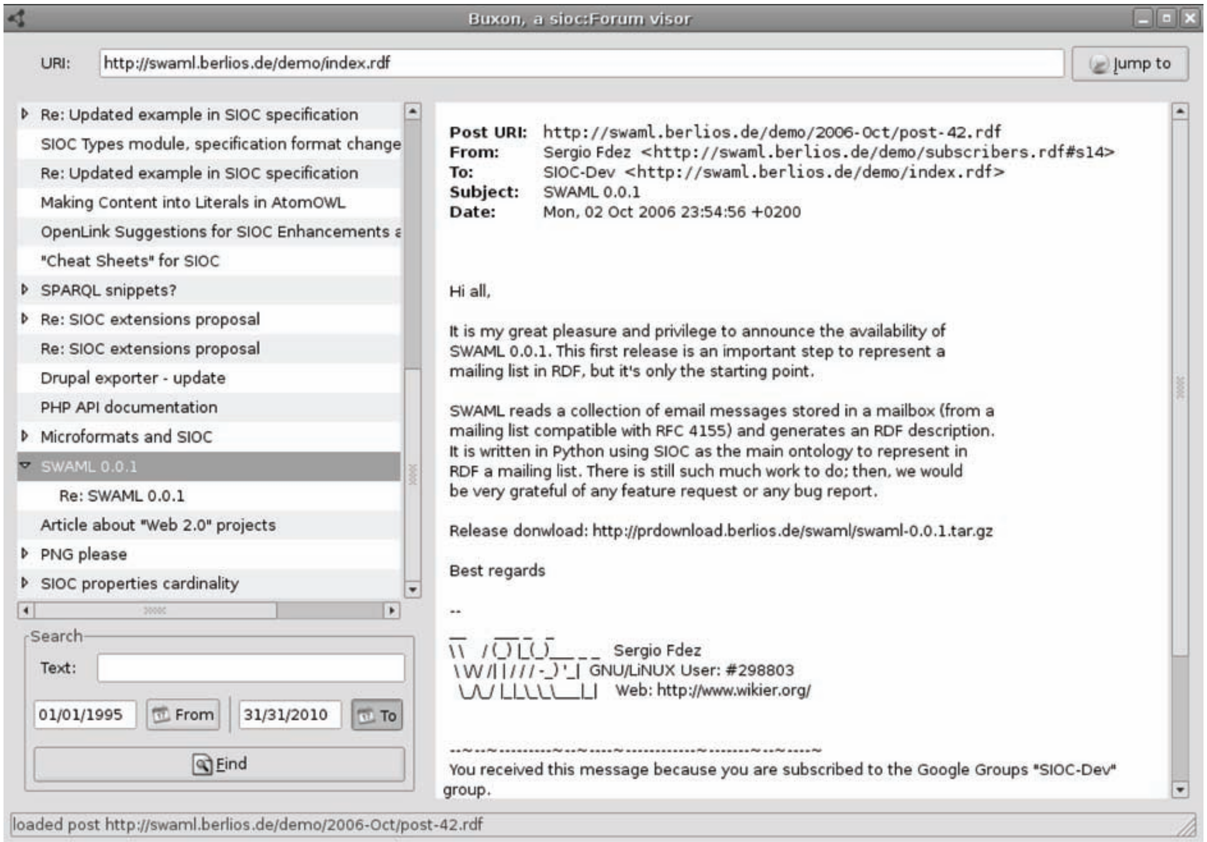
We have also explored this path. SWAML generates simple XHTML pages for each message to illustrate the usage of both RDFa and GRDDL. We must remark that these pages are just a proof-of-concept of the semantic enrichment, and they lack many of the fancy features and complex templates of the already-existent applications which generate plain HTML.

CONSUMING MAILING LIST METADATA

Buxon

Buxon is a multi-platform desktop application written in PyGTK. It allows end users to browse the archives of mailing lists as if they were using their desktop mail application. Buxon takes the URI of a sioc:Forum instance (for example, a mailing list exported by SWAML, although any sioc:Forum instance is accepted) and fetches the data, retrieving additional files if necessary. Then, it rebuilds the conversation structure and displays the familiar message thread list (see Figure 7).

Figure 7. Buxon browsing SIOC-Dev mailing list.



Buxon also gives users the ability to query the messages, searching for terms or filtering the messages in a date range. All these queries are internally translated to SPARQL (Prud'hommeaux & Seaborne, 2007) to be executed over the RDF graph. Newer versions of Buxon can send the sioc:Forum URI to PingTheSemanticWeb.com, a social web service that tracks semantic web documents. That way, Buxon contributes to establish an infrastructure that lets people easily create, find and publish RDF documents.

Other Browsers and Clients

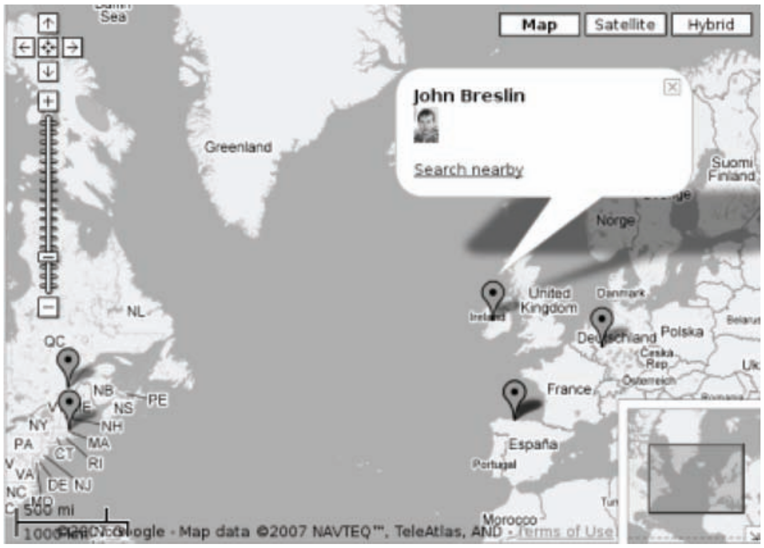
The SIOC RDF data can be explored and queried using any generic RDF browser, such as Tabulator (Berners-Lee et al., 2006). The most interesting applications appear when instances of sioc:User are linked to FOAF descriptions of these users. For instance, it is trivial to write a query to obtain the geographical coordinates of members of a mailing list and to codify them into a KML file (Ricket 2006), provided they describe their location in their FOAF file using the basic geo vocabulary (Brickley 2006). The KML file can be plotted using a map web service such as Google Maps (Figure 8).

It is also possible execute visualize the messages in a time line view using the Timeline DHTML widget by the MIT SIMILE project using a query like the one we propose in Figure 9.

EXPERIMENTATION

A corpus of RDF data with many foaf:Person instances was assembled by crawling and scrapping five online communities. There is a shared

Figure 8. Plotting the geographical coordinates of the members of a mailing list using KML and Google Maps.



topic in these communities, namely open source development; hence we expect them to have a significant number of people in common. We continue the work started in Berrueta et al (2007) to mine online discussion communities, and we extend it to new information sources. More details are described in Berrueta et al We use the following sources:

- *GNOME Desktop mailings lists:* All the authors of messages in four mailing lists (evolution-hackers, gnome-accessibility-devel, gtk-devel and xml) within the date range July 1998 to June 2008 were exported to RDF using SWAML.
- *Debian mailing lists:* All the authors of messages in four mailing lists (debian-devel, debian-gtk-gnome, debian-java and debian-user) during years 2005 and 2006 were scrapped from the HTML versions of the archives with a set of XSLT style sheets to produce RDF triples.
- *Advogato:* This community exports its data as FOAF files. We used an RDF crawler starting at Miguel de Icaza's profile. Although Advogato claims to have +13,000 registered users, only +4,000 were found by the crawler.
- *Ohloh:* The RDFohloh (S. Fernández, 2008) project exposes the information from this directory of open source projects and developers as Linked Data. Due to API usage restrictions, we could only get data about the +12,000 oldest user accounts.
- *Debian packages:* Descriptions of Debian packages maintainers were extracted from apt database of Debian packages in the main section of the unstable distribution.

Instances generated from these data sources were assigned a URI in a different namespace for each source. Some of these data sources do not directly produce instances of foaf:Person, but just instances of sioc:User. An assumption is made that there is a foaf:Person instance for each sioc:User, with the same e-mail address and name. These instances were automatically created when missing. This assumption obviously leads to redundant instances of foaf:Person which will be later detected by the smusher.

The ultimate goal of our experiments is to exercise the smushing processes described previously against a realistic dataset. Two million RDF triples were extracted from the sources described above, and put into OpenLink Virtuoso server which provides not only an effective triple store, but also a SPARQL endpoint that was used to execute queries using scripts.

We evaluated two smushers: the first one smushed foaf:Person instances assuming that foaf:mbox_sha1sum is an IFP; the second one smushed the same instances comparing their foaf:name labels for string strict equality, without any normalization. Both smushers were implemented using SPARQL CONSTRUCT rules. The newly created owl:sameAs triples were put in different named graphs. These links were analyzed to find co-occurrences of people in different communities.

Some communities use the e-mail address as their primary key to identify its users. However, other communities use a different primary key, thus allowing users to repeat their e-mail addresses. For instance, a small number of users have registered more than one account in Advogato with the same e-mail (these accounts have been manually reviewed, and they seem to be accounts created for testing purposes).

Our data acquisition process introduces a key difference between how user accounts are interpreted in Debian mailing lists and GNOME mailing lists. The former considers e-mail address as globally unique, i.e., the same e-mail address posting in different Debian mailing lists is assumed to belong to the same user.

On the other hand, a more strict interpretation of how Mailman works is made with respect to the GNOME mailing lists, where identical e-mail address posting in different mailing lists are assumed to belong to a priori different users. In the second case, we rely on the smushing process to merge the identities of these users.

Although they must be handled with extreme care due to the issues afore-mentioned, the combined results of the two smushing processes are consistent with the expected ones. For instance, there is a very high overlap between the Debian developers (maintainers of Debian packages) and the Debian mailing lists. Obviously, Debian developers are a relatively small group at the core of the Debian community, thus they are very active in its mailing lists. Another example is the overlap between Advogato and GNOME mailing lists. Advogato is a reputation-based social web site that blossomed at the same time that the GNOME project was gaining momentum. Advogato was

Figure 9. SPARQL query to extract the information required to visualize a time line of the messages posted to any sioc:Forum instance.

```
PREFIX sioc: <http://rdfs.org/sioc/ns#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dcterms: <http://purl.org/dc/terms/>
PREFIX dc: <http://purl.org/dc/elements/1.1/>
SELECT ?start ?title ?description ?link
WHERE {
  ?post rdf:type sioc:Post .
  ?post dcterms:created ?start .
  ?post dc:title ?title .
  ?post sioc:link ?link .
  ?post sioc:content ?description
}
```

passionately embraced by the GNOME developers, who used Advogato to rate each others' development abilities.

We also studied whether there are some people that are present in many of the communities at the same time. We chose communities which are closely related to each other, consequently, we expected a high number of cross-community subscribers. There are several people who are present in many communities. We can conclude that almost all the most active open source developers in our dataset are core members of the Debian community. Another interesting fact is that only a few people among the top members of the communities consistently use a single e-mail address and just one variant of their names. This fact proves the difficulty of the smushing process, but also its usefulness.

CONCLUSION AND FUTURE WORK

There are a lot of ongoing efforts to translate data already reachable on the web into formats which are semantic web-friendly. Most of that work focuses on relational databases, micro-formats and web services. However, at the time of this writing and to the best of our knowledge, e-mail was almost excluded from the Semantic Web. Our project, in combination with the generic SIOC framework, fills this gap, conveniently providing an ontology and a parser to publish machine-readable versions of the archives of the countless mailing lists that exist on the Internet.

Furthermore, the SWAML project fulfills a much-needed requirement for the Semantic Web: to be able to refer to semantic versions of e-mail messages and their properties using resource URIs. By re-using the SIOC vocabulary for describing online discussions, SWAML allows any semantic web document (in particular, SIOC documents) to refer to e-mail messages from other discussions taking place on forums, blogs, etc., so that distributed conversations can occur across these discussion media. Also, by providing e-mail messages in RDF format, SWAML is providing a rich source of data, namely mailing lists, for use in SIOC applications.

The availability of these data leads to some benefits. In the first place, data can be fetched by user applications to provide handy browsing through the archives of the mailing lists, providing features that exceed what is now offered by static HTML versions of the archives on the web.

Secondly, the crawlers of the web search engines can use the enhanced expressivity of the RDF data to refine search results. For instance, precise semantic descriptions of the messages permit to filter out repeated messages, advance in the fight against spam, or introduce additional filter criteria in the search forms.

Another consequence of no lesser importance is that each e-mail message is assigned a URI that can be resolved to a machine-readable description of the message. This actually makes possible to link a message like any other web resource, and therefore enriches the expressivity of the web.

Integration of the SWAML process with popular HTML-based mailing list archivers, such as Hypermail or Pipermail, would be a giant push to speed up the adoption of SWAML. It is well known that one of the most awkward problems of any new technology is to gain a critical mass of users. The semantic web is not an exception. A good recipe to tackle this problem is to integrate the new technology into old tools, making a smooth transition without requiring any extra effort from users. Merging the SWAML process into the batch flow of tools such as Hypermail would allow users to generate both RDF and production-quality, semantically enriched HTML versions of the archives.

So far, no semantic annotation relative to the meaning of the messages is considered. Obviously, such information can not be automatically derived from a RFC 4155-compliant mailbox. However, it is conceivable that it could be added by other means, such as social tagging using folksonomies, or parsing the metadata added by the authors of the messages using micro-formats or RDFa when posting in XHTML format. The inherent community-based nature of mailing lists can be exploited to build recommendation systems (Celma 2006).

We have also explored smushing techniques to spot redundant RDF instances in large datasets. We have tested these techniques with more than 36,000 instances of foaf:Person in a dataset automatically extracted from different online open source communities. We have used only public data sources, consequently, these instances lack detailed personal information.

We are aware of the extreme simplicity of our experimentation using label comparison. In our opinion, however, it contributes to show the potential of this smushing technique. We note that it is possible to have more usages for it, for instance, smushing not just by people's names, but also by their publications, their organizations, etc. Surprisingly, the named-based smushing finds a high number of redundant resources even if the comparison strategy for labels (names) is very simplistic (in this case, case-sensitive string equality comparison). More intelligent comparison functions should lead to a higher recall. In this direction, we are evaluating some normalization functions for names. We have also evaluated classical information retrieval comparison functions that take into account the similarity of the strings (e.g., Levenshtein); nevertheless, their applicability to compare people's names is open to discussion.

We believe that the ratio of smushing can be further improved if the dataset is enriched with more detailed descriptions about people. Experiments are being carried out to retrieve additional RDF data from semantic web search engines as a previous step to smushing.

We have implemented a smusher application for persons, and we intend to use it to further investigate the potential for the optimization of the smushing process. The way in which these techniques are translated into actual algorithms is critical to achieve a promising performance of the smushing process, especially for very large datasets. In parallel, increasing the precision of smushing will require to study how to enable different smushing strategies to interrelate and reciprocally collaborate.

ACKNOWLEDGMENT

The authors would like to express their gratitude to Dr. John Breslin and Uldis Bojārs from DERI Galway, whose support and contributions have been a great help to this work. Also thanks to Ignacio Barrientos for his contribution packaging SWAML for Debian GNU/Linux.

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This work was previously published in Social Web Evolution: Integrating Semantic Applications and Web 2.0 Technologies, edited by M. D. Lytras; P. Ordonez de Pablos, pp. 42-56, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 1.26
Social Semantic Web and Semantic Web Services

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ABSTRACT

In this chapter the authors aim to portray the social aspects of the World Wide Web and the current and emerging trends in "Social Web". The Social Web (or Web 2.0) is the term that is used frequently to characterize Web sites that feature user provided content as their primary data source and leverage the creation of online communities based on shared interests or other socially driven criteria. The need for adding more meaning and semantics to these social Web sites has been identified and to this end the Semantic Web initiative is described and its methodologies, standards, and architecture are examined in the context of the "Semantic Social Web". Finally the embellishment of Web Services with semantic annotations and semantic discovery functionality is described and the relevant technologies are explored.

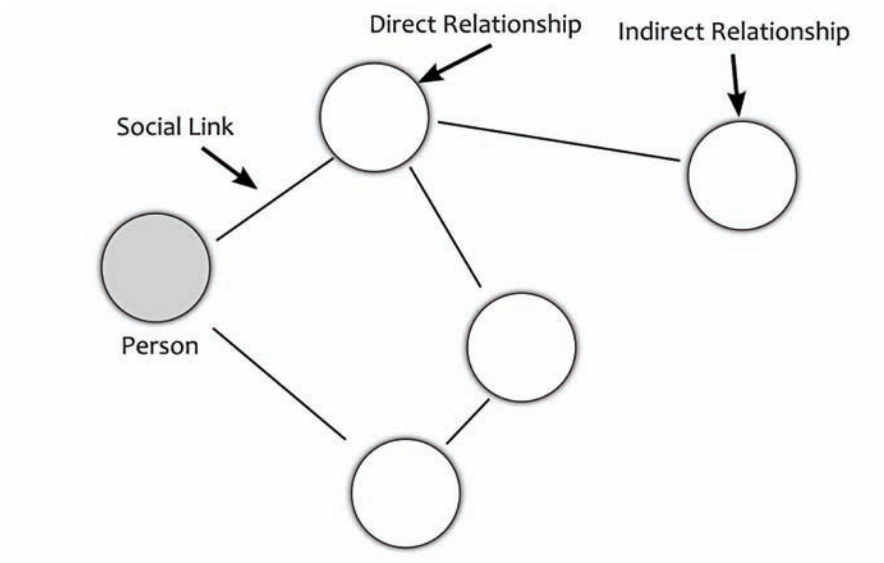
INTRODUCTION

The World Wide Web (WWW or, simply, the "Web") has been used extensively as a huge network of interconnected islands of data where documents are linked, searched for, and shared, forming a massive, albeit not always well organized, digital library. Sharing of digital content has always been the major requirement for the Web since its inception and will continue to be one of its most important features in the years to come. Nevertheless, what we experience nowadays is the endeavor for extending this sharing to cover also additional artifacts beyond plain documents, like data, information, and knowledge. The power of the hyperlinks, connecting different, possibly disparate entities, can also be exploited in order to connect information sources and people: not just "dumb" machine readable data but dynamic content like user profiles and ultimately people themselves for building virtual communities. The vision is that the current web of computers and documents will be broadened to the web of people. A "People Web" is the one where users are the nodes of the graph, the edges being their relationships and interactions in space and time, thus constructing new virtual societies (see Figure 1).

This new environment is leveraged by the introduction of an array of technologies collectively identified as Semantic Web (Berners-Lee, Hendler, & Lassila, 2001). The Semantic Web builds upon the existing Web and provides the necessary sub-

DOI: 10.4018/978-1-60566-340-1.ch011

Figure 1. A social graph



strate for giving "meaning" and "Semantics" to Web resources and Web interactions. The benefits will be many in a number of application domains and while the challenges, technological and other, are numerous, the momentum is strong and the Semantic Web slowly but steadily enters in a number of diverse domains like health and life sciences.

Furthermore the Semantic Web promises a great potential for supporting the construction and smooth operation of Web communities of people. In this chapter we study its fusion with social software and software for machine to machine communication over the Web for supporting this vision.

BACKGROUND

Since its launching in 1990, the Web has grown exponentially both in terms of size and in terms of use and utility to people and organizations. The inherent simplicity of hypertext and its feature limited, in comparison to previous hyper linking systems, one-way, inexpensive links (Universal Resource Identifiers – URIs) but also the employment of the Internet as its networking substrate led to its wide adoption and success.

In spite of its success and popularity the early version of the Web lacked in many respects, ranging from user accessibility and user interface design to the ability to repurpose and remix existing Web-based data in not pre-established ways. Although the hyper linking facility allowed the interconnection of different documents on the Web, the "traditional" Web suffers from fragmentation in the sense that the huge graph lacks any organization and discipline. This "anarchy" in the Web has also been its driving force for the success it has enjoyed so far but created the need for having special machinery, e.g. search engines like Google, to deal with the efficient indexing and discovery of the available information. Despite the fact that the search engine technology has made important steps in indexing and searching massive amounts of data on the Web, there's still the issue that keyword based searching is limited on its potential and usually finding "what the user wants" proves to be a tedious task. Another major limitation of this environment is that the people are not part of the equation. Users are expected to be the actors triggering the Web interactions but they are not allowed to participate and be involved enough in these interactions:

- Content delivered is not personalized. What the user gets back is usually not in-line with her interests or other preferences and there's no feedback link going from the user back to the system she interacts with so as to guide future interactions.
- Contextual information is not taken into consideration. The people as complex systems do not act in an easily predetermined way and the context of their actions is usually ignored or not taken advantage of. This context information ranges from the user's profile, which is also dynamic in nature, to the specific objective she/he is trying to achieve at a specific point in time.
- Content is passive and static, stored and maintained in back end databases, which the users do not have the ability to enrich or customize to their own needs
- Communication and collaboration of the users to build Web communities are not supported enough. Discussion forums were the sole way to build such communities but with no means to support intelligent integration of the different forums or to enhance the user collaboration experience.

These and other requirements are the ones that the Social Web tries to tackle. Social Web does not represent a shift or radical change in technology per se but rather a shift on the perception of the human – machine interaction by placing the users in the centre of the system and in control of these interactions. But from the other end of the spectrum there is also a clear need for making the Web itself more intelligent to support these machine facilitated social interactions. The Semantic Web could provide for such an enabling technology and recently the convergence of the Social and the Semantic Web and the experimentation of the two working in complementary ways have gained a lot of attention and research interest.

SOCIAL WEB OR WEB 2.0

The situation described in the previous section led to the emergence of a new breed of Web applications and sites that were collectively identified as "Web 2.0" by Tim O'Reilly (2005) and whose major design principle is to "*harness network effects to get better the more people use them"*. The value of "Web 2.0" sites and applications therefore comes to a large extent by the number of users participating and actively communicating and sharing through them so the term "*Social Web*" is actually a synonym. The social nature of this Web is evident when the collaboration of people and their active contribution is considered. The very essence of such sites is the building and maintenance of Web based *virtual communities* of people that produce and maintain *collective knowledge*. Examples of such community oriented and social networking sites include:

- Blogs, i.e. Web sites managed by individuals that provide news or opinions on certain subjects (typically personal online diaries), where typically other people are able to leave comments. In addition to comments, the hyperlinking facility of the Web has been extensively used to provide "trackbacks" (i.e. reverse hyperlinks that identify who is talking about me) and recommended blogs ("blogrolls"). Therefore blogging has been emerged as a method for anyone to publish content on the Web and building online communities of people that communicate, share, and integrate.
- "Social bookmarking" sites (e.g. http://del.icio.us/) where users can store and share their bookmarks with the additional possibility to provide metadata through the

means of tags, i.e. terms that denote concepts, meaning, intent, etc. These sites provide for user maintained and collaborative indexing of the Web content in a way that it may be more efficient to search there for something than in general purpose Web search engines.
- "Wikis" (e.g. http://en.Wikipedia.org), which are collaboratively built Web sites where the users, through custom made and user friendly interfaces, are able to create, share, enhance, and manage the content.
- Content sharing sites, e.g. YouTube (http://www.youtube.com/) for videos or Flickr (http://www.flickr.com/) for photographs, where the users upload their multimedia content and share it online with other users.
- Social networking sites, such as Facebook (http://www.facebook.com/) and MySpace, for online communities of people who share interests and activities or who are interested in exploring the interests and activities of others.
- Classified advertisement sites, e.g. Craigslist (http://www.craigslist.org), which offer advertisements for jobs, resumes, services, etc. grouped in categories.

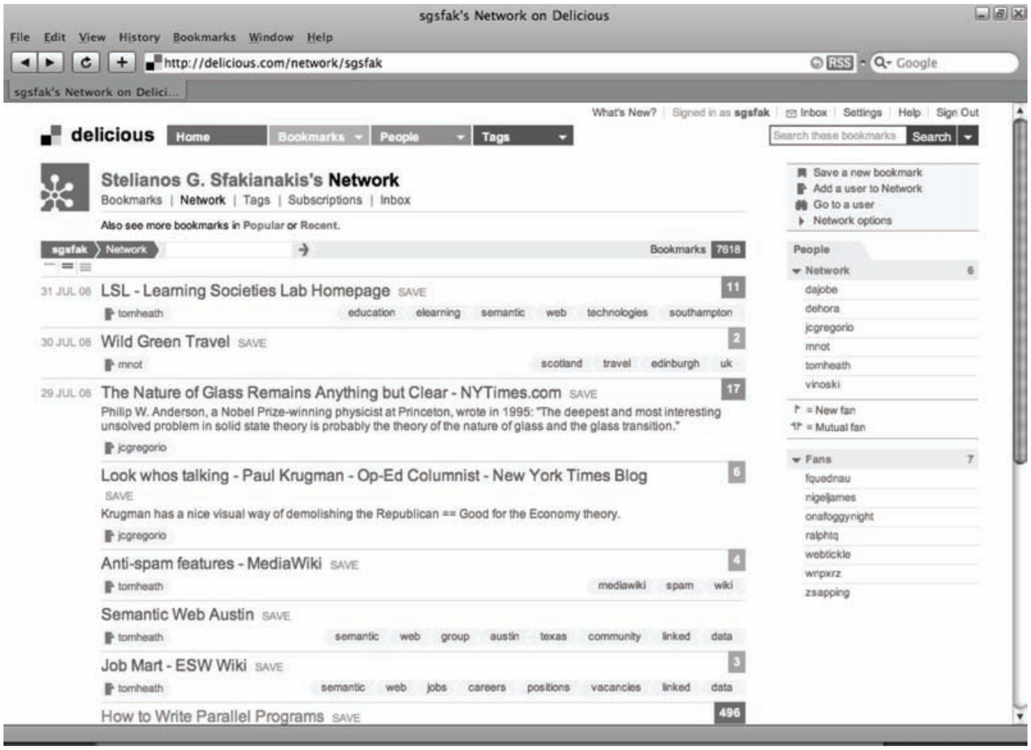
If we take only "Wikis" as an example we can see that these Web sites have been used in a multitude of ways:

- As online encyclopedias, e.g. Wikipedia
- As free dictionaries, e.g. Wiktionary (http://en.wiktionary.org)
- As free libraries of educational books, e.g. Wikibooks (http://en.Wikibooks.org)
- As software development repositories and issue tracking systems, e.g. Trac (http://trac.edgewall.org/)
- As open forums to promote research interests, like OpenNetWare (http://openwetware.org/) for biology and biological engineering
- As open educational centers to support learning activities, e.g. Wikiversity (http://en.Wikiversity.org/)
- As social event calendars, like Upcoming (http://upcoming.yahoo.com/)

The single distinctive feature of Wikis and a central trait of the social Web sites is the *user generated content* and its "open" editing: anyone can edit an existing Wiki article or create a new one for a particular topic if it doesn't exist already. The users therefore are responsible for adding content and maintaining the information that is available from these sites. Of course such an approach can raise a lot of concerns about the validity of the content, the lack of authority, etc.[1] and there have been cases in the past where such skepticism was proven true, such as the Seigenthaler incident[2]. Nevertheless this open model has worked quite well in practice and in general so that at the time of this writing Wikipedia is considered by many a serious competitor to the Encyclopedia Britannica. The reason for this can be explained as another instantiation of the "wisdom of crowds" phenomenon (Surowiecki, 2004): the participation of many people, possibly with different background, habits, way of thinking, and so on, in a decision making process usually yields better results than when the individual opinions are considered separately from one another.

The contribution of user content and the sharing of the uploaded information are the main forces for the formation of *online communities* of people. In Figure 2 an example of this community creation process is shown for the Del.icio.us online bookmarking site. Online bookmarking sites like this provide the means for storing and organizing bookmarks of Web sites on the Web instead of the users' desktop browsers. By storing their bookmarks in a central area the users are additionally enabled to create their online social

Figure 2. Del.icio.us networks of users



networks by registering other users as members of their network so that they can be notified about the bookmarking activity of these users. These networks therefore connect users with their friends, family, coworkers, or even totally strangers when they unexpectedly meet each other on the Internet and discover they have similar interests. Facilitated by these network links the users can subsequently observe each other's online behavior and even proactively send interesting Web sites addresses to their peers, easier and quicker than using email or instant messaging.

What the previous examples show is that in the Social Web users are in the limelight: they are the primary actors in the data sharing process through their contributions and online behavior. They are usually indulged by the low cost entry and participation in these Web sites, and, to a lesser extent, by the visual appeal the Web 2.0 sites offer to the viewer. The modern Web sites are actually Rich Internet Applications (RIA), where the majority of the business and control logic resides on the client (i.e. the Web browser), leveraged by technologies like AJaX[3] and Comet[4] which provide more responsive user interfaces.

The Social Web offers a meeting point for people to collaborate and share information in an open environment. The openness is a distinctive characteristic of Web 2.0 and it's supported by Open Data APIs like content syndication via RSS/Atom[5] and lightweight Web services interfaces like Open Search[6] . These technologies enable the view of Web sites as Web applications and their synthesis ("mashup") in more complex applications. An example of such combination of existing Web sites and their data to create new/aggregated content is Housing-Maps (http://www.housingmaps.com/) where houses to rent or buy are located through Craiglists and projected over geographic maps drawn from Google Maps (http://

maps.google.com) so that a user can easily locate the information he wants in an interactive and visual way. A more general and reusable way to combine and "mix" content from different Web sites is offered by Yahoo! Pipes[7] which can be thought of a simple but effective way to build "workflows" and "dataflows" on the Web.

The above discussion shows that collaboration between people but also between Web sites/applications supports the notion of "collective intelligence" to the Social Web. An instance of this intelligence built collectively is the creation of "folksonomies" for categorization of resources. A quite popular way of classifying content in Web 2.0 Web sites is through "tagging". A tag is a keyword which acts like a subject or category. The user is allowed to attach whatever keywords she wants to identifiable content such as links in the case of social bookmarking, or videos and photographs in the case of digital content sharing. The important thing is that tags can be shared, used in searches, or recommended based on the choices of other users for the same content.

The new term "folksonomy", as a fusion of the words "folks" and "taxonomy", has been suggested to describe this method of classifying content through tags that are collaboratively generated and shared. Of course these "poor man's" classification schemes are informal in nature, could contain duplication in meaning, or be simply erroneous but again they are contributed by the users and the more people contributing the more robust and stable these "folksonomies" become. A self adapting and auto regulating method is usually followed through the use of tag clouds (Figure 3). In simple terms a tag cloud is a visual representation of a user's tags where each tag is weighted based on the user preferences and how many times he has used the tag. Through such an approach "good" tags are likely to prevail assuming that the user participation is high.

Collaboration, sharing, "mashing", annotating and "tagging" content are roughly the distinctive features of Web 2.0 and although in most of the cases the approach is not formal or the solutions are suboptimal the user participation and their socialization needs have driven the evolution of Web of documents to the Web of People (Ramakrishnan & Tomkins, 2007).

SEMANTIC WEB

To the other end of the spectrum, with roots in Artificial Intelligence research, the Semantic Web emanated as an extension to the current version of the Web that aims to enhance it by the promotion of higher level sharing and integration of data and information. According to Berners-Lee et al. (2001):

The Semantic Web is not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation.

The Semantic Web aims to support the representation and exchange of information in a meaningful way so as to make possible the automated processing of descriptions on the Web. The objective is to enrich the unstructured information in the current Web with machine processable descriptions of the Semantics in order to make its navigation and exploration by software agents as easy as it's for the human users today, or even easier. In this context Semantic Web promotes a shift from the current "syntactic" world to the future "Semantic" world of services, applications, and people and aims to make the machine to machine communication feasible so that not only data but also information and finally knowledge are shared.

The Semantic Web Technology Infrastructure

In technological terms the Semantic Web architecture consists of an array of technologies that can roughly be visualized in a layered design layout as depicted in Figure 4. The basic infrastructure in

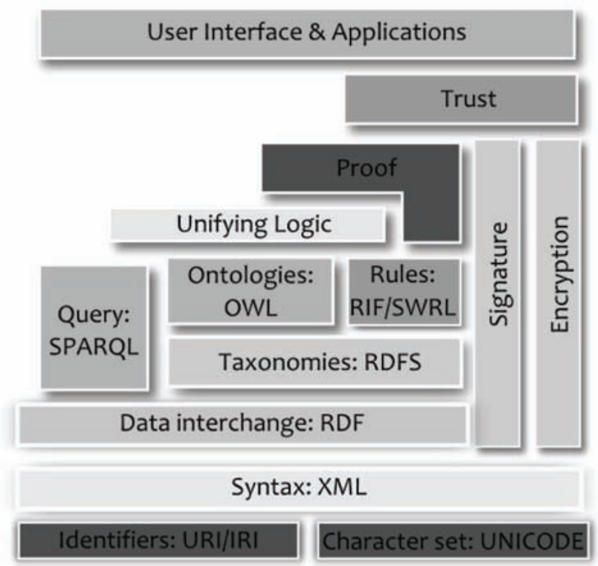
Figure 3. A tag "cloud"

the bottom layers in this stack of technologies is the exactly the same to the syntactic Web: Uniform Resource Identifiers (URIs) used for identification of Web resources, universal encoding schemes for characters, i.e. Unicode, and XML and its related technologies (e.g. XML Namespaces) as a ubiquitous data serialization format. Some of the upper layers like Proof and Trust are missing or are work in progress. Here we will concentrate on the middle layers where the core infrastructure technologies of the Semantic Web reside: RDF, RDF Schema/OWL, and SPARQL.

The *Resource Description Framework* (RDF) is a syntax neutral data model that enables the description of Web resources in a simple way (Lassila, Swick, et al., 1999). At the core of RDF there is a model for representing and describing *resources* through named *properties* (also known as *predicates*) and their values. The resources can be anything that can be identified with a URI. Although in the initial specification of RDF resources were limited to Web documents and Web sites, it is possible and quite frequent in practice to describe, by the means of RDF and the various URI schemes, real world entities like people, or more abstract things like relationships and concepts. The use of URIs and especially the HTTP based ones for identifying persons or other physical entities may seem strange at first but this is in compliance with the architecture of the World Wide Web (Berners-Lee et al., n.d.) which strongly suggests the use of URIs for identifying anything that can be of importance irrespective of how abstract or tangible it may be.

The properties serve both to represent attributes of resources and to represent relationships between resources. They are also identified though URIs to make them unique. The combination of resources and the properties that connect them builds the simple RDF data model. In this data model the primary informational building block is the "triple" which denotes the subject – property - object expressions (Figure 5). The subject denotes the resource, and the predicate denotes

Figure 4. The Semantic Web stack of technologies



traits or aspects of the resource and expresses a relationship between the subject and the object. Since an object of a triple can be the subject of another one, a set of RDF triples forms a *directed graph* where the RDF resources, both subjects and objects, are the nodes of the graph and the predicates are the labeled arcs. As an example, in Figure 6 there's a simple RDF graph. The graph shown in the figure describes an entity identified through the URI "http://ssfak.org/stelios/", apparently denoting a person, which has a "name" property with the value "Stelios Sfakianakis", a property denoting the homepage of an organization a person works for relating it to the resource "http://www.ics.forth.gr/cmi-hta/", and a "maker" property that connects it (backwards, as an object) to the resource identified as "http://ssfak.org".

RDF as an abstract model is independent of any specific serialization syntax. The normative representation syntax for RDF graphs is XML but more lightweight formats, such as Turtle (Beckett & Berners-Lee, 2008), exist.

The simplicity and flexibility of RDF is evident but in certain cases its generality must be formally confined so that software entities are able to correctly exchange the encoded information. For example, stating that an animal is the creator of a Web page does not make sense in the real world but RDF does not forbid anyone for making such a claim. Ontologies (Uschold & Gruninger, 1996) provide such a tool to specify what can be expressed in the context of an application domain or in a real world scenario, what is the underlying meaning, and how the information presented can

Figure 5. RDF Data Model

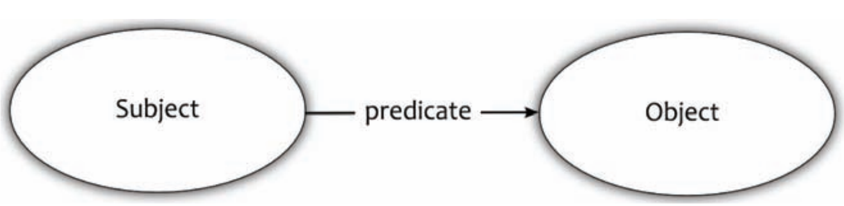
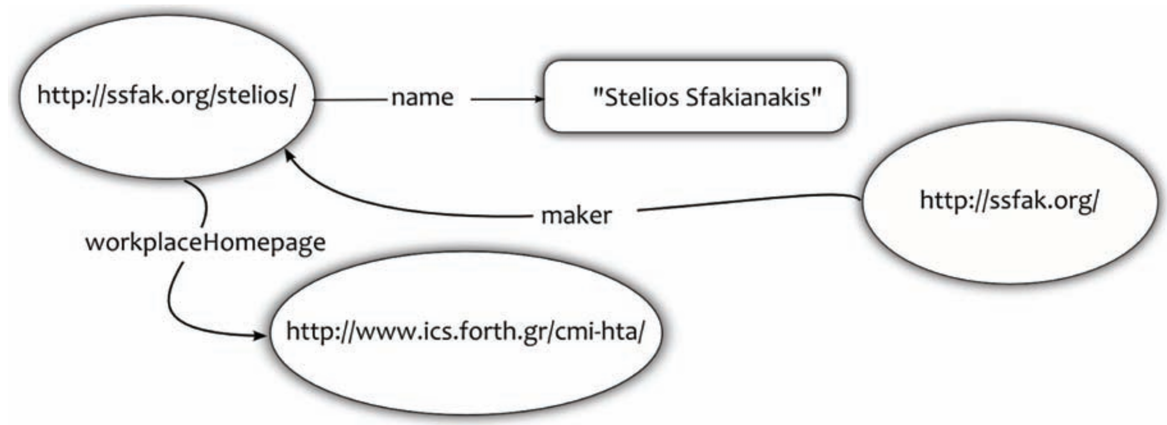


Figure 6. Abstract representation of RDF triples



be further processed to generate more information. Moreover ontologies and their less powerful relatives like taxonomies and thesaurus provide the means for achieving a common interpretation of a domain and a shared understanding of the concepts and relationships involved. In the Semantic Web there are two main technologies for providing such rigor: RDF Schema and OWL (Brickley & Guha, 2004; Dean, Schreiber, et al., 2004). RDF Schema provides the means for defining classes, class hierarchies, properties, property hierarchies, and property restrictions. Its expressive power is basically limited to the representation of concepts, their relations, and taxonomies of concepts. On the other hand the Web Ontology Language (OWL) was introduced to address the need for more expressiveness and extends the RDF Schema by providing three variants: OWL-Lite, OWL-DL, and OWL-Full. Without delving into details, the different species of OWL provide different degrees of expressiveness and are able to define existential restrictions, cardinality constraints in properties, property types like inverse, transitive, and symmetric, and a lot more. The added features of OWL allow the ontologies built in conformance to it to be formally treated and the data represented are amenable to "reasoning" and inference, i.e. they can be processed according to formal logic rules to deduce new information. All these happen on the basis of the Web infrastructure: RDF resources and their URI references are used, the open world assumption is followed, since partial information on the Web is a quite frequent phenomenon, and the ontologies themselves can be freely intermixed and meshed since hyperlinks are employed everywhere.

Since RDF is the common interchange and representation model of information, the Semantic Web transforms the hyperlinked syntactic World Wide Web to a huge database or a Global Giant Graph, as Tim Berners-Lee put it. The standard query language for this huge database is SPARQL (Prudhommeaux & Seaborne, 2008), which is similar to SQL. In addition to the query language the SPARQL standard defines an application protocol for the submission of queries to RDF sources and the retrieval of results. With the query language and the access protocol defined, the SPARQL specifies a Web friendly interface to RDF information, whether this is actually stored as RDF triples or not. It is therefore feasible to make SPARQL queries to relational or other databases through an appropriate wrapper or transformation process that translates, either online or in some preprocessing step, the internal data to an RDF compliant format. As a result these Semantic Web technologies enable the connection of data between different and heterogeneous data sources, effectively allowing data in one data source to be linked to data in another data source. (Bizer, Heath, Idehen, & Berners-Lee, 2008)

SOCIAL SEMANTIC WEB

In recent years the cross pollination of Semantic Web technologies and Social Networking has emerged as an interesting roadmap. The Semantic Web technology can significantly enrich and expedite the Social Web in order to establish the *Semantic Social Web* (*Greaves, 2007;*Gruber, 2007*).* In the Semantics-enabled social Web content can be easily connected, integrated, navigated, and queried so that the benefits of today's Social Web can be greatly enhanced and augmented beyond the limited user experience offered by social networking sites alone or the restricted keyword based search and matching.

What does the Semantic Web offer to the Social Web? First and foremost, the Semantic Web technologies can be used to provide rigor and structure to the content of the user contributions in a form that enables more powerful computation. Currently social Web applications are more focused on the distribution and the management of content and the social interactions around it rather than the provision of Semantically rich descriptions of the data. Although there are popular, "low end" technologies like "microformats" and tagging/"folksonomies" to cater for the annotation and the description of data, these seem to be ad hoc and unstructured efforts in comparison to the formal Web ontologies and metadata descriptions. On the other hand, as already described, the Semantic Web promotes the global distribution and integration of resources in a single, giant, interoperable graph. So, additionally, the standards and infrastructure of the Semantic Web can enable data sharing and computation *across* independent, heterogeneous social Web applications.

Furthermore, the Semantic Web can enhance the Social Web with additional intelligence as Jemima Kiss (2008) wrote:

If Web 2.0 could be summarized as interaction, Web 3.0 must be about recommendation and personalization.

An example of such added value is the case of Semantic Wikis (e.g. Schaert, 2006; Völkel, M., Krötzsch, M., Vrandecic, D., Haller, H., & Studer, R., 2006). The Semantic Wikis support the annotation with Semantics descriptions the links and the content they provide and take advantage of these annotations for providing more intelligent search and navigation. The annotation is usually done by some extended version of the Wiki editing syntax so that every link to another page or any important attribute of the current page is annotated with a property identifier. For example in a Semantic Wiki's page about the Europe the amount of its population, which is a number, can be wrapped with the appropriate metadata that denote that this number represents the population. Such metadata annotation makes structured search easy, e.g. for queries like what is the population of Europe, or which continents have population above a certain amount. Additionally it facilitates the users in providing more active content in the pages by incorporating "online queries" in the Wiki pages, in the sense that the page's content can be dynamically generated by the results of these queries on the metadata annotations. Although the details may vary from one implementation to another, there's usually an underlying model based on RDF and OWL to support these Wikis and the content can be exported in a Semantic Web compliant format. DBPedia is an interesting example of a truly Semantic Web Wiki which offers the content of Wikipedia in a machine-readable and searchable format (Auer et. al., 2007).

In another application area, Semantic Web technologies can facilitate the browsing experience of people and the searching capabilities of the Web search engines. Unlike traditional search engines, which "crawl" the Web gathering Web pages information, Semantic Web search engines index RDF data stored on the Web and provide an interface to search through the crawled data. Because of the inherent Semantics of RDF and the other Semantic Web technologies, the search and information retrieval capabilities of these search engines are potentially much more powerful than those of current search engines. Examples of such early Semantic Search Engines include the Semantic Web Search Engine (SWSE, http://www.swse.org/), Swoogle (http://swoogle.umbc.edu/), and Zitgist Search (http://www.zitgist.com/). These and other Semantic Web search engines explore and index the documents of the Semantic Web and its ontologies by the means of user friendly interfaces that hide the details and complexities of the technology.

Blogs, which are one of the most prominent examples of the Social Web, can also be enhanced with Semantics. Augmenting a blog with content and structural metadata is usually called Semantic Blogging (Cayzer, 2004; Bojars, Breslin, & Moller, 2006). Putting Semantics in a blog's contents means that the topic of the content is described in a machine processable way. On the other hand describing the structure of the blog Semantically entails the description of the entities that compose it: the posts, the comments, the users, etc. To this end there are a number of efforts to make the Semantic Web more social by building new ontologies to support people in their social interactions and provide Semantics to the Social Web. Two of such ontologies, SIOC and FOAF, are of particular importance in the context of Semantic Blogging and are described below.

SIOC

Existing online community sites usually provide rich information for specific interest groups but they are isolated from one another, which makes difficult the linking and merging of complementary information among different sites. The Semantically-Interlinked Online Communities (SIOC) project aims to link online community sites using Semantic Web technologies. It defines methods to describe the information that communities have about their structure and contents, and to find related information and new connections between content items and other community objects. SIOC again is based around the use of *machine-readable information* provided by these sites.

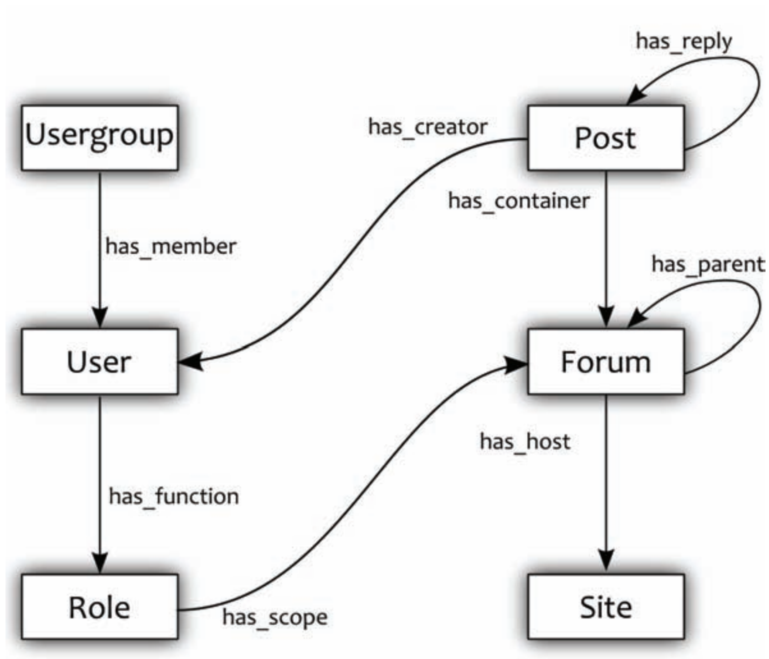
The main entities of SIOP are shown in Figure 7 and it's easy to see the role and the function of the main concepts. The entity Site refers to the location of an online community or set of communities, which hosts one or many blogs. A Forum can be thought of a discussion area on which posts are made. In a Forum a number of posts are contained where a Post represents an article or a message send by a user to the forum. Posts can be connected as people reply to previous posts and these connections can cross site boundaries since the identifiers of posts (as well as any Semantic Web resource) are universal and unique.

From the figure above it can be said that SIOP defines a common schema for the different blog sites and discussion forums. This of course needs not be their internal schema but a common, shared, and standard representation of their information model. Adopting SIOP therefore is a major step in achieving the integration of social content in Web 2.0.

FOAF

The Friend-Of-A-Friend (FOAF) project focuses on expressing mostly personal information and relationships in a machine-readable form. A central entity in the FOAF vocabulary and the one most frequently used is the Person (Figure 8). According to FOAF a Person may have names, e-mails, interests, publications, etc. It can also be connected to other resources like the Web site of the organiza-

Figure 7. The main classes and relationships of SIOC



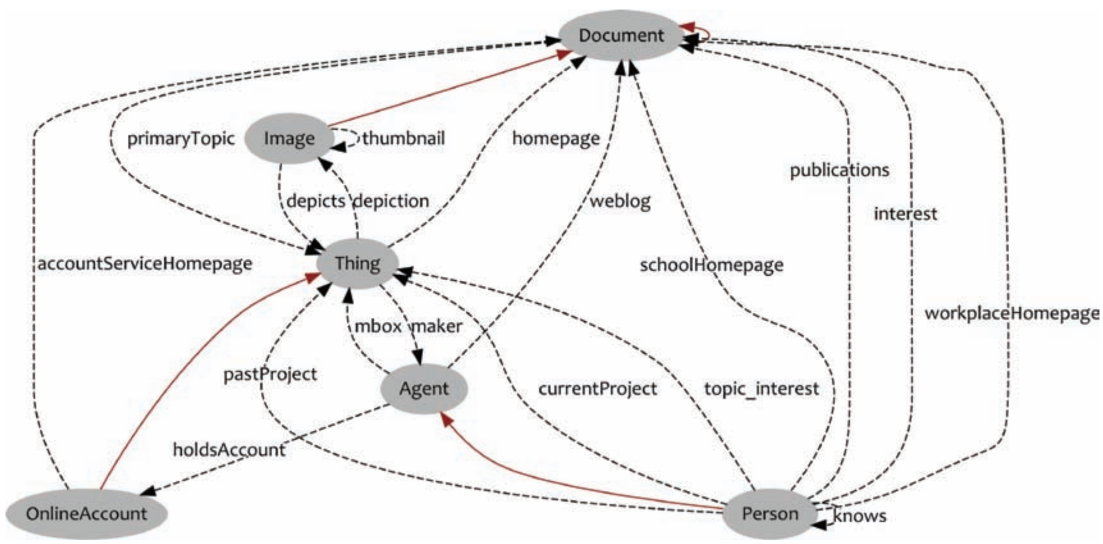
tion he/she works for (foaf:workplaceHomepage property), a personal blog site (foaf:weblog), the Website of his/her school (foaf:schoolHomepage), or to other people that he/she knows (foaf:knows). A lot of personal information can be therefore represented and parts of the real world's social graph can be inferred by following the foaf:knows relationship.

Of particular importance to the Social Web is the support the FOAF vocabulary offers to link the physical persons (foaf:Person) to the accounts they hold in a number of social Web sites (e.g. Flickr, Facebook) through the foaf:holdsAccount property. It is therefore possible through a single FOAF document that could be indexed in a Semantic Search engine to join all these different accounts and the information each of them exposes. Integration of different social content and behavior can be achieved and the resulting graph of information is searchable in an unambiguous and machine interpretable way.

Semantic Web Services

Application integration requires an agreed infrastructure to be in place for the exchange of information over the network. Over the last couple of decades there have been several attempts for defining such an infrastructure, such as Sun/RPC, CORBA, Microsoft's DCOM, Java RMI, and others. Currently Web Services are the favorite and most popular technology for building distributed systems over the Internet. As a middleware technology Web Services represent a new generation that tries to mitigate the problems of legacy integration technologies such as CORBA by adopting a more Web friendly substrate. Such a different approach seems to be needed in order to support business-to-business integration over the Internet where crossing organization borders has implications on the security, interoperability, scalability, maintenance, flexibility, and other aspects of application integration. In order to achieve these goals the Service Oriented Archi-

Figure 8. The main classes and relationships of FOAF



tecture (SOA) has been proposed. Informally speaking, in such architecture (Web) Services are network accessible entities that offer a number of functionalities to their callers. The SOA environment should be highly dynamic as suggested by a number of real world phenomena, like network instability, changing real world requirements and settings, etc. The need for "late binding" of services and clients is important and Figure 9, depicting the main entities of SOA and their interactions, shows that a middle service repository or registry is introduced. This repository stores "offers" of functionality as these are published by service providers, and subsequently performs matching with the corresponding "requests". After some matching has been performed the corresponding parties (services and their clients) are free to communicate and exchange data.

On the technology side Web Services put more emphasis on the following:

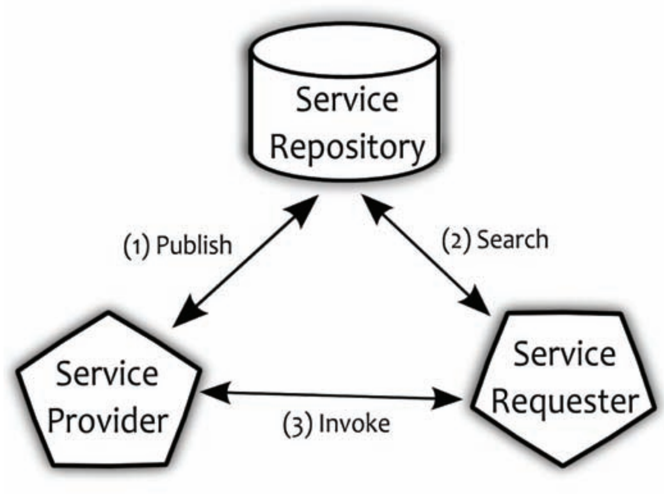
- Transport over widely accepted Web and Internet protocols like HTTP/HTTPS and SMTP
- XML message payloads to provide the extensibility, introspection, and interoperability required in building complex multi party systems
- Platform and programming language independence

The Web itself is built around these very directions: open protocols, text based (markup, e.g. HTML) message and document content, and abstraction over implementation details. In essence the underlying infrastructure is roughly based on the following technologies:

- SOAP messaging format, which is based on XML, to provide a wrapper format and protocol for data interchange between Web services
- Web Service Description Language (WSDL) documents to describe the services' functionality and data exchange

On top of these a number of standard technologies have been specified for handling discovery (UDDI), security (WS-Security), trust (WS-Trust), composition (WSBPEL, WSCL), etc. Nevertheless for this discussion the WSDL standard is the most pertinent specification because it specifies

Figure 9. Web service architecture



in a machine readable format the structure of the XML messages exchanged.

Integration of computation and functionality is an additional field where Semantic Web shows a great potential of use because the Web Services, at their present incarnation, provide syntactic interoperability only. The WSDL service descriptions are restricted to the syntactic aspects of service interaction: how the service can be invoked, which operations may be called, what are the number and the type of the parameters each operation needs, etc. However, what the service does and in what order its operations have to be called in order to achieve certain functionalities is usually described only in natural language either in the comments of a WSDL description or in UDDI entries or other documentation. *Semantic Web Services* (McIlraith, Cao Son, & Zeng, 2001) is an "umbrella" definition to include the annotation of existing Web services with Semantics and their publication, discovery, and composition.

The vision again is to make feasible the machine to machine communication by providing machine interpretable descriptions of the services. Such descriptions will make possible the automatic discovery, composition, and invocation of services. Because of this a lot of efforts in metadata descriptions are centered on the Semantic Web and its technologies, namely RDF and OWL. In the area of the Semantic Web Services the following technologies and standards are relevant to the Semantic description of Web services:

- **UDDI (Universal Description, Discovery and Integration)** allows the discovery of potential business partners on the basis of the services they provide. Each business description in UDDI consists of a businessEntity element that describes a business by name, a key value, categorization, services offered (businessServices) and contact information for the business. Each businessService element contains descriptive information such as names and descriptions, and also classification information describing the purpose of the relevant Web service. Using UDDI, a Web service provider registers its advertisements along with keywords for categorization. A Web services user retrieves advertisements out of the registry based on keyword search. So far, the UDDI search mechanism relied on predefined categorization through keywords, but more recently specifications to use OWL in UDDI are emerging as a uniform way to express business taxonomies.

- **Semantic Annotations for WSDL and XML Schema** (SAWDL; Kopecký et. al., 2007) is a means to add Semantics inline to WSDL. It is actually a set of extensions to WSDL 2.0 but can also be used for WSDL 1.1. With these extensions the service provider can attach references to Semantic concepts for the functionality of an operation or the type/meaning of a parameter and additional information for the transformation (mapping) of the XML data either to ("lift") or from ("lower") the corresponding Semantic terms. The Semantic domain model used is external to these annotations and could be expressed in OWL or other ontology language of choice.
- **OWL-S** (formerly DAML-S) builds on top of OWL and allows for the description of a Web service in terms of a Profile, which tells "what the service does/provides", a Process Model, which tells "how the service works", and a Grounding, which tells "how to access the service" (Martin et al., 2004). The service profile describes what is accomplished by the service, any limitations on service applicability and quality of service, and requirements that the service requester must satisfy in order to use the service successfully. The process model gives details about the Semantic content of requests, the conditions under which particular outcomes will occur, and, where necessary, the step by step processes leading to those outcomes. In the process model a service can be described as an atomic process that can be executed in a single step or a composite process that, similar to a workflow, can be decomposed in other processes based on control structures like 'if-then-else' and 'repeat-while'. Finally, Grounding descriptions supply information about the communication protocol and other transport information (such as port numbers) and the message formats and serialization methods used in contacting the service. The only currently specified grounding mechanism is based on WSDL 1.1 and will be extended to WSDL 2.0 as soon as it's finalized.
- **The Semantic Web Services Framework (SWSF)**, initiated by the Semantic Web Services Initiative (SWSI, 2004), includes the Semantic Web Services Language (SWSL) and the Semantic Web Services Ontology (SWSO). SWSL is a logic-based language for specifying formal characterizations of Web service concepts and descriptions of individual services. SWSO is an ontology of service concepts defined using SWSL and incorporates a formal characterization ("axiomatization") of these concepts in first-order logic.
- **WSMO (Web Services Modeling Ontology)** defines the modeling elements for describing several aspects of Semantic Web services (Feier et al., 2005). These elements are Ontologies, which provide the formal Semantics to the information used by all other elements, Goals which specify objectives that a client might have when consulting a Web service, Web services that represent the functional and behavioral aspects which must be Semantically described in order to allow semi-automated use, and Mediators that are used as connectors and they provide interoperability facilities among the other elements. It also defines the Web Service Modelling Language (WSML) which formalizes WSMO and aims to provide a rule-based language for the Semantic Web.
- **BioMOBY** (http://www.biomoby.org/) is a Web Service interoperability initiative in the field of bioinformatics aiming to facilitate the integration of Web-based bioinformatics resources. Currently there

are two approaches to achieve such integration: The first approach, based on the Web Services paradigm, is referred to as "MOBY Services" (MOBY-S), while the second one is called "Semantic MOBY" (S-MOBY) and is based on concepts from the Semantic Web. MOBY-S uses a set of simple, end-user-extensible ontologies as its framework to describe data Semantics, data structure, and classes of bioinformatics services. These ontologies are shared through a Web Service registry system, MOBY Central, which uses the ontologies to Semantically bind incoming service requests to service providers capable of executing them. S-MOBY on the other hand employs RDF and OWL and the document oriented infrastructure of the WWW (the GET/POST methods of HTTP) for publishing and retrieving information from its discovery servers.

As shown above this is an area of active research. So far SAWDL enjoys the approval of W3C being one of its recommendations but of course is lacking when compared with WSMO and OWL-S. Nevertheless SAWSDL can be combined with these most prominent technologies and it remains to be seen whether such approaches are adequate or something more powerful should be introduced.

CONCLUSION

The social aspects of the Web show an uprising evolution and all the indications imply that this trend will continue. The current Web 2.0 sites are quite successful in attracting people share their data and interests, and build online communities, but the next step will be to enrich them with more Semantics in the lines of the Semantic Web to provide a unifying platform for people and machines to use and collaborate. The need for Semantics (Breslin & Decker, 2007) is evident for enhancing the social networking sites with advanced filtering and recommendation services and also to provide data portability and integration between different sites and networks. This is an active area where the Semantic Web technologies can greatly help.

There have been a lot of discussions about what will be the "killer application" of the Semantic Web, which means some breakthrough in the domain that will show beyond any doubt the full potential of the Semantic Web. Nevertheless we think that Semantic Web technologies are used slowly and without much "noise" in a lot of different areas and as "extension to the existing Web" are not clearly visible but are certainly catching on. There is a common view nowadays that the Semantic Web will not supersede the Syntactic Web in any way but they will happily coexist in a symbiotic manner: the Web of documents will be enriched by the Web of data and information.

In terms of the core infrastructure what we see as emerging trend is the use of simple REST Web services (Fielding & Taylor, 2002) that present a small entry barrier and a transition from the SOAP and WSDL Web Services technologies backed by big commercial corporations like IBM and Microsoft to more flexible and agile architectures. These architectures are more bound to the existing Web and also are more Semantic Web friendly since they share common basic infrastructure and interaction protocols (e.g. Web protocols like HTTP used as application protocol and not for transport, full support for URI to access network resources and Semantic concepts, etc.). The whole history of the Web clearly shows that successful distributed systems of this scale are built on open access, open protocols, and open source methodologies combined with collaborative behavior by the people (developers, users) involved.

Research questions and issues for further investigation abound in this Semantic new world. First of all the issue of trust and security and how this is incorporated in the Semantic Web machinery should be tackled on. For example currently a user can claim anything in his FOAF document, or a malicious application can publish RDF information that contains false statements. The notion of identity and validation of the identity is important and there is ongoing work in this area, e.g. the incorporation of user certificates or Web based authentication mechanisms like OpenId[8]. Semantic Web has also increased demands for supporting indexing and reasoning over the managed content. The scalability concerns are real when we think about a Semantic Web search engine of the size of Google. Finally the adoption of these technologies by the users needs work to be done in the presentation layers as well. Easy to use, friendly, and functional user interfaces are necessary for making the transition to the Semantic Web more painless and transparent for the users.

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KEY TERMS

Semantic Web (SW): The creator of the World Wide Web Tim Berners-Lee defines the SW as "a web of data that can be processed directly or indirectly by machines". A similar definition coming from the World Wide Web Consortium (W3C) describes the Semantic Web as "a Web that includes documents, or portions of documents, describing explicit relationships between things and containing Semantic information intended for automated processing by our machines."

Social Web/Web 2.0: The way people socialize and interact with each other through the World Wide Web. This term is also used to denote a large number of Web sites that are devoted to people and their social interactions through the creation of online communities of users that share digital content and information, discuss, or enable communication in any possible, Web-facilitated way.

Web Service (WS): A Web Service is defined by the World Wide Web Consortium (W3C) as "a software system designed to support interoperable machine-to-machine interaction over a network". Since this definition is quite general the term "Web Service" commonly refers to systems that communicate using XML messages that comply with the SOAP messaging format. In such systems, there is often machine-readable description of the operations offered by the service written in the Web Services Description Language (WSDL).

ENDNOTES

1. Despite the irony in itself as a fact, an extensive survey of this criticism can be found in the Wikipedia at http://en.WikipedSia.org/Wiki/Criticism_of_Wikipedia
2. http://en.Wikipedia.org/Wiki/Seigenthaler_incident
3. http://en.Wikipedia.org/Wiki/Ajax_(programming)
4. http://en.Wikipedia.org/Wiki/Comet_(programming)
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6. http://www.opensearch.org
7. http://pipes.yahoo.com
8. http://openid.net/

This work was previously published in Virtual Community Practices and Social Interactive Media: Technology Lifecycle and Workflow Analysis, edited by D. Akoumianakis, pp. 207-225 , copyright 2009v by Information Science Reference (an imprint of IGI Global).

Chapter 1.27
Technological Social-ism

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ABSTRACT

Culture is a byproduct of our brains. Moreover, we'll look at ways culture also employs ritual (from shamanistic practices to grocery shopping) to shape neural paths, and thus shape our brains. Music has a definite (well researched) role in this feedback loop. The ear learns how to discern music from noise in the very immediate context of the environment. This serves more than entertainment purposes however. At a glance, we often can discern visual noise from images, nonsense from words. The dynamics are hardly unique to audial compositions. There are many kinds of compositional rules that apply to all of the senses and well beyond. The brain develops these rule sets specific to the needs of the culture and in order to maintain it. These rules, rarely articulated, are stored in the form of icons, a somewhat abstracted, context-less abbreviation open to wide interpretation. It may seem somewhat amazing we can come up with compatible rules, by reading these icons from our unique personal perspectives. And often we don't, as we each have differing tastes and opinions. However, "drawing from the same well" defines abstract groupings, to which we choose to subscribe. We both subscribe to and influence which rule-sets we use to filter our perceptions and conclusions. But the way we (often unconsciously) choose is far more elusive and subtle.

INTRODUCTION

Language may have both a hard-wired component in our DNA, and a learned component (Chomsky, 1977). Neither is operable without the other. Or at least we don't get language without both. This is a debatable theory, yet very useful to us. If spoken languages could be thus constructed/understood, it seems sensible that non-verbal languages could also follow this organization. Fundamentally each are means of using symbols to represent ideas we want to transfer from our minds into another's (Calvin, 1996a).

Furthermore, it appears likely that where music operates neurologically on a (non-verbal) linguistic level, it too is organized in this dual fashion. Music also obeys both fundamental laws and is influenced by the immediate culture, while influencing it. Music serves cultural cohesion on a neuro-level (shown in many modern studies thanks to the fMRI (Levitin, 2006; Doidge 2007). In many cases, mu-

DOI: 10.4018/978-1-60566-352-4.ch020

sic, culture and the neural result are inextricable (Huron, 2008).

The way humans use musical instruments extends well beyond providing entertainment. We choose to employ a drum to speak to our own minds and the minds within others (more about this later), even if we are doing so with no knowledge of it, or intention in manipulating brain waves. But essentially, we mustn't forget that these instruments are tools at our disposal, they are also technology whether old or new. However we use the net, it is also a tool. Its ultimate product "cyberspace", shares many important features with music and cultural cohesion as well. Thus our big question becomes: if culture informs the web and visa versa, what neurological impact is it being used for?

In other words, asking a tribal member why a certain drumbeat is used in a ceremony gets you one answer. It is not at all the wrong answer (Narby, 2001). But asking an anthropologist or neurologist who studies the effects of "deep listening", gets a very different answer. The beat ultimately is used to hold the culture together hypnotically.

Let's consider the modern equivalent of a drum though. It is a tool, one that has neurological effects, which may be one reason we use it. Oddly though, we often do not employ computers as tools but as human substitutes. Instead, the tasks for which computers are commonly employed are strangely inappropriate. We pretend they function as specialized brains.

Human brains accomplish most thinking (perceptive and conceptual) by means of switching logically between inductive and deductive reasoning (Dewey 1910; Fodor, 2000; Hawkins, 2005). Computers, with no means of comprehending or creating anything remotely like context, accomplish tasks using only a limited version of deduction[1]. Some inductive reasoning can be accomplished with a computer by iterating through every single possibility (by making the question deductive). But in real life, this is absurd. Real problems have either infinite unknown possibilities or at least unpredictable ones. Computers simply can't solve things humans can. And we still have no clue as to how we do it.

John Dewey (usually required reading for educational studies) published a very good account of "How We Think" in 1910. It happens to stand as a very good description of how computers don't think. Boolean Logic (Hillis, 1998) and *modus ponens* have been common subjects in Philosophy, Logic, Psychology and Cog Sci for much longer than computers have been on the open market. But no one questions that there is more to human brains and thought than these formalizations. In other words, this is old news from rather common sources. So why have we resisted what should plainly be ingrained into our habits of thought, just to bang our heads against the wall?

On the flip-side, though most of us may want computers to accomplish human functions (as in security facial recognition or recognition of written words), we aren't all actually working on these things first hand. Instead, most of us are using these same machines primarily to store and send strings of text (email, the web, word processing, spread sheets, …). The processor is minimally involved in just delivering a copy from one terminal to another. This is hardly a harmful or bad use. But it certainly doesn't warrant the fancy hardware. Not even close.

The Bigger Picture

An oft posed question: are we guided by technology? is certainly a valid, common sense approach to the issue. However, the answers it produces are necessarily misleading. It is a question like 'When did you stop beating your wife?' There may well be an accurate way to answer, but no satisfying response. Why?

Every question belies a symptom of one particular perspective. From our traditional point of view, the question is rather logical. But in looking at this issue, we need to divorce ourselves from reductionism. Specific views, whether positive or negative vectors, typical of disciplines, cancel each other out. Such margins of error and signal noise are negligible when we get far enough away to view the bigger picture. Specificity is a good thing, but sticking to one small area is not. We need to continually ricochet to a much broader range of subjects. Not adhere to any exclusively. Thus, we will be drawing from neurology, mythology, anthropology, art history, and music theory alike. Applying the ideas of Eric Hoffer on political revolutions to Jeff Hawkins' modern perspective about computers and neurology, musically induced trance states to occurrences of mass hysteria, the psychological theories of Jung to Chomsky's linguistic theories, prove all the more enlightening when taken together.

Why do we choose to delineate between "science", "art", "social work", "exercise" at all and not make all disciplines one? After all much can be culled from one "expert", when applied to other subjects. Obviously, these delineations are breaking down. They are habits of traditional academic organizational systems that we are shedding.

There actually is a deeper rhyme to this reason, albeit a bit arbitrary. Since we humans can only focus on smaller numbers, we justifiably have used somewhat artificial schemes to break up the overwhelming sea of data into categories and subcategories, until the pieces are more easily digestible to the majority of human minds. *Chunking* is a function of our perceptivity and not an a priori reality in nature (Solso, 2003). Incidentally, we tend to project our own limitations onto our inventions. Computers do also have harsh limitations, but this is certainly not one of them[3].

We are finding there is no "normal" when it comes to our mental abilities (Gardner, 1983). Why this is so slowly seeping into our (Western?) culture is certainly a peculiar phenomenon. Despite what we may have been taught, all of us probably actually prefer to organize in a very personal way, though are often pressured into "doing it right". Others of us, who appear to "organized" people as being "disorganized", are often really "pile people". Stacks of papers are arranged not alphabetically, topically or chronologically, but in an ongoing process of convenience. In several ways, a computer is the ultimate pile person. Organization, merely a lens, does not even exist out side our minds (or at least we can never prove it) and can only really be seen by indirect means.

Piaget explained that children assume their thoughts are the only thoughts animating and motivating everything around them (toys, the rain, the moon, etc.) We adults do so too, not out of egocentrism, but often because we do not fully distinguish between our compulsive tendencies toward reductionism and our projection of reductive organization onto chaotic sensory input (Piaget, 1951). Taxonomies are really just more chaos lumped onto chaos – accept (sometimes) to us.

Pina Bausch is a choreographer. In a performance, the dancers appear on stage with piles of sand and begin making castles. (Bausch, 2002) Of course they didn't take classes to learn to play with sand, yet if they did, would this course "Sand Castles Building 101" be found under dance, architecture or child development? Labels, being another element in internal mental organization, are readily classifiable. But icons don't always fit nicely. A behavior pattern as a metaphor for play, childhood, exploration, discovery, all rolled into one, is an icon. The castle is hardly the end goal, but the activity is. The end is a verb, not a noun and not an end at all but an ongoing process. We traditionally categorize in terms of nouns, at least on paper, but not in our subconscious (Calvin, 1996; Sacks, 1996), and it doesn't happen in nature (Gordon, 1999; Johnson, 2001), only in our bloated cortexes.

Our use of the web casually confuses the label and the icon. Labeling icons, we often miss more important aspects of the data. The molecules of vapors, as well as their undulating interaction, that defines a cloud, are not organized according to the Dewey Decimal System. Placing them in some sort of linear framework renders the entire thing no longer a cloud at all.

Blind conviction goes much deeper than egotism or even ego-ism. In his history of psychology, Morton Hunt describes the birth of Gestalt psychology. In particular, a few researchers (Duncer is one) began looking at how we solve problems using tools.

In one situation, for instance, the subject was asked to mount three small candles on the door at eye level, ostensibly for 'visual experiments'. On the table were some candles, a few tacks, paper clips, pieces of paper, string, pencils, and some other objects, including the crucial ones: three small empty cardboard boxes. After fumbling around, every subject eventually restructured his view of the things at hand and saw that the boxes could be tacked to the door and used as little platforms to mount the candles on.

But in another version of the problem, the three boxes were filled, one with little candles, the second with tacks, and the third with matches. This time fewer than half of Duncer's subjects solved the problem. They had seen the boxes being used for a specific purpose, and that made it harder to see them as usable in an un-boxlike way. (Hunt, 1993, p. 298)

I. LOOKING BEYOND

The Collective Unconscious

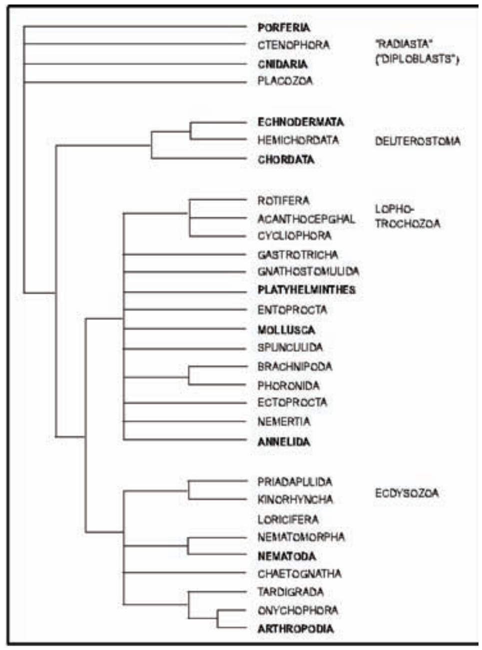
The term "Collective Unconscious" refers to a shared iconography across cultures, time, and distance (Campbell, 1972; Opler, 1994). The term was coined by Carl Jung (Jung, 1919)[2] who writes "In addition to the personal unconscious generally accepted by medical psychology, the existence of a second psychic system of a universal and impersonal nature is postulated. This collective unconscious is considered to consist of preexistent thought forms, called archetypes, which give form to certain psychic material which then enters the conscious. Archetypes are likened to instinctual behavior patterns." (Jung, 1968, p. 451). Jung's points are well taken, but his context is the milieu of psychology in Europe in the first part of the 20th century. He wasn't talking about technology at the beginning of the 21st. Yet, much can be culled by revisiting his ideas.

Jung begins by ruminating about "simple" instincts like thirst, shows that simplicity/complexity are entirely subjective human projections. He soon focuses on the *archetype*, a type of instinct. This may seem problematic, since archetype seems to necessarily imply analysis by the consciousness. But he seems to be discussing archetypes in some abstracted (*pre-conscious*?) form. Joseph Campbell explains this way.

All my life, as a student of mythologies, I have been working with these archetypes, and I can tell you, they do exist and are the same all over the world. In the various traditions they are variously represented, as, for instance, a Buddhist temple, medieval cathedral, Sumerian ziggurat, or Mayan pyramid. The images of divinities will vary in various parts of the world, according to the local flora, fauna, geography, racial features, etc. The myths and rites will be given different rational applications, different social customs to validate and enforce. And yet the archetypal, essential forms and ideas are the same – often stunningly so. And what then are they? What do they represent?

The psychologist who has best dealt with these, best described them and best interpreted them, is

Figure 1. Nature doesn't classify animals, we do. And we do it impulsively. This phylum diagram was surprisingly easy to compile because the hundreds of such charts throughout the world are all organized almost identically. Even cultures that do not share this biological data, arrange animal classifications this hierarchical way according to easily-observable classifications.



Carl G. Jung, who terms them 'archetypes of the collective unconscious,' as pertaining to those structures of the psyche that are not the products of merely individual experience but are common to all mankind. (Campbell, 1972, p. 216)

The Collective Unconscious has since taken on far broader applications. Other books that talk about the Collective Unconscious include *The Universal Collective Unconscious and Metaphysical Utopia*, *The Complete Idiot's Guide to Being Psychic*, *Buckland's Complete Book of Witchcraft*, *Mastering Astral Projection: 90-Day Guide to Out-of-Body Experience*, *Ouija: The Most Dangerous Game*. It may seem easy to be disparaging of these titles. However, like Jung's, they are driven by a core idea, and a very astute one. Where they take it is a detail, informed by a chosen culture.

While witches, evangelists and self-help authors have all taken the term Collective Unconscious to far broader definitions than the original conception. Collective Unconscious may not necessarily be limited to mythology per se, but need not be extended to speaking with the dead. Is there a similar a repository, broadly accessible to many, containing shared cultural information? Of course. The web.

Music's Role in Ritual

Now let's turn to the question of how we are effected by various kinds of collective unconsciousness-es. To begin to answer, we will look at how we humans determine and define our cultures, a matter of iconography and ritual. Why exactly do all cultures, often independently of others, make songs?

Perhaps you are familiar with such studies where music is the tool, used in rituals. Natives beat drums not just to entertain. In the West, *The Mozart Effect* (Campbell, 1991) is an interesting illustration of this phenomenon, but even war chants (Sacks, 2007) are fitting examples. Aside from its aesthetic role, music indirectly influences behavior on several levels. Prolonged attention to a beat, tends to excite the thalamus (or so many suspect), and/or bring about a *trance state* in the brain (Levetin, 2006). The neural activity creates subtle, yet complex electric frequencies. In particular, trance states marked by increased Theta waves, from 7-9 MHz. (Robbins, 2000). This occurs to varying degrees both in the performers and the individuals partaking in ritual.

Hypnosis is often seen as un-masculine and shunned in Europe and the US, but in most of the world and throughout most of human existence, it continues to play a leading role in social interaction. However, it still sneaks into our lives in many forms, from opera to rock stars (Hunt, 1993; Rouget, 1985). Like babbling language, perhaps we just can't help it (Crystal, 2005).

A good example of the integration of music and trance is the Balinese Bebuten ceremony. In it participants/dancers plunge daggers into themselves. They do so, acting out a fierce battle between mythical beasts and a witch who has placed a curse on the community (Becker, 2004). They are not so much intending to hurt themselves though. Even under hypnosis, they are fully aware. Maybe even more so. As such, they are transformed into limbs of the community atoning for the tribe, not as representatives, but as appendages of the given social system. By acting out this scene, they are hoping to suggest a new fate for the community and scaring the spirits that are responsible for their luck. The self is entirely enveloped into the "world" (environment) or nether worlds (as defined by the culture) at this point.

The actual logic behind this enactment is not really important, and that is precisely where many foreign observers studying these ceremonies become missionaries rather than scientists (Sells, 1996; Daniélou, 1991; Narby, 2001). Many seemingly obvious factors don't make perfect sense to a removed observer. Their desire to create and adopt shared goals overrides "logic". It actually appeals to a different memory system (LeDoux, 1996; Sacks, 2007). Though emotional memory and episodic memory can influence each other, often they don't. Thus we don't always realize we are reacting to memories. In effect, these performers are accessing a parallel mind. A mind unlocked by music.

One may decide that the participants' interpretations of their motivations are unrelated to the result. For example, that solidarity as a result of these highly emotional rituals may have more influence on defending against invaders than appeals to spirits. This would be a condescendingly smug view. If the enemy invaders are thwarted (or aren't) does it really matter why on a neurological level? Couldn't solidarity with ones peers be inseparable from favor from the gods? Perhaps the brain is merely a radio antenna tunable to the gods? The cynic very importantly chooses to be missing just as much as the fanatic.

In other cases, the subject undergoing the trance is the performer or shaman (Narby, 2001). A more modern example is the young James Brown (Lethem, 2006) whose act intentionally referenced Baptist revival services, which, in turn, borrowed heavily from trance-inducing rituals around the world, particularly from Africa in the 1700's. Brown's ritualistic performance, with his spasmodic yet intricate footwork, ultimately breaking down and covered by a cape, modeled on older rituals, was quite literally a religious experience for many.

Psyching the self up for these rituals is what gives them their effective power. Expectations and acoustics work in tandem. Though trance states are clearly a bio-mechanical function between the brain and the environment, seldom are the rituals effective without a learned expectation of effectiveness[4] (Becker, 2004; Alderage & Fachner, 2006). A ceremony is designed to drive the "witch doctor" to a frenzied state, where the audience is moved sympathetically (Levetin, 2006). As with James Brown, you might begin as an observer, enjoy the show, get more into it, and finally let loose dancing yourself as a very active participant. Perhaps even inspiring the dancer next to you to more enthusiasm. This process happens in many forms. Anecdotes about moving post-9/11 memorials tend to begin with the individual's surprise at their strong emotional reaction and go into how swept up the group became, usually involving singing or music. This is not to say that they weren't actually swept up. But to be swept up, often involves being carried away with others, often employing a hypnotic medium, such as song. Is hypnosis a relinquishing of control? One could just as easily say, this unleashes the "real" self, that's been suppressed.

These rituals serve a dual purpose. By yielding to the community, individuals' problems are, at least temporarily, put aside, for the sake of solidarity. They can also help curb out of control emotional feed-back loops on a neurological level[5], containing unleashed cycles. Fewer cases of pent up rage is certainly good for everyone in the community.

As individual desires are yielded to the will of a team (even if it is never spoken, articulated), we elect to hone the priorities of that culture, like healthier crops, appeasement of a spirit, etc. and develop strategies for working toward them. Common needs create a sense of community, a oneness, where one's super ego is dissolved into a greater life force.

The *deep listener* of pounding tribal drums or the healer's maracas becomes not so much at one with a god per se, but one with a culture (Becker, 2004). Dancing to the pounding bass frequencies of modern music, we may forget we are in a subway car. Individualism is (temporarily) lost, a drop that has been added to the sea. That drop may only wield so much influence alone, however as part of a tide yields unlimited influence. The same is true for the web.

"Teamwork" has a positive ring to it. In small scales, likely groups under 50 (Gladwell, 2000), it probably does more good than harm. Fusing an identity from a small group is hardly infallible, for example the Manson Family, but usually eliciting good (though rarely great, as we'll see later) results in the workplace. On a larger scale however, there may be more examples like the Moonies than Martin Luther King. But who could say? Certainly Gandhi, Lincoln, Roosevelt, etc had positive impacts, though also lead a lot of followers enthusiastically to their deaths.

The point here isn't that conformity or group-think is always bad, but that only individuals seem capable of assessing if the final decision warrants action. And we can't be both completely self-aware individuals and completely faithful members. Why do we gravitate toward such dual polarism (Goffman, 1959)? For some reason, we are fed the belief that individuality is situated at one end of a spectrum and often mutually exclusive from cohesion. But thus linearly arranged, the median of opinions as a result has no real value. There is no useful center point. Often the only way to maximize both positions is to move freely among these extremes, respecting and supporting each, but always with an eye open to abuses and harm that can come from either. While unwavering unconditional faith can be fool-hearty, a constantly critical stance would prohibit true immersion and lead to a false sense of understanding.

II. THE MIND

Linguistic Issues

There are an infinite number of alternative ways to convey very specific information. Data saved digitally is one such method, a protocol of binary *bytes*. Humans concoct languages. Each digit is independent of its neighbors. Humans concoct languages. Words are very dependant on their neighbors, not just for grammar agreement but for the general meaning of the sentence.

Importantly, the human method doesn't translate into digital form nicely (Fodor, 2000). But the distinction is far more complex, but the solution is alarmingly simple. We just have to fully grasp it and take advantage of it. As an example, smoke is not essential to friction, but when we see smoke coming from a mechanical object, our first guess is to look for what parts might be rubbing each other wrong. We don't really need machines to create more meaning (to determine how the smoke got there). They aren't good at it, but we do that just fine ourselves. Instead, what computers might be able to do is mimic the key that unlocks our language recognizing function (create virtual smoke, or rather generate fresh air free of smoke).

The software Eliza is a prime example of this. It was created to carry on a conversation, something computers can't usually do convincingly. But it uses a psychological trick, repeating parts of the human's previous replies at random. So the person conversing sees significance in the computer's words, even if the machine doesn't.

The Turing Test says if a panel of experts on a subject can carry on a conversation with an unknown entity, and they are unable to or inaccurately determine the entity's human-ness, the machine passes. Probably more informatively, I would propose the test should go something like this: Select 10 random high school students (I am assuming a Western audience, but any background would surely do). Play them 5 songs, chosen unpredictably on the spot: a pre-18th century Classical piece, a 20's recording of early jazz (including the crackle), a pop song from the 50's, the theme song from a 70's sit-com, and a current (but yet unreleased) rap tune, and ask them in under 15 seconds to determine the chronological order. The question would be if any machine could consistently score better than the high schoolers. Pretty much impossible.

Essentially, the high school students needn't recognize the actual songs, but the genres. Furthermore, one can usually tell at a glance (and we do channel surfing), if an image was filmed or videotaped and in what era, what the level of seriousness is, roughly if it would be interesting to us. Compare a gardening program from 1970 on BBC to a modern reality TV show set in a garden. Color tonality, transition frequency, and how close are the close-ups are all big clues – for humans.

But if those same high school kids were asked to compose a few seconds of early European classical music, that might convince the next group, in under 15 seconds, my money would be on the machine. In fact, the machine could come up with hundreds in a under second. In other words, there are two very distinct skills. Humans induce effortlessly. Computers stink at it. But computers assemble from deductions effortlessly. Humans get bogged down in possibilities.

Amazingly, nearly every known human language in the world and throughout time can be analyzed into remarkably identical parts of speech, take the form *subject-object-verb*[6]. Some use *subject-verb-object* and only a handful more variants of this order occur very rarely (Hunt, 1993; Pinker, 1995; Calvin, 1996) but many schemes never occur. Why?

Noam Chomsky's theories of an LAD (Language Acquisition Device) and "auto-generative" language demonstrate that an infinite number of variations could be created and still understood without explicitly understanding the rules and exceptions of grammar (in whatever native language) (Chomsky, 1977). Children often make mistakes in trivial ways (saying "foots" instead of "feet", mussing the *surface grammar*) but consistently maintaining, comprehending and employing the culturally defined organization of sentences (*deep structure*). A child may say "My foots hurt!" but never "Hurt feet my!". We understand "Jane said: see Spot Run", "See Spot run toward Dick.", "Jane told Dick about Spot running." without ever literally experiencing all of these specific, seemingly infinite variants. We recognize the deep structure. Marc Hauser describes Chomsky's theories further.

> This combinatorial machinery [a module in the human (but not other species) brain for LAD] provides algorithms for specifying the details of our communicative utterances. The fact that we use this machinery for communication is, however, incidental. … Put simply, even if Australopithecus afarensis – the famous "Lucy" – had a language organ, we would not be in the position to definitively assess its role in communication or, for that matter, any other behavioral expression. This point should be swallowed completely, especially in light of Chomsky's (1986, 1990) own belief that our use of the language organ for communication was quite accidental. *(Hauser, 1998, p. 34)*

If the brain simply applies this pattern recognition function to whatever stimuli is input, distinguishing relevant organization from randomness, it would stand to reason that the brain could be using the same module for differentiating say music from the sound of leaves in the wind.

Musical Grammar

No matter what culture, recognition of communication is a matter of projecting. The French hear vowels Americans can't, who hear L's in ways Japanese can't (Pinker 1995; Solso, 2003). Music is no different. The strategies are culturally specific, learned, articulated in retrospect. But they are absolutely concrete, not psychological effects. Sounds absolutely do not exist in the air. They exist as sound only in the brain of the listener (Levetin, 2006). Furthermore, composers, musicians and listeners need never even be aware of the rules they apply consistently.

In Western culture, the number of pitch and rhythmic options for a 2 bar melody is huge, but not at all infinite. In fact, we use a remarkably tiny fraction of the possibilities[7]. Which of these subsets of musical options we adopt, is defined by culture. Amazingly, across cultures, our music sounds unique yet identifiable to that culture, in part because our pools are roughly the same uncanny size.

Asian music and Middle Eastern music obey surprisingly similar rules, ones the listeners come to adopt subconsciously (May, 1980). The Westerner tends to hear sounds that do not correspond to normal Western music theory rules. The Eastern ear looks for anomalies according to Eastern Music Theory rules. These rules need not be articulateable. The individual may not even be aware they know that their brain is using these guidelines as a filter of the chaos of sensory data. Westerners tend not to notice subtleties in more complex rhythms but do in melodies. Whereas for Easterners the reverse is generally true (Aldrige & Fachner, 2007). This is important in that to see from one culturally informed perspective blinds us from others. We are compelled to choose a perspective, but there is absolutely never a "right" one.

Chunking (mentioned earlier) is the term for the brain's tendency to dissect incoming data into digestible bits (7 digit phone numbers, 7 note scales, 7 Wonders, 7 days a week, 7 dwarves. Seven is about average for people around the world, throughout time). This extends far into a myriad of unexpected non-verbal cues. Our brain applies the filter it obtains from experience and culture (in every part of the world, throughout history) to every detail, from understanding how complex Chinese characters can survive the centuries (Coe, 1999), limiting the pool of vocabulary of specific musics (Levetin, 2006) and dance (Shay 1999), recognizing someone in cartoon by their mannerisms (Fliecher, 1932; Linklater, 2002) and even Richard Gregory's *redintegration* experiments (Hunt, 2003; Carter, 1999). We invent "facts" according to what we see (Sully, 1881) revising the surprisingly innate and uniform assessment of beauty we are born with (Etcoff, 2000). Chunking and culture work together (creating icons) to make comprehension easier for us.

III. THE EMPEROR'S NEW PARADIGM

Shifting Between Perspectives

Individuals are free to apply the tools as best they know how to their own very personal situations. Just as the monkey may use a stick to reach a banana, the desire for the banana always precludes the decision how to use the stick. Needs change how we see the tools, not the other way around. In a movie, an ex-special ops mercenary poses as a substitute teacher and lectures the class about "perception".

"What do you think this is? [holds up a yo-yo]
It's a simple toy, man. [drinking from a bottle]
To you it is, but back in 1500 in the Philippines it was a weapon. [lashes out with the yo-yo and shatters the bottle] *(Pearl, 1998)*

We don't learn by rote that a screwdriver can be used as a hammer. We pick it up and try it. Nonetheless, once a method works at all, it is incredibly difficult for some to discard. Hence, more precisely useful methods are often met with irrationally vehement and disdain, in favor of impractical yet more immediately learn-able alternatives. The resulting perception is then that the object has one very specific purpose and that purpose is defined by a *stable state* (Dawkins, 1978; Gladwell, 2000).

It comes as no surprise that contributors don't want to see the issues complicated out of reach or lost in unfamiliar territory. Web designers want to continue proudly designing pages as if they are fixed layouts for print. More importantly, they have an industry and are paid by it. In recent years, the designer's role has shifted, but has not escaped the goal of making content easier to digest. We employ buffers from being thwarted by unfamiliar technical information in the forms of blogs (Weinberger, 2007). This static-ness is intrinsic to print, not the web at all.

Browsers get away from static-ness with easy to read defaults and allowing user customizations of the general appearance. Still designers insist on over-riding these features in favor of static-ness, especially using CSS (Castro, 2003). Personalized options offered are trivial. Customizing means presenting pages in our favorite colors. "Read more of this article" doesn't purport to alter or update the article in any way.

Though HTML technically does support interaction in the form of hyperlinks, it is the very lowest level of interactivity (Gleick, 2002). Compare the highly interactive question - "What was the most interesting thing you did today?" and the equivalent of hyperlinks - "Do you want fries with that?". You really have three ways to answer: "Yes, go ahead and continue whatever you have planned." (click), "No, wait to continue just yet." (don't click) or supply an answer that gets no meaningful response. However, a computer has no problem "listening for" millions of possible responses. Why would web pages so uniformly ignore what they are capable of, for limitations of linear design? HTML is hardly a bad thing, but it is a cherry on the top. CSS (generally flavorless) and JavaScript may be the colorful sprinkles, but there's still a lot more to a sundae. Yet we regularly throw the rest away.

Design is unavoidable (Tufte, 1990). Arranging any data on any page involves design. But there is design for design's sake (as in logos, marketing or dressing fashionably) to convey an essence by creating an icon and design for function's sake (as in architecture, form design, and even typography) where the graphics are a subservient means to the an unrelated end goal. Will it withstand rain? Does it need to convey specific words? These are questions that (can) trump aesthetics.

Though not entirely separable, design and function can be viewed distinctly. The problem arises, when design limitations are placed on function artificially. If designers of web pages only think in terms of static pages, that leaves very little function. But the page is still essentially static, serves no non-design function, utilizes neither the computer processor nor any significant peculiarities of a vast network. Later we'll talk about how the web can be used, but for the most part, we settle for a 300 billion gallon billboard soup.

We even go so far as to invent a mythological expertise, in order to defend our higher as well as lower techno-caste system (Goffman, 1959; Marvin, 1988). What's wrong with a little ignorance? Nothing, at all! But once we have invested so much in a bad idea, we would look ridiculous (to ourselves) to admit the farce. We need someone to play expert and tell us we are right. How much in time, money and effort would you estimate we have invested in the web? Add up the costs of every computer, not to mention connection hardware, hosting fees, etc. We simply must justify it to ourselves.

The same could be said of cars. Modern ones may work differently than the original models. But drivers benefit from changes not being too drastic, as with solar powered cars. Drivers want to remain safe knowing the steps for finding a mechanic will work every time. One can imagine that the car owners not even be drivers though. They may be using a car exclusively as a couch, while still insisting on their mechanics. After a few generations of this, any mechanic would reasonably claim the only definition of a mechanic is someone who fixes upholstery. The cars will certainly do the job, no harm could come of this. It is a blatant waste - but actually only if you have experience driving. Owners just argue that's the going price of a couch and resent being told they were fooled.

Most users of the web, may be content as infant passengers in the back seat. They have no idea there is interaction happening, but just enjoy just looking out the window (hands in lap). To them riding in a car, is nearly an identical activity as sitting on a couch watching TV. So, it seems fitting the web must be like that too. After all, the web isn't like anything we don't make it like. If we make a "hands-in-lap" web, the web really is like that (Greene, 2004).

Allowing for the widest possible re-purposing, is often a key to survival. VS Ramachandran says this about animal evolution:

A trait may represent a further refinement (through natural selection) of another trait that was selector for a completely different purpose. Feathers evolved from reptilian scales to keep birds warm but have since been co-opted and transformed into wing feathers for flying; this is called preadaption. (Ramachandran, & Blakeslee, 1998, p.209)

If the net bears any similarities to past technologies, it is absolutely only because this is how we have applied the tool. The computer is nothing like a phone. The computer doesn't work similarly to a TV. But we use computers mostly as substitutes for two tools that still work fine[8]. The net is only like the telegraph because we eventually understood the telegraph and applied that understanding to the net.

People called the railroad the 'iron horse' and the automobile the 'horseless carriage'. For decades the telephone was viewed in the context of the *telegraph, something that should only be used to communicate important news or emergencies; it wasn't until the 1920s that people started using it casually. Photography was at first used as a new kind of portraiture. And motion pictures were conceptualized as a variation of stage plays, which is why movie theaters had retracting curtains over the screens for much of the twentieth century. (Hawkins, 2004, p. 205)*

DIY

The acronym, normally used as an adjective, could well be turned around as a command. Do it your (own damn) self. The desire to bypass years of discipline to become an instant expert is everywhere. Judging by popular titles, we can learn or accomplish anything in 30 days (Shenk, 1999). Often even that much wait proves too excruciating (Glieck, 1999).

DIY grew out of a punk rejection of the influences of "the Man"/big brother. What's ironic is that in all likelihood, punk was probably born in a music industry board room when they decided to team Sid Vicious (he doesn't actually play on studio recordings, had almost no actual musical ability, but looked the part) and Johnny Rotten (also more for his act) with Malcolm MacLaren (who provided stylistic fine tuning rather than anything compositional) (Heylin, 2007). Punk was essentially the discovery that a cool attitude sells, while skills we once assumed were essential are optional.

The Sex Pistols were great! No question there. But the reason the meme spread all over the world depended on distribution. The reason punk was on sale in the big stores, was certainly not because it rejected the industry, it's because marketing departments guessed how to package it. "The Great Rock 'n' Roll Swindle" (Sex Pistols, 1993) was certainly fictionalized for the sake of drama, but like all mythologies there's factualness in the mythological-ness of it. Though most post-punk enthusiasts would be horrified to entertain the thought, there wasn't actually anything idealistic about it. We were all duped. We can argue angrily or lighten up and laugh at ourselves. In the case of the web, we tend to argue.

Looking into the machines themselves, and not the ideals obscuring them. People still commonly think employing a computer can be a "time saver". In cases like musical scoring with a professional MIDI sequencer or now user-friendly software like GarageBand, it can for most. A person fluent in reading and writing on staves will probably loose time. But for others it can make a helpful difference not to need to go through and decipher each note. Classically trained composers may argue that this brings the average quality of composing down, making it is more open to amateurs (Marvin, 1988; Hopkins, 1982). This view is hardly worth arguing for or against, as it misunderstands the essential shift in what is required of the "expert".

Neither side is more right than the other. Both are completely valid from their respective perspectives. By not recognizing schemas, computer technology works - as long as we don't insist on any correct point of view. Computers and a need for truth are simply incompatible. Computers can only provide hypotheticals and alternatives. Often attributed to an age/generation thing (which isn't really true of course), some folks get frustrated with machines, some with the search for fact, but both camps spend their money all the same.

While it is an arguable issue whether a Puritan work ethic results in more invested artists, and thus more profound art, this is not the only issue by far. It is often the only one addressed by fanatic proponents from either side of the argument though. Often extreme zeal and reverence are invoked to describe both the traditional values and the new shift to the new technology (Glieck, 2002; Tapscott & Williams, 2006) as if they are advertising a show on Broadway. The greatest hyperboles ever to appear on Earth!!! Rhetoric aside, one side argues for patience in acquiring skill. But such a work ethic is only interpreted as outdated elitism by others. The other side argues for the freedoms of expression newly available to the common man[9]. Mozart can be boring and therefore of no musical value to kids who want to dance. And Kanye West can be just noise, revealing no interesting musicality to Classicists. This point gets argued to death and leads nowhere.

Nonetheless, the sheer numbers of works, that explode like a burst dam, do have a very real negative effect. No curator (using the term loosely) of artworks or employer listing job openings can realistically expect that, where once they could manage to cull the best candidates out of 200, they can make any such claims when there are 200,000 of them. There just isn't time, nor the attention spans. Doing some quick math, it's plain that they can initially only give each candidate a .2 second glance. Obviously, some ideas take a few seconds to sink in, and those will surely be lost. In fact, which they see at all is either random or limited to the applicants they are already familiar with. By round two, the remaining survivors inevitably all start to look the same any way. And that does bring the quality down (Shermer, 2002).

Let's look at an illustration of this concept. Say in gym class you were the team captain, picking all of your players before anyone else from 100 students, you might pick the best team, and may thereby win more games. But picking from millions the odds of noticing who the key players are no longer significant. Among that huge crowd may be the Yankees, but who could ever notice when there are so many others. Every other captain has roughly the same slim odds. Likewise, ill-chosen HR employees are thereby theoretically less and less adept at what they do, at choosing the next generation of employees. So begins the exponential growth of mediocrity. Averages on the web, do not behave like the bell curves we expect. Nearly every aspect behaves like a steep slope.

Not that the web needs censorship, but why do we choose to "shit in our own bed"? We piously insist there is a new ultra-accessible frontier for gathering information and then set about to transforming it into a hiding place for information. There's a subtle difference. The messages on the net (whether spam or blog diaries) are actually often only meant for a small audience. For grandma, mention of our green socks may bring a little amusement. But it is as if we think we're still using previous media. These messages are not for everyone in the world. Nonetheless, we know full well that's where they go and brush this aside with no further thought of the result.

In targeting our messages, we might as well use a sawed-off shotgun to catch a fly. The question is, why do we pay $1000+ to have access to information that could be sent more efficiently to our target with a 40-cent stamp? Why spend more when we already have a more effective way to reach our specific audience? Skywriting is no way to create intimacy. Moreover, we've known this and seen this developing for decades now and only make the situation worse.

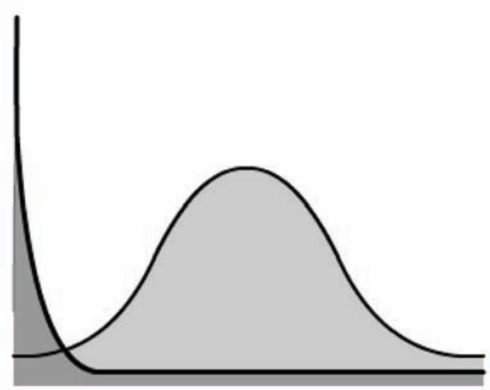
But is any kind of quality on the web even necessary for it's greater function? Maybe not? For example, who care's if someone in class says something other than "here" at role call, so long as their name is checked off, the result is successful. The existence of content is necessary but the content of the content is arbitrary (Calvin, 1996). Has a comparable situation come up before?

IV. DEVOLVING TENDENCIES

Time is a Wheel, not a Line

History always repeats. I am only glancing as far back as the Industrial Revolution, but as you probably already know, every promise the net makes, has been made over and over. What's remarkable is that technology again and again makes these claims as if it were offering a never-before possible opportunity, a new brighter horizon (Barbrook & Cameron, 1995).

Figure 2. The illusion of the bell curve has been reinforced by centuries of experience. Things do behave in such a way. But suddenly, a lot more things don't fit that model. We assume an average popular site will get an average number of visitors. Not at all. A handful of sites get a phenomenal number of visitors, some get very few, but most get next to none (glancers, who spend 20 seconds or less determining if your site fits with their search). The spread is more like an exponential curve. It may seem like anyone can climb to the top. A handful of anecdotal evidence are all the success stories we need (like Linux and Wikipedia) to ignore the billions of sites that were forgotten before they were ever remembered. The average Joe/Jane is still a serf doing the grunt work to support a remote aristocracy, it's just a very different looking aristocracy. The web certainly is communal, but it is an absolute mirage that everyone is represented. Our web projects never stand the same chances as the ones on top. In the same way. In music, the industry invests a lot of time and money determining what will be popular. Moreover, they have access to channels to test and market their products. Imagine trying to compete by simply playing loudly in the basement. Now imagine there are millions of basements next door (physically impossible but that's the web).



In the 1890's, advocates of electricity claimed it would eliminate the drudgery of manual work and create a world of abundance and peace. In the first decade of the 20th century, aircraft inspired similar flights of fancy. Rapid intercontinental travel would, it was claimed, eliminate international differences and misunderstandings. ... Similarly, television was expected to improve education, reduce social isolation, and enhance democracy. Nuclear power was supposed to usher in an age of plenty where electricity was 'too cheap to meter'. (Standage, 1998, p.211)

There is no horizon, neither brighter nor dimmer. And we know it. It's hard to hear the word "utopia" now without sniggering. But we rarely appreciate precisely why? It is because the promise is made obsolete by the development itself. Not by solving any conflicts, but by re-framing them. For instance, let's look at the last century's obsession with signal-to-noise ratio.

Once upon a time, recording audio onto wax cylinders proved too noisy. Progressing to the 60's, things improved and soon technology was such that we could hardly notice tape hiss above the recorded sound without listening for it (Spence & Swayne, 1981). Video, also recorded on magnetic tape, was subject to visual noise as well. This noise also accumulated with age. So at first eliminating it was a genuine problem to solve, even if just for archiving[10]. And soon enough we pretty much solved it. Nonetheless, we remained in the habit of facing that particular problem. We held on to it, long after the benefits hardly justified the efforts. Moreover, we didn't just want noise eliminated in recordings and edits made in studios fitted with carpeted walls and pro equipment, but wanted to do it at home, too.

We now rarely store mechanical or magnetic reproductions (like clay in a mold, on a macro- or microscopic level), we instead store the instructions to duplicate a subject (like recipes passed down for generations or DNA). In a picture, these instructions take the form of long lists of numbers which define grids of pixel values for red, green, blue and transparency, theoretically accounting for all possible colors an image could be (which is hardly true, such as warmer grays, florescent shades)[11]. A digital image (or sound) is a checkerboard of hues (or sine waves) (Aldrich, 2003; Myler & Weeks, 1993).

The resolution of the reproduction is no longer entirely in the quality of those pixels, but more importantly the sheer number of pixels (or sine waves). Hence "dots per inch"[12]. Despite claims, the noise to video/sound ratio has not been improved at all. Noise is just no longer much of an issue since the copy and the original[13] are now only related by coincidentally having similar colors/ sounds in similar places. In fact, once recorded, the "original" (which was really only a list of electrical charges) is discarded forever and playback of any kind absolutely requires constructing an entirely new copy,

At first, the resolution of this clone was limited.[14] In audio one may still notice the sample rate is four times lower for phones than CD recordings, about 11 thousand samples (MHz) and 44.1 (Aldrich, 2005). But this is most apparent in video, where you can often detect blocks of pixels and perpendicular edges in video. This was still a huge obstacle until a few years ago. So in retrospect, one has to ask, why did we support this tool that didn't work all that well for so long (Gleick, 2002)? It's hard to say if digital media (both audio and video) now, after years of improvement, offer better "imaging" than analog recordings. Trying to solve one thing, a new paradigm can often brings other things down. So you'd think there'd have to be a really compelling reason or really strong results. Nope.

Moreover, why choose to make things harder on ourselves with no apparent benefit (at least at first)? We are often comfortable knowing how exacto knives and paste-up boards work, and struggle with layout software. When the print doesn't look like the screen, we assume there must be something done wrong on the computer, without realizing it made exactly the mistake they told it to. That's what computers are good for.

Professional Art Directors, with years of experience and big salaries may not fully understand the impossibility of optics, or down/up-sampling (resolution, blockiness and size anomalies) are often to blame. Traditional methods work. Computer methods can but it requires patient un-learning. However, combining them (even attaching a printer to a computer) brings about the worst of both worlds. Most folks (especially people used to a paper mindset) are just not making the full transition, remain voluntarily stuck with baffling compromises.

Quality does not improve, criteria shift. A common view once was that acting on film for a silent movie was a legitimate expression, but the kind of acting in talkies was not. At first glance, this seems laudable. But remember, at this point, the camera still was considered rather like a replacement of the view of a live theater audience. The camera was not primarily used to focus attention, rather to show the whole scene, where the projection screen was a direct replacement for the live stage. For several years, the movie was yet another vaudeville act. Only gradually the live performance aspects faded away (Stokes & Maltby, 1999). (Though our computer screens are still influenced by the frame proportions.)

In his traditional manner, ... Elman [a violinist, subject of an early talking short features] chinned his violin, leaned back, and focused on a spot at the top of the balcony. The technicians explained he didn't have to do that anymore, that if he looked directly at the camera it would put his face in front of every member of the audience no matter where they were sitting. Elman couldn't grasp the concept. 'But I always look at someone in the top balcony when I give a concert,' he complained. He agreed to look at the camera, and as soon as the cameras began rolling, he reverted to looking at the balcony. (Eymann, 1997, p.79)

The advent of the talkie also drastically shifted the expertise. Acting was about muscle movement (like dance). Actors used a vocabulary of grandiose gestures to convey the grand emotions in scripts of the era. There even existed formal "code books" for each appropriate emotion and how to portray it (Lutz, 1927). Method actors like Marlon Brando would certainly only appear to them as a half-hearted, perhaps shy, understated attempt at "real" acting (Stanislavsky, 1936).

Adeptness came with years of study. A pleasant voice was simply something any layman had or didn't have, but acquiring it hardly seemed like a skill at all, just luck of the draw. Hence, success in this new paradigm was not based on traditional expertise but a random gift (Eymann, 1997). However, we still have acting schools. The "expertise" did not actually get supplanted, but merely shifted in specifics.

The casual use of the telephone seems so plainly obvious today, but wasn't always. Along the bumpy road to the perspective that we have now (which still stretches before us), telephone calls (like telegrams) were reserved for important or official news. However, an earlier idea folks tried was very different. There was a time you could subscribe to something like a radio station. You would be mailed a schedule, and say at 3:00, they would be playing a Mozart symphony (Kern, 2003, Fischer, 1992). Can you imagine sitting in your kitchen holding one of those old style phones[15] for say 20 minutes? But surely there are things we do with technology now that will seem just as absurd in years to come.

Precedents in Waste

Nowadays, stoves are rather the norm in 1st world households, but this was not always the case. When the gas stove was invented, there was already a strong social "ritual" in place, sharing the cooking area, the communal hearth. At the time when they first appeared on the market, Americans spent (relative) fortunes to have these cooking factories in their own homes (Fischer, 1992). Gradually, social functions shifted and eventually it seemed like an obvious necessity to have a stove in every home. "Fire is revered generally as a deity to this day. The lighting of the household fire is in many cultures a ritual act." (Campbell, 1972, pp 248-249).

Light bulbs had a similar effect. And though now we scarcely notice the costs, originally equipping a house for electric light was a major investment. The investment also dissolved the need for families to gather in the same room. In other words, we paid willingly for privacy.

The cost could not eclipse the desire. Similarly, we spend huge amounts on computers, only to use them insistently for a very minimal purpose. A purpose that often other tools, common household items, do much better and far more cheaply. Not to circumvent an identified inconvenience, but to add several new ones. Moreover, by bringing computers into our homes, we have hardly improved beyond older inventions. The video effects we use now at our desks are the same ones that were available to pin the 80's. Is this wrong? Of course not, it is up to each individual and their bank account. But it is an odd phenomenon that indicates cost is not nearly the deciding factor in this particular market.

There was once a time on the ARPANET (Hauben, URL), back when graphic editing was too much work for most machines, computers could connect to a server that was the workhorse (Abbate, 1999). We could stand to learn from those days.

If you wanted to create your programs interactively, he reasoned, and if nobody was going to give you your very own 704 [a big computer for back then] to do it with, then the obvious answer was to get together with a bunch of other users to share a machine. … Give everybody a remote terminal so they could tap into the big computer through telephone lines whenever they liked, wherever they liked. … And finally, when the users needed some actual processing power, dole it out to them via an artful trick. (Waldrop, 2001, pp.163-164)

In terms of processing muscle, current cell phones are far ahead of where computers were when they became a public commodity (Greene, 2004). So what's a computer got, that a phone ain't got? The QWERTY keyboards (Bluetooth or built in, as in a Blackberry) are a clumsy but usable option. Allowing full size versions would hardly be a technical wonder. Phone screens are small but there could easily be monitors that attach to less powerful computers and supply their own VRAM. Do folks remember duo docks[16]? Software is not a hindrance. With a phone version of a plain text editor (like BBEdit) and FTP (for uploading files)[17], one could replicate most any computer function. But these 3 obstacles are hardly enough to prevent folks from adding their content to the web. It's as if the Great Wall of China were made 3 inches high all over and that was actually enough to keep invaders out.

This has been going on for years though, around the late 90's, we could purchase a webTV system or stand-alone email unit, for a fraction of the cost of a computer. Yet apparently we didn't often enough and the merchandise flopped. We can again send email, take snapshots and even look up web pages, all from our pocket-sized devices, but are dissuaded from giving up on computers. If we were all helpless victims of the industry, stuck with whatever they offered, that would be understandable. But we could hack (and we even have the tools sitting under our finger tips). Creating software is free (even creating software to run on cell phones[18]). We can even benefit from other hackers, as in Bit Torrent. Why doesn't that save us?

One interesting thing about the net is that people can cluster to solve problems, Open Source. Linus Torvald's project Linux is everyone's favorite example (Tapscott & Williams, 2006). But even these instances are subject to shared social influences. Linux would not exist if the need for it wasn't already common. Needs (even if they aren't fully understood or recognized) always preclude effort. Linux could not have happened without a strong selling point and a bit of trend following. Culture, not just some of the individuals in it, needs to agree to the need first, for openness to thrive. In a disappointing but usual case, we upload an Open Source project and nothing happens. The need, even if erroneous, has to be adopted by culture first, before the droves of supporters clamor onto the bandwagon blindly. Though one can sometimes see how a figure like Hitler or even Bill Gates could have profound influence on developing a new culture, it has to be a culture already hungry. It is just waiting for someone to say "I can provide beyond your wildest dreams".

The Nature of the Wave

People upload the concerns at the forefront of their thoughts. If images are uploaded of refrigerators, it is not because these people are devoted to the appliances. They may be concerned about selling them, repairing them, etc. but the refrigerator itself is a tangential idea. However, the refrigerator is like the stuff of dreams. It can appear to the subconscious out of context. Thus it is an icon (Jung, 1919). It indicates something, but not always the significance or application of that thing. And this describes how, with enough amassed conscious concerns, you can re-contextualize and draw from a subconscious mythology.

Though very unconsciously, we can also choose perfunctory social banter, not unlike role call, over in-depth intimacy. This may seem deplorable if we assume the net is used as a socializing tool (Reeves & Nass, 1996). But if the net is simply a means for everyone to share an iconography, this chatty banter in social software may actually serve a very un-social function. It allows people to say "count me in with everyone else" and weeds out contributions that serve to dissuade cohesion (Jacobs, 1961). Such is the psychological force behind social software. To join the club, the requisite initiation is to encourage replies like "oh kool dood". Insightfulness and real passion may require longer posts, but only really serve to rock the boat, putting esteemed members at risk of drowning.

It would seem there must be an unfathomable tidal wave of ideas to which to give our attention on the web (Popper, 2007). We could be drowned in ideas if we resisted this wave, but we dive in head on. Which actual molecules make us wet? Without the tidal wave pushing from behind, those individual molecules would have no effect. It is the sea of them, many more than we perceive directly, that makes swimming possible. On the web, that means that the ideas that end up at the forefront are there somewhat arbitrarily.

We need not see the millions of pages uploaded to feel their effect. In fact, most of them are seen by under 50 people (and over 200 bots). A few sites are the hubs, seen by millions, the molecules that touch us, and are often only on in a position to touch us because of the combined effects of the other viewers (Barbási, 2002). Sites like Boing Boing may be the molecules making us wet, are only able to, because they reach us before so many ever can. They are the surface of the water, the foam on the shore.

Obviously, not all of the participants in a ritual are the shaman (or James Brown). A concert hardly has the same wild effects on us in an empty arena. The fame, visibility and attention given to the "star" in no way indicates the rest of the crowd is any less effective, just less identifiable. Which brings us back to the idea that anything labelable is really interchangeable. Categorization is essentially *surface grammar*.

Following the Fold

We tend to mistake the notion that we are simply "social creatures" for the underlying idea that we are creatures of opportunity. We often just adopt the first solution that doesn't immediately hurt us. In many cases, latching onto a culture proves far more practical way to go. Do I need my umbrella? Look outside and see if others are carrying theirs (Weinberger, 2007). We (aspire to) contribute symbiotically to the system that helps us. How much of this strategy is genetic is debatable. Some insist humans are social by nature, but that doesn't fully explain why and how we go grocery shopping.

Being social we are also vulnerable to succumbing to mass hysteria. Wacky but harmless notions are common (Heuer, 1951; Simons, 1993; Clancy 2005), but extreme examples include Holland's "tulipomania" of 1634-1636, witch hunts, the Florida real estate frenzy of 1924-1926, the panic caused by *the War of the Worlds* radio broadcast in 1938 can spiral into real trouble. Modern tech phenomena include decades of virus alerts (which ironically spread like viruses), the dot.com bubble burst, the Y2K scare. We seem to be drawn to distractions like OJ Simpson (Rushkoff, l994), not because of any personal impact, but to revisit our social bonds.

No person of any economic strata, age-group, educational level or time period is exempt from this behavior (Bulgatz, 1992), though often the poor and uneducated are hit the hardest in the mad rush to join the frenzy (Vronsky, 2004). In many cases, as with Jonestown, those people are specifically targeted with tragic results. Feelings of vulnerability often fuel the mass hysteria, but threats and fears can impinge on any classification of people. Stanley Milgram's famous Obedience experiments demonstrate that any of us, given the right external conditions, relinquish our own rationality for our best guess at what is expected of us by "authority" in our chosen culture (Blass, 2004).

Blind faith tends to create impenetrable illusions that ignorance has effortlessly been replaced with expertise (the "money for nothing" bait of successful cons) (Weill, 1948). When it comes to using the web, we are defiantly ignorant. Though many claim to know better, this is fool-hearty. Apparently, our ignorance does not prevent us from unconscious uses of the network though. We just may not realize why we do what we do. Rather, not fully understanding, we may be freer to use the tools to save our sanity. Unconsciousness often protects us from our conscious decisions to over-ride unconscious ones. We need to feel protected in a big social group and simultaneously can be overwhelmed with the demands from so many strangers. The two dynamics are at odds and would make us crazy, if we didn't devise buffers. Walking down a crowded street, talking on a cell phone is one strategy.

Revolution

The history of the net has been something of a "mass movement" as articulated by Eric Hoffer in 1951. In a mass movement, such as the Bolshevik, French, and Nazi revolutions, even Christianity, the status quo is upset by discontent with freedom. Though "more freedom!" may be their chant, freedom also puts responsibility on the shoulders of the individual. What revolutionaries actually want is less responsibility as an individual and broader anonymity. The effort to blend in, generally becomes an effort to make everyone the same, discrediting notions of elitism (whether imagined or real).

This is in stark contrast to the notion that revolution is a reaction to oppressive poverty and despotism. Of course it also echoes tenants of DIY-ism. In many cases, such as "lurkers" (often the vast majority by far) in on-line discussion groups, we voluntarily do not wish to actually be involved. We don't actually want the interactive benefits of the web to replace magazine subscription. We'd often rather just keep tabs on the movement, the discussion that serves to dictate how to behave. Furthermore, people intent on survival see no use in diverting attention to matters of no immediate consequence. In effect conservatism (in all its forms) is the petri dish that inflicts oppressive paranoia[19]. It is people with idle time and disposable incomes that spend their resources to maintain the computer industry. Hopefully, in this essay, you will see, I am not casting blame, I am part of this trend, but asking why.

The ARPANET's transition from a tool for scientists was gradually pried open from institutions who could spend large sums buying into it for large faculties, often with funding, rather than out-of-pocket money, to the hard core techies who weren't academically affiliated has been well documented (Rushkoff, 1994; Shirky, 1995; Waldrop, 2001; Greene, 2004). Then the internet unlocked the door at first to the basement "nerds" and gradually aspired to welcome the functionally technophobic with the advent of web 2.0. Though the cost was at first an obstacle, it has become a given, an expectation. For instance we may still buy Microsoft's Office, though OpenOffice has been free for years. It is also unusual, and thus uncomfortable for the new user to think free software could be better than expensive software.

The decisive factor at every step seemed to be, not minimizing cost, but minimizing unfamiliarity (even at the expense of confusion from horribly baffling and inflexible design).

As with any mass movement, opening to a wider base means generalizing for broader appeal. That means that once they have joined, everyone will be reciting the same simplified mantra. In effect, we all must share the same lowest common denominator intelligence, or rather suppress our tendencies to think too far "outside the box". This is not to say greater accessibility is a bad thing, nor a good thing, but that opening admission does result in letting individuals get "lost in the crowd" and "hidden in plain sight", and the "dumbing down" that is often a symptom can easily be mistaken for the disease.

It is not simply the oppressed versus the oppressor that brings out revolutions. The person who harbors no hope of improving their misery, is not a revolutionary prospect, would rather things stay the same. Life is hard enough as it is. Moving the horrible but consistent land mines all around them is a scary proposition. Miserable conditions become easier to live with as long as they remain familiar. Revolutionaries offer disruption only to those who are eager to gamble everything, and feel confident that whatever the outcome, their lives will remain fairly comfortable. Paradigm shifts that upset stability are brought about by folks with leisure on their minds[20]. But the specifics of a doctrine are pretty much arbitrary.

It is futile to judge the viability of a new movement by the truth of its doctrine and the feasibility of it's promises, What has to be judged is its corporate organization for quick and total absorption of the frustrated. Where new creeds vie with each other for the allegiance of the populace, the one that comes with the most perfected collective framework wins. (Hoffer, 1951, p. 41)

We have computers, connected to a network. The capabilities are enormous and yet email and static web pages remain their most common use? Fundamentally, communication over the web can never possibly work ideally on so many levels, but we obediently adjust our criteria to "good enough" (Reeves & Nass, 1996). We discontented yet hopeful seekers of change can all join the faceless crowd with Facebook. Not that Facebook ever intended to promote this anonymity, quite the opposite surely, but its success may stem from a popular need to be nullified. The pressures to subscribe to mass movements "produce both readiness to sacrifice the self and a willingness to dissolve it by losing one's individual distinctness in a compact collective whole." (Hoffer, 1951, p. 59)

Looking at ex.plode.us (a site that compiles the membership of several social software sites) may prove an ideal demonstration of this. Here are six of hundreds of pages retrieved from a single search.

V. TECHNOLOGICAL PERSPECTIVE

Using the Computer

Before going any further, I want to mention some positive examples. There is nothing wrong with buying things that we don't end up needing after all. We also own things, not because they fill any utilitarian purpose, but just because we like having them. Fun clothing, photos and artwork are particularly conspicuous examples. However, here is a case where we see a cool pair of bright red shoes, spend a significant sum on them, decide it is crucial to wear them for as many hours as practical (as if they provide essential nutrients by osmosis?) and wear them every night to sleep in, but remove them each morning. After a year, though the shoes are still quite fine, we replace them with an even more expensive pair. Huh? Let's look at alternatives.

Prominent sites that take advantage of the network of computers (like Amazon or Ebay), rather than solely providing sedatives in the guise of eye-candy, are rare but not impossible to find. More obscure are the personal examples, things we could all accomplish alone in an afternoon. The web can be used simply as a feature of software, a way to reach solutions, an ingredient to be fluent with in wielding this technology. The web is another folder on your desktop, but one so full of files, it has great uses.

Dan O'Sullivan, a professor at NYU's Interactive Telecommunications Program is certainly wielding the tools at hand. One fine afternoon, as a curator of a computer art show of about 150 pieces, he created a very web savvy utility to solve a very real problem, how to arrange these works in the finite space, given finite resources. Pieces often had very specific space, lighting and sound requirements. They all had extensive equipment requirements, needing various things from carpeting and green screens to a water supply, not to mention all the hardware like projectors, CPUs, speakers, cameras or things like wall space, tables, windows, web access.

So in the registration process, he included a software map of the gallery and fixtures. Each artist could place a marker on the map. Artists could return to see the latest version of the marked map. However, you could only edit your own marks (though O'Sullivan could edit all of them as needed). If artist clustered in one popular spot, others could decide to move to a less populated area. The solution to the problem was thus accomplished, finding an the ideal configuration, particularly given the limited efforts expended by everyone involved.

Another example happened when researchers looked into the game "Six Degrees of Kevin Bacon". In the game, a person mentions a movie, someone suggests a pair of actors that appeared in that movie and also were in a second movie together. More movies are mentioned, until the chain of paired actors includes Kevin Bacon. The goal is to see, from any initial movie, how few other movies can be linked to reach a co-starring role with Kevin Bacon.

Using the *IMDB* (Internet Movie Database), Duncan Watts was able to create these tables indefinitely and much more reliably than by poling humans. One thing he found is that Kevin Bacon is hardly the center hub of the Hollywood universe. In links to other actors he rates a little above average. In this way, Watts wielded the tools for the sake of his inquiry (Watts, 2003). He did not look for a pre-packaged research utility or even modify an existing one, he created the software from scratch that accessed the web.

Human Tasks vs. Computational Task

Many of us assume a computer can't consistently create masterpieces (Hawkins, 2004; Carter, 1999; LeDoux, 1996). A few remain convinced that a computer could theoretically create something like pop music and best sellers (Tapscott & Williams, 2006; Jenkins, 2006). How? On the net, one can randomly generate a song-worth of notes, or randomly put sentences together until 200 pages are reached. Then, as with Evolution, generate a variant. Thanks to the enormous number of potential judges available[21] on the net, humans can decide which iteration is the better one, and that becomes the new template for the next generation. Because there are so many, their votes will end up reasonably representative of the group consensus. Theoretically. This concept was made most famous with the (theoretical) *Turing Machine*, but even *Information Processing*[22] utilizes the computer in this way (Hunt, 1996).

Even if an individual voted "incorrectly", the overwhelming volume of votes would push the outcome, not towards the "better" (as if such a concept were even viable) but toward more popular. This is also why it would never create a "masterpiece". The masterpiece, steps well beyond the expected. A tiny minority may recognize it's "greatness", but most do not at the onset, without other leaders to follow[23]. Einstein and Monet are obvious examples, where public opinion gradually shifted in their favor, but didn't start as comprehension without a few model believers to imitate (Gardner, 1993; Solso, 2003).

The common needs (spoken or not) are what create deep comradery, and not the content of the messages. The net can transmit messages. Many propose that this can engender *social capitol*, a trust between members (Watts, 2003). But trust is not emotion. Membership and kinship are not synonymous. Certainly, the messages are no more faulty for conveying empirical matters (including chit-chat, but don't make sentiments too wordy or require more than a quick glance). Moreover though, the medium simply doesn't work for more complex messages. We don't get an email alert when visitors' to our web pages eyes glaze over. A face-to-face conversation is interactive on hundreds of levels (at least) and not one or two. If we were all Autistic maybe communication mediated by computers (as we do now) would suffice, but so far what the net does and what people do is very distinct (Boyd, 2005).

But there are two ways we use computers. One is the hands-on way but the other is the way we imagine computers in the abstract. For instance, we vaguely imagine computers at NASA or even at the bank are for. Most of us don't know or really even care in any detail, yet we have a sense of what we think their role is. We tend to assume our subconscious attitudes are informed by conscious ones. Hopefully not. Movies like *2001:A Space Oddessy, War Games* or *The Terminator* series reiterate remarkably similar anthropomorphic messages about our tools. This is the same technophobia as when people became afraid Nikola Tesla was out to destroy the human race (Tesla & Childress, 1996). It's silly in retrospect, but is an inevitable stage in any development.

An example of high-end computing is the *neural network*. At first glance, it would seem this idea would be of no use at all[24]. At second glance, you see it of use, if only it didn't have that preposterous name. A basic model of a neural network may look at a face with 4 binary features, one of two types of eyes, ears, nose, etc. (Adbi & Valentin & Edelman, 1999). Presented with randomly assorted faces of this kind, it guesses if a known face is the same as a new face, perhaps which features are more likely to appear together. The limited number of options is essential to "learning.

As the system "learns", it gives weight to it's predictions, called *Hebbian learning* (the *Widrow-Hoff* method is similar but adds a feedback loop. "Fuzzy logic" is similar but without necessarily networking (McNeal, 1994)). This is obviously a simplification to refer to the concepts, but there are countless pages written about this. However, that's not how brains work. We make unpredictable adjustments to the odds on the fly. "That might be Janet who might be wearing his clown make-up." Like language, there are infinite possibilities, but we use schemas to narrow our choices drastically (likely to chunk-sized options with every recall).

By creating context, we can pool sketchy *top-down* and *bottoms-up* knowledge and derive useful conclusions. A more comprehensive description of the *frame problem* (and the *conduit metaphor*) would require a whole book (Fodor, 2000; Ortony, 1993) so forgive me for trying to sum it up here. Computers can't know about anything beyond what they've been programmed explicitly. Without telling them about 4, they can't add 2 and 2. Thus there is a limit to what they can learn. Computers can only do an amazingly thorough job of re-combining facts they know. They can't consider of things outside of the frame they have been given. Computers just don't "frame" things and can't employ our method. And it ends up, this method is essential to how we conceive of problems (Dewey, 1910; Hawkins, 2004).

Again, this is hardly to say we are wrong in trying (for a while). It is just very peculiar behavior

Figure 3. Looking at ex.plode.us (a site that compiles the membership of several social software sites) may prove an ideal demonstration of this. Here are 6 of hundreds of pages retrieved from a single search.

on our part. It is not that we should "correct" our use, as much as we should wonder about how we landed on it, and why we have so tenaciously clung to it, for so incredibly long, when we should know these issues fully well. The points here are not recent or arcane discoveries at all. No industry or advertising is to blame. We choose what to buy and how to use the tools freely. But by clearly identifying our motives, we may be able to shed light on how best to achieve them, particularly by discovering ways to act in our own favor, and no longer in a veiled form of self-abuse.

CONCLUSION

There is a big difference between web 1.0 and 2.0. Its the difference between going to the lumber yard to get wood cut to build shelving and going to the ... store for shelving. In one case its ground up and custom and in the other its glitzy but you're working with pre-defined units. Its a different way of thinking - what gizmos/widgets can i find & add? – Katharine Staelin, Web designer since 1995.

Very true.

However, let's take another step and compare a 100-year-old oak bureau and a unit from Ikea. The Ikea model has benefits that most folks (including the retailer, manufacturer and shipper) need. It's cheap and more applicable to different (but pretty similar) situations like storing books, clothes, flatware, etc. What's worrisome is subtler. Where people once saw funny uses for peculiar furniture, now they just don't want to, are trained not to. They see an old bureau that is obviously a bedroom piece doesn't belong in a kitchen.

That said, most of us are mediocre carpenters. Our pre-fab furniture can only end up so bad. But it can only end up so good, too. At an insightful, yet perfunctory level, it's only the range of quality that is changed. And that's what has happened with the all-purpose look of blogs. But looking at it in reverse, where a page of no interest can be clicked away and immediately forgotten (has minimal effect), the odds are now remarkably slim that we'd land on a page that knocks our socks off.

I am picking on blogs and the web, but these are symptoms. There is a much deeper and more profound dynamic I am referring to here. In this process, we are being trained as to what we need to do to get more expected result, not more useful ones. Part of that training is selective attention. We smooth over differences between what we hope to find and what we are offered. Without noticing our habits shifting, our brains (subconsciously) re-work our inquiries to fit the answers given so things make sense to us (Gallison, 1997). We ask Google for things that cause Google to reward us or not punish us with confusion. This is the wave and we are already drenched.

By subscribing to this wave, we also downplay our individualistic differences. But here we must take caution. An emergent property of this cohesion is that the web now contains mechanisms for enforcing a cultural harmony, even amongst traditionally opposing views. Acceptance is a slippery slope. Ideally, we cast away bigotry but we can also give child molesters the stamp of approval. This dilemma is not a dilemma at all. It's simply that we are used to judging right/wrong, true/false, good/bad and the **net** is a way to discard these things. Truth doesn't matter. From a traditional perspective, the net absolutely is lawless anarchy. But the net is not about truth, it is about collecting points of view. The only fact lies in the idea that someone, somewhere wants to make a point of view more accessible. And that is completely trivial, beside the point. Authors and their beliefs are arbitrary because they have deliberately chosen to be so.

Whether a collective unconscious, a gas oven, a cultural ritual, a verbal language or a popular tune, these are all tools, we created at our disposal. We have a choice in how to employ them. As every one of us, in big cities and out in the sticks, is encroached on with greater the pressures of population density and *overload*, the more prone we become to use these tools as a shield, protecting our intimate individuality. Such a scheme is hardly a bad one. Quite the contrary, we may be desperately saving what little sanity is still salvageable.

Democracy is not freedom, but a strategy to allow anonymity. Or if you'd rather believe it is, freedom's key feature is to absorb most of the blows to individuality, by distributing them to the masses in imperceptible little inconveniences. Spam is an obvious illustration, but even the fact that people use blogs that don't precisely fit their needs, though are willing to adjust those needs, is a far more profound case. Or that people eagerly use web pages, a monthly fee and pricy computers instead of filling notebooks and leaving them on the street or sending postcards. What are we anxiously paying for?

Ultimately, we made this collective unconscious. The net is our resource, at our machines' disposal (and not at all visa versa). It is unprecedented-ly useful because it continually evolves, because no individual, consortium or law really has the effect on it of the totals of us, because we feed it, look after it and nurture it. What we created was certainly impressive. Technology is ours to transform, to some degree obviously at the content level, but much more importantly at the perspective level. We are heading further into aimlessness and danger, but aren't on a fixed course at all. Hopefully, a splash in the face, wakes us up. We can now choose to steer.

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KEY TERMS

Consciousness: This word (often called "the C-word") gets people all flustered and surely needs definition. Many want to believe it is uncannily elusive. I disagree. Jeff Hawkins seems to as well and articulates it quite nicely. "Consciousness is not a big problem. I think consciousness is simply what it feels like to have a cortex." (Hawkins, 2004, p. 194) Of course "feels like" is even more problematic. I would alter this slightly. Consciousness is the result of whatever the neo-cortex does. We don't precisely know all the details, but whatever they end up being we can just call "consciousness."

Digital: This has to be one of the most abused buzz words ever. It has a very definite meaning that gets lost in a hazy fog. People often think it means something like "newer and better". Actually, it just means "less accurate (for a good reason though)". Theoretically, analog is any value from 0 to the highest, an infinite gradation of grays. In reality, we are limited by human perception and frustrated by mechanical limitations. Digital means that the same reading is now only 0 and 1, black or white. There is no question this is an imperfect alternative. What is useful though is that when done enough times, we can surpass previous limitations (though we don't always). Creating copies is far more reliable since there are so few possible states per *pixel* (see below). In fact, whereas before "copy" and "original" were useful ideas, now they really don't apply. The thing we play back now is always a copy. The original, which only existed as electrical pulses, is long discarded as soon as it is saved. But there is no longer any reason to distinguish, since they are identical clones.

Network Behavior: Individual entities (nodes) can be grouped to communicate with each other in a myriad of configurations. Two cans and a string is the simplest networking model, where there is only one link between the *nodes*. The phone system is a complex network, allowing any node to relay to any other. Or you can think of social networks. In cases where "she told two friends, then she told two friends and so on, and so on." In networks, tiny events can take on enormous proportions. Where a germ is passed between nodes, the epidemic charted over time, does not look like a gradual slope, but stays low, then suddenly explodes. The features of the network beyond the sum of its nodes are the *emergent* properties. For instance, telephones are only so handy in isolation but by connecting them in a network. That's a simple emergent idea, but there are more complex ones. For instance, you can scream at one end and raise a person's pulse at the other.

Neural Net(work): A computer system is often designed to mimic the workings of the brain, primarily for the task of statistical learning. However, this term is a bit misleading, since it is not at all likely that the brain learns in even a similar way to the way computers (even networked ones) save and retrieve data from memory. Nonetheless, whether accurately depictive or not, it is a remarkable programming. In very generalized terms, data comes from several distinct sources (often with their own processors analyzing *input*. Each source is called a *neuron* and has a weight of influence. The data is scaled according to the neurons current weight. The central computer determines the successfulness of this pool and updates the weights accordingly. Thus it seems to learn, which processes influence the outcome more heavily in complex tasks. Of course, this implies fore-knowledge of the goal, which brains don't consider and computers can't do without, However, the pooling and dynamic weighing process is no less effective once the analogy to the brain is discarded.

Pixel: Usually this word is used in the technical sense (and probably one you are well familiar with). But the general concept is often a hazy one. The term being popularly bandied about with careless excitement, refers digital-ity. It is the smallest indivisible element in a collection of like elements that comprise an entity. "All in all it's just another brick in the wall." You could say the places on a checkerboard are pixels. But they needn't even be square. City blocks may be considered pixels. But they needn't be configured in any orderly fashion. Cells in a cluster of tissue could be pixels. The audio equivalent of resolution is called the *sample rate*. Usually to call something a pixel, there needs to be an encompassing (explicit or implied) system. A colored dot of ink is not necessarily a pixel, until you consider it part of a larger picture, say in a newspaper.

Surface Grammar: and **Deep Structure:** These are terms coined by the linguist Noam Chomsky. Probably this entire essay is predicated on an understanding of these terms. It hardly matters if this theory proves correct for language, it is nonetheless a very useful way of looking at the issues. But if you aren't familiar with the terms, and many aren't, we'll try here. According to Chomsky, (non-human) animals certainly communicate but insists that these communications can not really be called language because the animals lack essential mental features. He has a point. It's a fine one and could easily be overturned some day. But it is based on the notion that there is a unique mental apparatus. A *Language Acquisition Device*. A bee dance or a bird call serve linguistic purposes, but bees' and birds' brains don't have enough parts. Each human language obeys a somewhat unique set of conventions. "Noam talks about language." is not the same as "Language talks about Noam." The difference in meaning is derived from their specific *surface grammar*. But the fact that we can put words together in some order and it will convey a message is *deep structure*. Though it is clearly impossible all the specifics of a language would be in our genes (no one is born speaking fluently, we need to learn), it is also unlikely we could learn so many detailed rules, so proficiently, with almost no trial-and-error for many aspects, in the few years we acquire language. "Colorless green ideas sleep furiously." Chomsky's famous example feels like it should make sense but does not. Possibly because, while we may figure out by "looking up" the references of our learning, that this is meaningless, we are "hard-wired" for the rules by which a languages rules are concocted. The brain doesn't actually know syntax from chaos, it simply applies this pattern recognition to whatever stimuli is input. Over the ages we have gradually adapted this mental tool to the task of communication via words.

Turing Machine: Probably, if you bought this book, you are someone who knows about Alan Turing's ideas more than I. It is a very popular concept in computing and for good reason. Turing's original example has been applied in countless variations, in countless disciplines over the years. But what the Turing Machine, from 1936, refers to is a proposed concept (never actually built), where a computer could use feedback with a conditional assessment function to "learn". Almost all computer learning is based on this idea in some way.

ENDNOTES

1 Object Oriented programming mainly differs from Procedural Programming (now all but extinct) in that there is a short hand method of grouping behaviors into "Classes". If the object in code is a member of the Cat class, any specific instance *inherits* all of the variables and functions of that Class. Thus if Mittens is of the Cat class, and Princess has a variable for breed, and a function purr(), Mittens probably has those things too. However, it would be convoluted to detect if there were purring happening anywhere in the program and then impossible

to determine if it is a Cat doing it. At least without setting up very externally specific and reasoned decisions. There is no identifyCatsByWhateverMeans() function.

2 Higher level programming languages have *data types*, which may seem comparable to chunking. There are huge, essential differences, but the main ones are that chunks are not a fixed size, and can expand/contract. There is no precise point at which they fail. And there is no analogy to *casting*, or switching between data types.

3 Jung notes that "resistance to its [archetypical] expression may result in neurosis", which, as we read on, resonates eerily. Sanity may depend on a degree of conformity" (*ibid.*) This notion, that archetypes are not created to serve luxury or interest, but from a genuine psychological need for our mental health, has great ramifications as we continue.

4 Before the Beatles and Elvis, during Frank Sinatra's early performances audiences, mostly of teenage girls, often screamed and fainted. His manager noted the phenomenon and made it more likely to occur by planting 16 young women who had been instructed to initiate this behavior. They were soon accompanied by authentic screamers and fainters. The antics spread to the thousands of others. As with the laugh track of television sit-coms, people will often follow the herd, even when the leader is obviously a fraud. Shows are funnier to us if the (artificial) crowd seems to enjoy them. We are constantly on the look-out, hungry, for cues to appropriate behavior, even when we "know" better.

5 Keeping control of neurological feedback loops is what drugs like Prozac are all about. LeDoux shows how potential fear stimuli triggers the amygdala, which sends two signals, one to create visceral effects and one to the pre-frontal cortex to assess the threat. There, the signal either is abandoned or sent again to the amygdala, completing a loop. There really is often nothing to fear, but fear itself. This is also why feelings of apprehension can take hold, without much antecedent. It is a runaway feedback loop. The amygdala keeps sending the signal to the rest of the body, increase the pulse rate, speed up breathing, dish out more adrenaline. But meditation and other like forms of trance states, has the ability to assuage those loops.

6 English only relatively recently switched from this structure.

7 Only about 100 of the thousands of frequencies are commonly used (Levetin, 2006). Though by tuning off concert pitch these dozen notes (times about 8 octaves) are relative and not absolute. Of the dozen tones, they are often further divided into patterns called scales (an example is all the white keys on a piano are C Major, the black keys are "accidentals" of that scale). Cultures tend to stick to the same 3 or so 7 note scales (Temperley, 2007). Though that leaves about 2.5 million possibilities for every interval. Quite a lot but hardly infinite.

Likewise, rhythms tend to be either on the beat, or a division of that by some factor of two (half a beat, half of half, half of half of half, etc). Occasionally factors of 3 or 5 (or even 7, 9 or 11) are used sparingly in Western music. Eastern and Middle Eastern music is more open to factors greater than 2, and tends to limit melodies to 5 of the 7 note scale (May, 1980; Arbabi, 1997). Again with regard to rhythm, the possibilities are enormous, but drastically fewer than infinite.

8 However, cell phones and TVs are now quite imitative of computers, this is not essential to their actual functions. A peculiar phenomenon. Traditionally, successful need fulfillment, drives manufacturing and thus marketing. This appears to work the other way around. However, as we'll talk about

later, a need may actually exist yet.

9 Ironically, but only examples disruptive to systems that have always worked are ever heard. Napster and Bit Torrent type file sharing is more about the fun of getting things for free. The resulting anarchy is an afterthought, and hardly as detrimental as if it were a bona fide strike against the industries. We literally could upload every song and movie as it comes out, but this may actually be self-defeating.

10 I would say, an important transition for us now, is to let go of the idea of archiving. While digital storage may be semi-permanent, the means to play it back is in hyper-flux mode. Digitization is paradoxically ephereralization. Or rather, the more non-linear and computer-centric the thing, the less likely it will be available for long. But calling archiving an obsolete game is akin to blasphemy.

11 Actually colors outside of the visible spectrum (like Infra-red and Ultra-violet) would be useful for many applications.

12 Though "inch" varies slightly, making matters even more complex for traditional designers.

13 There really is no original. The usefulness of digital-ness is like replacing an assembly line with a hall of mirrors. The fundamental way computers and the net operate, renders issues like copyright, moot points. Looking is "stealing" or rather there just is no useful way to talk about "stealing" anything that can be digitally recorded. This bothers a lot of folks who depend on things like royalties. Prolonged arguments simply conceal the issue. We can try to weave convoluted smoke-screens and offer excuses, but the concept is a simple one – if you understand how digital technology works, you understand that the word "original" has no real relevance. Without that word, any argument collapses like a house of cards.

14 Folks today complain that modern audio CD's suffer from a standard set decades ago, limited older capabilities.

15 Many arms must have grown sore. For a few decades, the phone featured one cup to speak into and another one held to the ear. Later, those two pieces were consolidated. The "French" style one piece receiver, that we still see sometimes in land lines, and ubiquitous until about 2000.

16 These were early Mac notebooks (1992-1994) with a garage-like box that acted as a monitor base and peripheral hub. I have a few and they still can be networked (LAN or internet). They have browsers, can send email, cost less than those $100 computers for Africa that every talks about. So why do I, along with so many of us, keep buying new machines?

17 Both programs are surely out there already but which would take a Python or J2ME programmer a day to write from scratch. Often these features are built in to programs such as Dreamweaver and many professional web designers simply aren't always aware they exist (much more usefully) outside of a specific program.

18 Free IDEs for cell phones are offered by Google (Android) and at Mobile Processing.

19 Paranoia from schizophrenia (and other psychological problems) may be awful for that individual, but that individual is seldom also able to organize unwilling masses to comply with their defensive strategies. Conservatives (again, loosely defined) tend to project their needs onto others who would be fine if they weren't being so regulated. Often the minority, they devise very calculated means of getting others to adopt their strategies. However, if conservatism implies a need to keep the status quo from change, the only way they can possible manage to keep things comfortable (or even bearable)

for themselves would be to convince the majority that change is a bad thing.

[20] Oddly, this is the exact effect that the adoption of the light bulb had as well. People could read by the fireplace with the family in the living room, but chose to move to secluded bedrooms. People could see by moonlight (and stars back then!) but street lights made it feel less scary to go out for an evening stroll. Note that most places on which livelihood depended, were closed by that hour. Certainly this was not a universal case, but you see how most of the light bulb's cultural impact came more from luxury than dire need.

[21] Note that these are people with idle time and attention. Perfect revolutionary fodder.

[22] A precursor to Artificial Intelligence, where Sociology and Computing initially met.

[23] Recall the plants at Sinatra shows from footnote 4.

[24] The problem can be summed up like this. "[neural nets] do not differ *essentially* from standard statistical models. … Networks usually have several layers. The first layer is called the *input* layer, the last one called the *output* layer." (Adbi & Valentin & Edelman, 1999, p. 2). Thus you see, the task at hand is not actually accomplished entirely asynchronously but remains essentially linear. And though we don't know much about how brains do what they do, we are sure of many ways they don't work. Brains are definitely not linear.

This work was previously published in Handbook of Research on Computational Arts and Creative Informatics, edited by J. Braman; G. Vincenti; G. Trajkovski, pp. 343-374, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Section II
Development and Design Methodologies

This section provides in-depth coverage of conceptual architectures, frameworks and methodologies related to the design of social computing tools and technologies. Throughout these contributions, fundamental development methodologies are presented and discussed. From broad examinations to specific discussions of particular frameworks and infrastructures, the research found within this section spans the discipline while also offering detailed, specific discussions. Basic designs, as well as abstract developments, are explained within these chapters, and frameworks for designing successful e-learning environments, social search engines, and social software are examined.

Chapter 2.1
Distributed Learning Environments and Social Software:
In Search for a Framework of Design

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ABSTRACT

This chapter discusses how the construction of an adequate design and intervention framework for distributed learning environments might be approached. It proposes that activity theory has some interesting concepts and perspectives to offer in this regard. In addition, it discusses the concept of affordance, understood as perceived possibilities for action, and its potential consequences for learning environment design. Furthermore, some current technical and conceptual challenges for the implementation and maintenance of distributed learning environments are addressed. The authors consider their text as a proposal for a necessary reorientation and a call for contributions to the search for an adequate design and intervention framework for distributed learning environments.

DOI: 10.4018/978-1-60566-208-4.ch011

INTRODUCTION

In recent years higher-education systems are undergoing a considerable transformation process on various levels. The implementation of leadership-, evaluation- and accreditation schemes that are mainly modelled after entrepreneurial solutions, are fundamentally re-shaping our higher educational institutions. This new regime also influences how communicative and productive practices like teaching, facilitating, and collaborating are technologically mediated. Many educational institutions apply now strategies and policies that aim for the implementation of large-scale, homogeneous, and centrally administered technological landscapes of tools and services to support and manage teaching and studying activities. Thereby they largely ignore that disciplines or areas of study still differ to a considerable degree on how they relate to certain occupations and professions, the labour market in general, and on what educational traditions they have developed over time Bleiklie (2004). From an observer's point of view, all actors appear primarily as "residents" of such an institutional landscape of pre-selected and decreed sets of tools and services. Everyone is expected to perform all necessary mediated activities within its boundaries.

Apart from general communication systems, content repositories and digital library systems, institutional landscapes of universities are still dominated by Course Management Systems, that are often somewhat misleadingly named Learning Management Systems (LMS). These Course Management Systems are the prototypical technological expression or "flag ships" of the mainstream institutional strive for centralisation and control. Thus, it comes as no surprise that the ongoing development of these all-comprising platforms is driven by a continuous desire for expansion and assimilation of additional features and functionalities. At the same time very few of the Course Management Systems currently in use, provide interfaces for interaction and data exchange with a wider ecology of networked tools and services. The majority of these platforms rather operate as "closed clubs" and try to restrain all activities within their particular boundaries.

All these systems feature an unequal distribution of power and ownership with a clear distinction of roles (such as educational authority vs. participants) producing asymmetric relationships (Wilson *et al.*, 2006). Furthermore, they foster a general educational intervention approach that seems largely based on the rather illusionary expectation that human change processes can, and indeed should be, modelled on the basis of simple cause-and-effect relationships. We would like to argue that the socio-technological practices that are encouraged by the majority of today's Course Management Systems in higher education demonstrate clearly that the majority of instructional design and educational intervention models are still conceptualising humans, or the social systems they form, as "trivial machines" (Foerster, 1999). It seems like decades of multi-disciplinary work on system theory (see e.g. Willke, 2005) constructivist theories of knowing (see e.g. Glasersfeld, 1995), second-order cybernetics (see e.g. Maturana & Varela, 1980), and aspects of self-direction (see e.g. Candy, 1991; Fischer & Scharff, 1998) and self-organisation (see e.g. Harri-Augstein & Thomas, 1991; Jünger, 2004) in education have simply been brushed aside or entirely ignored.

Instead of treating humans as systems of (self) organising complexity that develop particular qualities like operational closure (and thus self-referentiality and highly selective interaction patterns with their environments), technological mediation in higher education and its underlying (instructional) design is mainly based on the idea that human change processes, and the intentional interventions that are supposed to "cause" such changes, can be reduced to simple cause-and-effect relations, simple purpose and goal attribution, and simple sequential temporal patterns (Willke, 2005). Thus, many technologically mediated environments that follow a traditional instructional design approach are fostering almost exclusively the teaching of codified knowledge and skills. Emphasising a clear distinction between educational authorities and students and their respective responsibilities, expert instructional designers and course facilitators are responsible for guiding the participants through a sequence of pre-structured events and interactions with pre-selected materials, towards a set of pre-defined instructional goals (Kerres, 2007). In general this creates rather sheltered and non-challenging environments that offer only a limited amount of prescribed interaction patterns and forms of expression. This predominant institutional approach to technological mediation of teaching and studying appears to be rather incompatible with a variety of contemporary conceptualisations of how human- and social systems evolve and function and what this implies for intervention and intentional change. Apart from this conceptual incompatibility the status quo in many educational institutions contrasts sharply with two major ongoing developments.

SOCIO-POLITICAL AND SOCIO-TECHNOLOGICAL CHANGE

From a socio-political perspective we have to attest that all post-industrial societies have seen a dramatic shift towards more symbolically mediated and information driven work processes. We can observe a general increase of "constructive" or "design"-practices that focus on the production of artefacts in the ongoing work process. Architects produce technical drawings and sketches, psychologists create diagnostic reports or treatment plans, programmers develop new prototypes, and so forth. What all these activities have in common is an evolutionary design- and development process that inevitably produces challenges and demands for change and "learning" on a regular basis. The progression of such design- and development processes is generally hard to predict, since goals and strategies often have to be changed and expectations have to be adjusted. Authentic challenges and tasks often require collaboration, communication, acting under (at least partial) uncertainty, and an overall working style that has been described as bricolage (J. S. Brown, 1999). Bricolage refers to the localisation, selection and combination of artefacts and objects (things, tools, documents, programme-code, etc) in a novel context. Beyond accessible artefacts, the systematic integration of other people and what they know and are able to do (see e.g. the work on distributed cognition by Hutchins, 1991, 1995), becomes a core component for successful problem solutions in information-intensive work settings.

Thus, in numerous work and life settings new important "areas of challenge" emerge. Many people, for example, find themselves increasingly operating in distributed and technologically mediated environments. They need to build up viable dispositions for collaborating, self-directing (intentional change projects), and social-networking successfully within these environments, while making use of new potentials for mediated action on one hand, and compensating the limitations and constraints of such a mediated form of (inter-)action on the other. Some scholars, particularly in the area of vocational education, have acknowledged this trend. Their conceptualisation of competence, for example, explicitly emphasises the role of dispositions such as orientations, values, and volitional aspects for (self-organising) action that can be successful in situations that carry a high level of uncertainty and complexity (Erpenbeck & Heyse, 1999; Heyse *et al.*, 2002). Thus, these scholars try to shift our focus away from dispositions such as factual knowledge and procedural skills that made up the core of the old concept of "qualification". Of course, factual knowledge and procedural skills are necessary dispositions in all contexts, but they are not sufficient to act successfully in many authentic problem situations. They might offer a starting point and some guidance but certainly not a straight solution in many areas of life and work.

In parallel to the changing nature of work and life challenges, we can observe from a more socio-technological perspective the emergence of a myriad of decentralized, only loosely-coupled, networked tools and services. These tools and services increasingly provide individuals and collectives powerful means to augment a myriad of activities and practices that transcend all kinds of institutional and organisational boundaries. The emergence of these small, simple, and networked tools and services, often labelled as social software or social media, is generally considered to be an important expression of the ongoing evolution of the Web towards a general computing platform and a renaissance of some core ideas of the Two-Way-Web (Berners-Lee, 2000). This looming evolutionary step is frequently labelled with the rather fuzzy marketing term Web 2.0. However, we believe that this development could potentially fuel a counter-movement to the mainstream, application-centred, institutional approach to technology provision in higher education outlined above. Many interesting lightweight, cost-efficient systems and tools have emerged in the personal Web publishing realm, including varied content management systems, content syndication and aggregation services, and a range of tracking and mapping tools of hyperlink economies and social networks (Paquet, 2003). These tools offer powerful means for the support of collaborative and individual work and study activities as they occur within contemporary information-intensive design- and development work outside of formal educational settings (Mejias, 2005).

In recent years we saw the emergence of a growing "avant-garde" of people who indeed support and improve their own personal work- and "learning" environments with a patch-work of preferred, networked tools and services. Empirical data on the size of this group is hard to obtain, but there are many indicators that the way people are using the Web for (self-)educational matters and collaborative actions has begun to change (Downes, 2005). In this realm, personal and collaborative Web publishing activities like Weblog or Wiki authoring, Webfeed publication and aggregation, social book-marking and so forth, are currently the iconic practices. Some individuals and collectives already apply these emerging means in creative ways to support projects of all kinds, including their intentional advancement of competencies (in the sense of dispositions for self-organising actions) in formal and informal contexts. These individuals have acquired the means and capabilities to construct and maintain their personal landscapes of technological instruments. They make use of such networked tools and services to establish new relationships and to construct extended social networks to support their own educational projects. They take responsibility for all necessary instructional functions such as selecting and acquiring material resources, pacing and monitoring themselves, establishing criteria of evaluation, generating feedback, and so forth. From a technical point of view establishing such patterns of actions is entirely feasible and the palette of mediating tools and services is constantly expanding and evolving.

We have argued elsewhere (Efimova & Fiedler, 2004; Fiedler, 2003; Fiedler & Sharma, 2004) that these emerging and evolving personal landscapes of tools and services are well suited to support a more open, conversational approach to learning and change, inside and outside of formal educational settings. The authoring of Weblogs, for example, in combination with the surrounding practices of Webfeed monitoring, reading and aggregation, social book-marking, and so forth, can be meaningfully conceptualized from such a perspective (Fiedler & Sharma, 2005; Sharma & Fiedler, 2007). If used properly these practices can support ongoing "conversations" with self, others, and artefacts. However, bringing these practices into formal educational settings creates considerable difficulties and tensions. Since these practices originated in the context of technological landscapes that can be described as open, distributed, networked, and publicly accessible, they often tend to be perceived as disruptive to existing approaches to technologically mediated teaching and learning in educational institutions. Therefore, some institutions try to control, suppress, and even ban them entirely (Attwell, 2007).

We would like to argue that the continuously expanding array of social media and social software solutions offers an interesting and somewhat promising technological tool set for particular design and intervention purposes in higher education. However, we believe that the application of such a tool set needs to be set in an adequate conceptual framework. Making systematic use of social media and social software looks particularly promising, if the overall goal of one's design and intervention efforts is the establishment of learning environments that attempt to foster the advancement of dispositions (for self-organising action) that are required to cope with high levels of situational uncertainty and complexity. Furthermore, we think that the ongoing socio-political and socio-technological developments that we sketched above, merit such considerations. In the remaining chapter we want to outline what conceptual and theoretical aspects could be worked into a framework for the design and support of distributed learning environments that try to make systematic use of social media and social software following a particular set of educational intervention goals.

BUILDING A CONCEPTUAL FRAMEWORK FOR THE DESIGN OF DISTRIBUTED LEARNING ENVIRONMENTS WITH SOCIAL MEDIA AND SOCIAL SOFTWARE

We suggest that a framework for the design of distributed learning environments could make use of some core ideas of activity theory (Yrjö Engeström, 1987). According to this line of theorising, activity systems arise when an actors want to realize certain objectives. Since we are mainly concerned with formal educational settings in higher education, these objectives are predominantly educational. For fulfilling their personal or group objectives in technologically mediated settings, actors need to construct, adopt and adjust their landscapes of tools and services to meet these purposes, adapt their activities to the co-actors‘ preferences, and jointly plan and coordinate their activities with studying-partners and facilitators. Different artefacts mediate the processes in such an activity system. Artefacts, as the materialised outcomes or by-products of goal-driven actions, may also serve as new inputs for other activity systems.

To analyze how actors in a given activity system perceive themselves, the artefacts and tools in use, and other participants, we find it useful to integrate the concept of affordances into our considerations for a learning environment design model. Gibson (1986) originally defined affordances as opportunities for action for an observer, provided by an (physical) environment. Gaver (1996) emphasized that affordances emerge in human action and interaction and, thus, go beyond mere perception. This contrasts with the common interpretation that affordances simply refer to situations in which one can see what to do (Gibson, 1986). Neisser (1994) elaborated Gibson‘s concept of affordance and distinguished three perceptual modes: 1) Direct perception/action, which enables us to perceive and act effectively on the local environment; 2) Interpersonal perception/reactivity, which underlies our immediate social interactions with other human beings, and; 3) Representation/recognition, by which we identify and respond appropriately to familiar objects and situations. Besides the affordances related to the environment, Neisser’s interpretation introduces the interpersonal perception of subjects in action as an additional source of affordances in the social and regulative domain.

The mainstream view on affordances in educational technology seems to consider them as objective properties of the tools, which are perceptible in the context of certain activities. Thus, it is commonly suggested that tools have concrete technological affordances for certain performances that can be brought into an actor’s perception through specific instructions (Gaver, 1996; Norman, 1988). This use of the concept tends to ignore its self-referential and subjective nature and observer-dependence. It seems to imply that affordances should be located in the environment or specific artefacts or tools. Kirschner (2002), for example, defines pedagogical affordances as those characteristics of an artefact that determine if and how a particular learning behavior could possibly be enacted within a given context. Kreijns et al. (2002) have defined social affordances as the “properties” of a collaborative learning environment that act as contextual facilitators for social interactions. However, we do not want to follow this common (mis-)understanding of affordances being the “property” of a particular learning environment. From an interaction-centred view (Vyas & van der Veer, 2005) affordances are perceived possibilities for action. They refer to what people perceive and signify during their actual interaction with an artefact or tool. While interacting with an artefact or tool actors continuously interpret the situation, and construct or re-construct meanings. Thus, we propose that instead of relating affordances "objectively" with certain features of software applications or other complex tools and artefacts, they should rather be related to the activity system. Actors must realize how they perform joint actions with artefacts and tools in order to accomplish their shared objectives. Affordances then emerge and potentially become observable in actions that people undertake to realize shared objectives.

A conversational grounding of objectives and tools for particular actions inevitably brings along the development of certain implicit or explicit rules for effective action in particular settings. In return these rules constrain how tools can be used in specific actions. In educational settings constraints for using tools in a particular way also arise from the perception of predetermined tasks, objectives and artefacts that are meant to guide and contextualise the activities. Furthermore, activities within an activity system are also constrained by the technical functionalities of tools and services, and the artefacts conveying meanings in a specific domain context. Actors must develop a (at least partially) compatible understanding of the affordances (for action) within a given setting, to make effective, coordinated performances possible within an activity system. This holds true both for facilitators and participants who need to collaborate. In our framework for the design of distributed learning environments we acknowledge that facilitators cannot pre-define, but only somewhat anticipate affordances that might be perceived in a particular learning environment. A distributed learning environment, however, has to evolve and cannot be "ready" when the participants start to (inter-)act. Cook and Brown (1999) and Vyas and van der Veer (2005), for example, assume that affordances should be conceptualized as a somewhat dynamic concept. In an ongoing interaction with tools, artefacts, and other people, actors are not only affected by the dynamic situational changes but also by their personal dispositions. Our personal dispositions strongly influence what affordances we actually perceive in a given situation at a certain point in time. This dynamic understanding of the affordance concept appears to be entirely compatible with the ideas of Engeström et al. (1999), who describe the dynamic nature of interactions between the various components within activity systems.

We suggest that a framework for the design of distributed learning environments needs to take into consideration that the perceptions of all actors within a distributed learning environment dynamically change over time. From such a perspective iterative cycles of grounding and regulating through conversational actions become increasingly important for all actors. Though facilitators cannot fully pre-determine an "objective" range of affordances for all participants, the production and communication processes still need some structuring and guidance. We propose that these processes can be structured around activity descriptions. Such activity descriptions involve participants and facilitators, their objectives, mediators of their activity (tools and artefacts) and anticipated affordances that are likely to be perceived in relation to suggested actions. Instead of entering into a pre-defined landscape of tools and services where all objectives, actions and evaluation means are defined and selected by an instructor, actors in our distributed learning environments design framework would be offered activity descriptions that allow them to set up and carry out certain educational challenges or interventions. The realization of each activity description in a particular institutional setting requires a conversational grounding process for establishing and maintaining a distributed learning environment on the basis of loosely-coupled components that can interoperate and interrelate on various levels. To start this process an initial set of tools and services needs to be selected that can support the productive and conversational actions of participants and facilitators. In more traditional instructional design models the instructors are expected to plan appropriate support strategies and tools before the actual activity. These models suggest instructors (or designers) need to (and in fact can) predict the outcomes of learning, define the ways, how to reach these outcomes, and determine which tools are appropriate for mediating these processes. This approach mostly reduces learning environment design in technologically mediated education to the selection of a set of tools, which offer objective functionalities for doing something. The instructor's task is to make use of these tool functionalities in pedagogically sound ways, creating instructional intervention strategies for using these tools in the activities. In addition, instructors are supposed to make learners aware of these tool functionalities in order to guarantee their success.

In our framework for the design of distributed learning environments, however, we understand environments for intentional learning and change as a broad and subjectivist concept. A "personal learning environment" entails all the instruments, materials and human resources that an individual is aware of and has access to in the context of an educational project at a given point in time. We think that our psychological and somewhat ecological perspective on that matter sets us apart from the majority of the current contributions on "personal learning environments". Though some authors continuously point out that they consider "personal learning environments" as a conceptual approach rather than a piece of software or technological toolset, a review of the existing literature on the topic reveals an overall tendency to use figures of speech and expressions that suggest the contrary (see e.g. Chan *et al.*, 2005; Harmelen, 2008; Johnson *et al.*, 2006a; Johnson *et al.*, 2006b; Milligan *et al.*, 2006; see e.g. Wilson, 2008; Wilson *et al.*, 2006). While we certainly share the general analysis of the shortcomings of the mainstream approach to technologically mediated teaching and studying on one hand, and the proposed transformation of the technological landscape towards loosely-coupled services, interfaces, and tools on the other hand (Attwell, 2007; Wilson, 2008), we find it useful to start from a more comprehensive and radically individualistic perspective that treats the mediation of actions with the means of networked, digital technologies, as one particular realisation of what a person tries to achieve in her "personal learning environment" and what potentials for action (affordances) she perceives. A recent contribution from Johnson and Liber (2008) offers an interesting explication of a cybernetic and more comprehensive perspective on that matter that seems to be compatible with our thinking. It is quite clear, that networked communication and information technologies play an increasingly important role in this regard, but it is misleading to assume that all relevant actions in the context of human learning and change are inevitably technologically mediated all the time One author of this chapter explores this in more detail elsewhere (Fiedler, 2008).

Another important aspect that does not seem to get enough attention in the ongoing discourse on "personal learning environments", is the qualitative differences that emerge if the intended outcomes of work and study are to be produced through collaborative action among a group of actors. While many personal projects of learning and change greatly benefit from the engagement of peers, experts, and facilitators of all kinds, we would argue that the amount of regulation and coordination that is required for collaboration poses challenges and requirements that are qualitatively different from what an individual actor experiences if she is only following her individual trajectory of actions and goals. If, however, an individual takes part in some collaborative work- and study activities with other actors, some common goals and objectives for action need to be established and maintained. In this case parts of a personal learning environment inevitably start to show qualities of a human activity system. Again, if this takes place in a, at least partially, distributed setting, the conversational and productive actions will need to be technologically mediated. From an observer's perspective the actors involved have to form a distributed learning environment as long as the collaboration among these actors is still going on. One the productive goals of the collaboration have been reached such a distributed learning environment might dissolve entirely. On the other hand some weak-ties between the former collaborators might be maintained and become a more constant element of the personal learning environment of particular actors. Needless to say that successful collaboration might pre-dispose certain collaborative learning environments to be re-enacted again for other purposes.

From our perspective such distributed learning environments generally have the following characteristics:

- They cannot be set up and defined comprehensively before any activity is carried out together.
- Their components need to be grounded conversationally by participants and facilitators.
- They integrate diverse elements of distributed social software and social media tools and services that support social networking, collaborative artefact production, sharing hyperlinks and resources, self-reflecting, aggregating and monitoring of all kinds of information and activity flows, and so forth.
- They are constructed and run upon the conversationally grounded and continuously monitored objectives, activities and evaluation means of the collaborating actors
- They mediate activity descriptions, which are constrained by the affordances that are perceived in respect to tool functionalities and their interoperability, characteristics of the artefacts and objects, and the participating actors' dispositions, such as preferences for certain objectives, working-styles, tools, co-workers and so forth.

The systemic nature of such environments suggests that scaffolding issues and tool are highly interwoven. Our framework presupposes that the participants‘ perception of affordances in concrete activities need to be taken into account. For example, in the context of an educational challenge that focuses on mediated collaborative work, all actors and facilitators have to observe the participants' actions and infer the affordances they perceive (or not) in relation to the tools and services present in a given distributed environment. Furthermore, facilitators need to provide feedback and guidance if it appears that the affordances perceived by the various actors differ considerably and don't allow for an effective realisation of the overall activity goals.

Thus actors and facilitators who want to help to establish and support distributed learning environments need to consider the following issues:

- How can one infer the affordances perceived by various actors within different activities?
- How can actors judge the effectiveness of the inferred affordances for the realisation of the overall objectives of an ongoing collaborative project?
- What type of feedback has the potential to broaden or advance the actors' perception of affordances within a given distributed learning environment?
- What mental models guide the judgements of actors on the effectiveness of the observed actions within a distributed learning environment?
- How can one support actors in establishing consensus on the affordances within distributed learning environments during various activities?

REMAINING TECHNICAL AND CONCEPTUAL CHALLENGES

One of the major challenges for growing a particular distributed learning environment is the selection of appropriate and interoperable tools according to the actors‘ perceived affordances in a specific activity context. There is a need to reach a common understanding and to find a consensus among collaborators in respect to the perception of affordances. This raises the question of how to locate and make choices regarding the selection of tools and systems for intended activities. The application of a framework for the design of distributed learning environments requires practices that support setting up and shaping technological landscapes made of loosely-coupled, networked tools and services of various kinds. A new emerging generation of aggregation- and mash-up tools and services look very promising in this regard (Severance *et al.*, 2008). The mash-up tools that we envision would not only allow all participants full control over the selection of information flows and feeds but also over the combination of production tools and workflows for realising their shared objectives for action. Collaborating actors could simply combine tools and services according to their needs for conversational and productive actions. In turn, their collaborative actions and their tool selections could be recorded and used as the informational basis for the development of additional decision-support tools that help to select tools and services in relation to particular activities. Here we speculate that activity-based, decision-support tools could be beneficial. They could facilitate choosing tools from heterogeneous technological landscapes. The iCampFolio is an example of an early prototype of a decision support tool that attempts to facilitate the selection of tools and services (Väljataga *et al*., 2007). The main purpose of iCampFolio is to provide people with an opportunity to find tools according to their planned activities. Among other views, the tool provides a community perspective that enables users to position themselves within the tool landscape in comparison to the affordances perceived by other actors. Hence, it enables one to find people with a similar perception of affordances and a similar use of tools for supporting their activities. The main design principle behind that tool is the intentional attempt to couple certain activity descriptions with the affordances typically perceived in its context in relation to particular tools and services (instead of their mere functionalities). However, the usefulness of such tools still needs to be evaluated in the field.

We have indicated before that a critical factor for an effective use of diverse technological landscapes of networked tools and services for the design of distributed learning environments, is the possibility to monitor the selection and use of particular tools and services and the information flows between them in the cause of action. The same holds true for successful scaffolding and coaching in these kinds of setting. Thus, we think that the use of distributed and networked social software and social media components for collaborative projects of intentional learning and change could greatly benefit form the selective aggregation of visible traces of different activities, like Weblog authoring, commentaries with certain tags, artefacts created and stored in different repositories, Wiki-nodes, discourse logs, and so forth. In places where distributed content flows and artefacts meet again, actors can even propagate themselves as connectors between various activity systems or networks of interest. If they intentionally mix their distributed activity traces with the traces of other actors (like in the aggregated feeds of the micro-content publishing service Jaiku - http://jaiku.com/) the aggregated information flow might work as a trigger for perturbation and dissonance and thus for change and learning in the long run (Glasersfeld, 1995; Harri-Augstein & Thomas, 1991; Thomas & Harri-Augstein, 1985). As far as these content flows are openly accessible, this potential effect is not only limited to the group of actors that inhabit a particular distributed learning environment. As long as a distributed learning environment makes use of open publishing and open access principles it always carries a potential for transcending the immediate circle of actors that make up the actual activity system. In general, social-networking and cross-pollination with other individual actors or activity systems is entirely possible and a lot more likely if distributed learning environments are mediated by social software and social media applications. We think that a framework for the design of distributed learning environments should try to conceptually integrate such a perspective and explicate some of the principles that are required to ensure an appropriate level of "openness" and connectivity of these environments (Downes, 2007).

Some social software applications already enable the visualisation of the distribution of simple meaning making activities like tagging within larger groups of actors (see Klerkx & Duval, 2007). What is still needed, however, is the visualisation of activities and the anticipated or perceived potentials for action (affordances) in relation to various components of a given technological landscape. Certainly, such a mapping or visualisation would not indicate which of the available potentialities are actually put into action. If we wanted to gain some insight on that matter, we would need to study the actual interactions that are carried out via specific social media and software tools and the content flows between those tools. This would also pertain the use of asynchronous or synchronous interaction tools when working collaboratively with artefacts. A growing number of these tools can increasingly be integrated with different Web pages, social software applications and mash-up tools. However, the development of tools and services that can keep and display interrelations between recorded conversational exchanges (like a text chat) and productive actions that created a particular artefact should greatly enhance reflective and communicative actions within distributed landscapes.

CONCLUDING REMARKS AND OUTLOOK

Most technologically mediated learning environments in higher education still reflect a design- and intervention approach that either ignores or even contradicts significant social and technological changes. The rise of symbolically mediated and information driven processes in work and life increasingly produces challenges that call for a particular set of dispositions and coping styles. We increasingly rely on collaborating and communicating with others, and our general capacity to act under partial uncertainty. For more and more people all this takes place in distributed and technologically mediated environments. It seems quite obvious that traditional ideas of qualification that overly emphasised the acquisition of factual knowledge and procedural skills are falling short in the light of these developments. While factual knowledge and procedural skills are certainly not becoming obsolete, they need to be embedded in a broader set of dispositions including internalised orientations, values, and volitional aspects necessary for (self-organising) action (Erpenbeck & Rosenstiel, 2007; Heyse *et al*., 2002; Jünger, 2004). Furthermore, in many work and life contexts, action becomes progressively more symbolically and technologically mediated.

In recent years, one outstanding driving force for this development has been the gradual evolution of the Web into a general computational platform. Step by step the Web embraces a growing number of decentralized, and only loosely-coupled, networked tools and services. Needless to say that these tools and services can be, and in fact will be, instrumentalised for an ever-expanding range of human purposes. We have outlined above that we see the design of distributed learning environments in higher education as one potential and somewhat promising field of application. However, traditional instructional design approaches and their underlying set of assumptions do not appear to be overly compatible with the qualities and characteristics of the practices that are emerging around social media and social software applications. We suggest that the same incompatibility holds true for an educational intervention perspective that emphasises the advancement of dispositions for self-organising action beyond factual knowledge and procedural skills. Thus, we need to carefully reflect and analyse the theoretically assumptions that are still driving most design and intervention efforts in formal education and formulate new frameworks that allow us to respond to the significant changes that we have outlined above. We are fully aware that this is not an easy undertaking, since it requires the rethinking of some core ideas within pedagogy and instructional design, such as agency, predictability, control, direction, and so forth.

We consider our text to be a preliminary and rather modest proposal for such a reorientation and a call for contributions to the search for an adequate design and intervention framework for distributed learning environments. In this regard we think activity theory has some interesting concepts and perspectives to offer. In addition, we discussed the concept of affordance, understood as perceived possibilities for action, and its consequences if used in the context of learning environment design. We have briefly outlined our overlap and difficulties with current contributions on "personal learning environments" and proposed a more psychological use of the term that takes all aspects of an individuals environment into account that are relevant within the context of a given project of intentional learning and change. Technologically mediated actions are seen as a realisation or expression of the potentials for actions perceived by a human actor in her particular environment. We argued for the emergence of qualitatively different challenges and requirements if human actors place their learning and change in the context of collaboration (in the sense of shared production) with others. Furthermore, we addressed some current technical and conceptual challenges for the implementation and maintenance of distributed learning environments, such as the selection of tools and services in a particular activity context, a lack of robust and versatile mash-up tools for combining and integrating selected tools and services, the aggregation of distributed content flows and activity traces, the explication of design principles that can ensure an appropriate level of "openness" and connectivity of an environment, and the visualisation of activities within a given technological landscape.

Currently, our conceptual framework for the design of distributed learning environments is nothing more than an outline of core components and related concepts. However, within iCamp, an ICT design and development project funded under the 6th framework programme of the European Union, we are following a design-based research approach (A. L. Brown, 1992; Cobb *et al.*, 2003; Collings *et al.*, 2004; Edelson, 2002) that allows us to explore some of our core ideas in a series of field studies. In this context we design and implement some prototypical educational challenges on the basis of our current understanding of how distributed learning environments can be initiated and supported within formal education. The empirical insights that we gain through our field research are then fed back into the next round of improvement and refinement of the overall design framework. The revised framework in turn will guide and inform further field trials. We expect this iterative process to support a gradual abstraction of principles and concepts and the overall development of a robust framework. In the meantime we hope that our preliminary contribution can spur some interest and debate on the potentials and limitations of distributed learning environments in higher education.

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This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 145-158, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.2
Pedagogical Responses to Social Software in Universities

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ABSTRACT

Learning management systems (LMS's) that cater for geographically dispersed learners have been widely available for a number of years, but many higher education institutions are discovering that new models of teaching and learning are required to meet the needs of a generation of learners who seek greater autonomy, connectivity, and socio-experiential learning. The advent of Web 2.0, with its expanded potential for generativity and connectivity, propels pedagogical change and opens up the debate on how people conceptualize the dynamics of student learning. This chapter explores how such disruptive forces, fuelled by the affordances of social software tools, are challenging and redefining scholarship and pedagogy, and the accompanying need for learners to develop advanced digital literacy skills in preparation for work and life in the networked society. In response to these challenges, the authors propose a pedagogical framework, Pedagogy 2.0, which addresses the themes of participation in networked communities of learning, personalization of the learning experience, and learner productivity in the form of knowledge building and creativity.

DOI: 10.4018/978-1-60566-208-4.ch023

INTRODUCTION

In contrast to earlier e-learning efforts that simply replicated traditional models of learning and teaching in online environments, social software, together with other components of the Web 2.0 (O'Reilly, 2005) movement, offer rich opportunities to move away from the highly centralized industrial model of learning of the past decade, towards achieving individual empowerment of learners through designs that focus on collaborative, networked communication and interaction (cf. Rogers, Liddle, Chan, Doxey, & Isom, 2007; Sims, 2006). Hilton (2006) discusses how a number of "disruptive forces" are shaping the future of higher education. These include: the unbundling of content; the shift from "provider push" to "demand pull;" the arrival of ubiquitous access to information and services; and the rise of the "pure property" view of ideas that is incongruent with the Web 2.0 philosophy and spirit of collaboration and sharing.

For the purposes of the current discussion, the focus is on social software that enables participation, collaboration, personalization, creativity, and generativity, as these are arguably the key elements of what it means to be educated in a networked age (Bryant, 2006). Social software tools are a defining characteristic of Web 2.0, and many are already being widely used to support learning. For example, one of the most basic social software tools, the Weblog (blog), has been a resounding success in many colleges and universities, used to facilitate reflective writing and the building of e-Portfolios (Ganley, 2004; Richardson, 2006a). With the rich and varied functionality of social computing in mind, together with its "always on" culture and participatory attributes, it is useful to consider the potential value adding of these new and emerging tools and technologies for millennial learners.

HOW SOCIAL SOFTWARE TOOLS IMPACT ON LEARNING AND WAYS OF KNOWING

The affordances of Web 2.0 are now making learner-centered education a reality, with collaborative writing tools (wikis, Google Docs & Spreadsheets), media sharing applications (Flickr, YouTube, TeacherTube), and social networking sites (MySpace, Facebook, Friendster, Ning) capable of supporting multiple communities of learning. These tools enable and encourage informal conversation, dialogue, collaborative content generation, and the sharing of information, giving learners access to a wide raft of ideas and representations of knowledge.

The attributes and affordances of the new software tools and services also make possible an expanded repertoire of online behavior, distributed collaboration, and social interaction. Mejias (2005, p. 1) observed that "… social software can positively impact pedagogy by inculcating a desire to reconnect to the world as whole, not just the social part that exists online," referring to the isolating and decontextualized experience of much text-based traditional education. Many social software applications straddle the virtual and real social worlds, as they entail both online and offline interactions and visual/verbal connectivity. These new affordances are being harnessed for knowledge sharing, development of ideas, and creative production, while allowing for personal sense making and reflection.

There are also associated changes in what and how people learn, and the ways in which they access information. Knowledge is no longer controlled and stable, but open to interpretation, modification, and re-creation by anyone, anywhere. The traditional macro-structures of the disciplines are being replaced by dynamic microstructures created by networked individuals working collaboratively. These communication networks are able to link people and summon the "wisdom of crowds" (Surowiecki, 2004), so that the collective intelligence of groups can be harnessed to generate ideas that are fresher, richer, and more sophisticated than the contributions of individual users. Lindner (2006) quotes Parkin (2005), who observes: "it's not content or even context, but process that gets us going" (p. 31), indicating that participating, doing, and experiencing rather than knowing what or where, and creating knowledge rather than consuming it, is the new mindset and *modus operandi* of learners, online communities, and the knowledge economy at large. All in all, we have an environment in which digital technology and the flow of information are paramount, and in which "learning to learn" (know-how) is now far more important than memorizing explicit knowledge and facts (know-what).

Implications for the Design of Learning Environments

The expansion and growth in popularity of Web 2.0 services and the increased prevalence of user-generated content have implications for learning environments in higher education, and are already influencing pedagogical choices and approaches (Williams & Jacobs, 2004). In what can be described as a user-driven revolution, there is a shift away from the production of Web content by traditional, "authoritative" sources, towards content is that is generated by the users themselves. In academia, these users are students and they now have the tools, spaces, and skills to contribute ideas and publish their views, research, and interpretations online. It is important to remember that these tools can also be used in combination and engage people through communication, co-production, and sharing. Through these activities, social and cognitive benefits accrue to both individuals and to the community of users who support and take part in them (Boyd, 2007; Barsky & Purdon, 2006).

For example, course content and learning resources can come from many sources, and this is partly a result of the ease with which social software can be used to create, share, augment, tag, and upload content. In what has been described as a "rip, mix, and burn culture" and a "digital democracy," all participants can become creators of content (Goodman & Moed, 2006; Hughes & Lang, 2006; Lamb, 2007). In academia, this means moving beyond the confines of learning management systems (LMS's) and tapping into a wider pool of expertise, to include community-generated learning resources (Eisenstadt, 2007; Lamb, 2007). These changes are having a profound and immediate effect on the learning landscape, and on the nature of literacies and skills required of learners, as many authors and researchers have recently noted (Eisenstadt, 2007; Berg, Berquam, & Christoph, 2007; Lankshear & Knobel, 2007). As students engage with social technologies and begin to generate and re-mix content, share it with a global audience, and connect to a wide range of communities, their expectations for "always-on" services and relevant, participatory, interactive flexible learning experiences expand and become drivers of change in higher education (Milne, 2007; Tynan & Barnes, 2007).

Nevertheless, challenges remain for higher education institutions in terms of how they will manage change, and set up physical infrastructures and spaces for learners (Bleed, 2001; JISC, 2006; Australian Learning & Teaching Council, 2008) to maximize networking and knowledge exchange. In the United Kingdom in particular, research on the applications of social software is informing innovative approaches to education in all sectors, and is driving a strong agenda for personalization of curricula and the foregrounding of lifelong learning skills, innovation, and creativity as desirable learning outcomes (Owen, Grant, Sayers, & Facer, 2006).

RETHINKING PARADIGMS: LEARNING AS KNOWLEDGE CREATION

Before investigating the transformative impact of social software tools on existing practice and pedagogy, a conceptual overview of emerging practices in higher education, grounded in explanatory theoretical frameworks, will signpost changes that are already prevalent. A number of terms and metaphors signal the change from traditional pedagogies to more active forms of teaching and learning engagement, where learners have greater levels of agency, social connectedness, and autonomy.

How we conceptualize learning evokes a number of possible scenarios or metaphors. Sfard

(1998), for example, distinguished between two metaphors of learning, the acquisition metaphor and the participation metaphor. The former represents a view of learning that is mainly a process of acquiring chunks of information, typically delivered by a teacher. An alternative model, according to Sfard, is the participation metaphor, which sees learning as a process of participating in various cultural practices and shared learning activities. In order to keep pace with knowledge-building processes that are emerging in the Web 2.0 era, it now appears to be necessary to go beyond the acquisition and participation dichotomy. The knowledge creation metaphor of learning (Paavola & Hakkarainen, 2005) mirrors the societal shift towards a networked knowledge age, in which creativity, originality, and the capacity to gain knowledge from networks are highly valued. The concept builds on common elements of Bereiter's (2002) theory of knowledge building, Nonaka and Takeuchi's (1995) model of knowledge creation, and Engeström's (1987, 1999) theory of expansive learning. The "trialogic" nature of the knowledge creation metaphor reminds us that learning is an intensely social activity, as ideas are generated with others in the community through mutual exchange, contribution, and sharing of ideas.

Applying the Metaphor: Students as Knowledge Producers

Students, enabled by social software tools, are capable of being both producers and consumers ("prosumers") of knowledge, ideas, and artifacts. As newcomers to a community of practice, they not only engage in "legitimate peripheral participation" (Lave & Wenger, 1991) to develop their own mastery of knowledge and skills through interaction with experts such as their instructors, but also have a responsibility to play a part in the continued advancement of the community's existing body of knowledge, as they move toward full participation in the socio-cultural practices of this community (Lee, Eustace, Hay, & Fellows, 2005). In a knowledge building community, members are managers or "curators" of its knowledge artifacts (Eustace & Hay, 2000; Lee, et al.,, 2005), intent on making responsible decisions in addition to generating novel and innovative contributions to benefit the community as a whole.

"Knowledge creation" and "knowledge building" are now terms that are applied in management, corporate organizations, and institutions of higher learning that value innovation and creativity (Leadbeater, 2006; Nonaka & Toyama, 2003). The knowledge construction paradigm can be appropriately applied to learning environments where digital tools and affordances enable engagement in self-directed activities, and learners have freedom and choice to move beyond mere participation in communities of inquiry to become active creators of ideas, resources, and knowledge artifacts.

LEARNING THROUGH AND WITHIN COMMUNITIES AND NETWORKS

In the Web 2.0 era, new and dynamic forms of community are emerging that are self-directed and open to a global audience. These offer new forms of social and intellectual engagement to students, often based on sharing objects and artifacts, in what has been termed "object-centered sociality" (Engeström, 2005). Flickr allows the posting and sharing of photos and commentary; social bookmarking (Furl, del.icio.us) allows people to connect through shared metadata and user-driven tagging of Web-based resources; social writing platforms enable collaborative writing and editing, asynchronous creation of text, and personal written commentary. Social networking practices also enable the creation of virtual communities based on shared motives and/or common interests, leading to powerful forms of relationship building. Such social, informal experiences are very often the foundation of learning (Gee, 2003). Social software tools tend to prioritize the individual, as anytime, anyplace connectivity is the primary driver; however, these tools also motivate the individual to link personal interests to broader social networks, thereby situating responses and contributions within a dynamic community that provides feedback and reciprocity (Owen,et al., 2006). These new agendas are already impacting significantly on the reconceptualization of pedagogies and practices in future environments.

Contemporary learning environments for the profession, for industry, and for society in general must therefore take into account the networked nature of knowledge, opportunities afforded by teamwork, and the importance of participation in knowledge generation in technology-rich environments (van Weert, 2006). A theory that has emerged to describe the social, interconnected, and community-based characteristics of learning in contemporary times is connectivism. In the words of its originator, George Siemens (2005): "Personal knowledge is comprised of a network, which feeds into organizations and institutions, which in turn feed back into the network, and then continue to provide learning to individual. This cycle of knowledge development (personal to network to organization) allows learners to remain current in their field through the connections they have formed" (p. 7).

Connectivism strives to overcome the limitations of behaviorism, cognitivism, and constructivism. It synthesizes salient features and elements of several educational, social, and technological theories and concepts to create a new and dynamic theoretical construct for learning in the digital age. In connectivism, learning is the process of creating connections between nodes to form a network, a view that is congruent with the ways in which people engage in socialization and interaction in the Web 2.0 world through social networking sites and the "blogosphere." As in the knowledge creation metaphor, connectivism acknowledges the centrality of learning through the generation of ideas, supported by social activity, enabled by personal networks, interactivity, and engagement in experiential tasks.

In summary, current educational and social research is making an increasingly strong case for the conceptualization of learning as a networked, collaborative, and social activity, supported by a range of ICT affordances, including those provided by the new wave of social software tools (Mejias, 2005; Brown & Duguid, 2000). The importance of integrating digital resources and social software tools stems from the fact that such resources are part of the knowledge society and economy, and are beoming more and more tightly woven into how we communicate, think, and generate knowledge and ideas in everyday life. In an era in which changes to higher education are set against the backdrop of the digital age and Web 2.0 revolution, fueled by high connectivity and ubiquitous, demand-driven access to information and services, we are witnessing broader societal and technological trends mirrored in the growth of paradigms of active learning in ways that compel us to expand our vision of pedagogy.

NEW CONCEPTUALIZATIONS OF PEDAGOGY THAT RESONATE WITH WEB 2.0

Emerging paradigms conceive of learners as active participants or co-producers of knowledge rather than passive consumers of content, and learning is seen as a participatory, social process supporting personal life goals and needs. To provide an overview, Table 1 describes emerging conceptualizations of pedagogy inspired and enabled by Web 2.0 and social software, along with their associated values and principles. These terms signal changes in pedagogy from teacher controlled, prescriptive, and didactic modes to learner-driven social, collaborative, and participatory approaches to task design and learner engagement.

If we consider and compare the conceptualizations of learning depicted in Table 1 to the narrow, transmissive approaches that are often adopted in higher education, a number of discontinuities

Table 1. Terms indicating innovative conceptualizations of learning

Term	Author	Principles
Network learning	Polsani (2003)	A form of education whose site of production is the network, i.e. that enables lifelong and life-wide learning processes through connections and access to networks where there are multiple layers of information and knowledge.
e-learning 2.0	Downes (2005)	Learning content is created and distributed in a very different manner to "e-learning 1.0." Rather than being composed, organized, and packaged, content is syndicated, much like a blog post or podcast. It is aggregated by students, using their own personal tools and applications. From there, it is remixed and repurposed with the student's own individual learning needs in mind.
social learning 2.0	Anderson (2007)	Learning is essentially social and dialogic and moves beyond didactic modes to learner engagement with social tools. Courses must be negotiated and tap into wider social pools of knowledge, as student control and freedom are part of lifelong learning for the 21st century.
micro-learning	Hug, Lindner, and Bruck (2006); Lindner (2006)	A new paradigm that involves learning through relatively small learning units and short-term learning activities. Micro-learning processes often derive from interaction with micro-content, which involves small chunks of learning content and flexible technologies that can enable learners to access them easily, anywhere, on demand and on the move. In a wider sense, it describes the way in which informal and incidental learning and knowledge acquisition are increasingly occurring through micro-content, micro-media, or multitasking environments, especially those that are based on Web 2.0 and mobile technologies.
nano-learning	Masie (2005, 2006)	An analogue of nano-technology. Similar to micro-learning, in emphasizing the trend towards the atomization of learning beyond the learning object (Menell, 2005) to comprise personalized smaller units of information that can be learned and recombined. This enables greater relevance for learners as well as allowing for just-in-time learning.
University 2.0	Barnes and Tynan (2007)	A new generation of universities using social networking technologies, where pedagogy is reframed to meet the needs of millennial learners and connect them to wider social networks. The key idea is to start with the connections students have made through informal learning in their day-to-day lives.
Curriculum 2.0	Edson (2007)	Curriculum is negotiated, personalized, and driven by learner needs. It is based on providing learners with skills in managing and accessing knowledge, and allowing them to take control of their own learning pathways.

become apparent. The big change is occurring in e-learning paradigms where new tools and software enable students to create, share, and showcase their own ideas and content, for example through e-Portfolios, podcasting, and blogging. The learner is conceptualized as mobile, active, and engaging with peers in collaborative knowledge generation. Downes (2005) notes that social software tools allow learning content to be created and distributed in ways that move beyond pre-packaged course content consumed by students, promoting the view that learning and the content associated with it involve highly creative processes on the part of both students and teachers.

Arguing along similar lines, Boettcher (2006) suggests that there is a need to carefully re-evaluate the role of content in courses, particularly in a higher education climate in which the value of textbooks and prescribed content is being questioned (Moore, 2003; Fink, 2005), and in which the open source and open content movements (Beshears, 2005; Massachusetts Institute of Technology, 2008; *MERLOT*, 2008) are gaining momentum. Today's younger students perceive little value in the absorption or rote learning of factual information, given the accessibility and ease of use of search engines and Web-based reference sites such as Google and Wikipedia (Berg, et al., 2007). Instead, the real educational value lies in the facilitation of a learning experience in which the students are empowered to create content for themselves and for others.

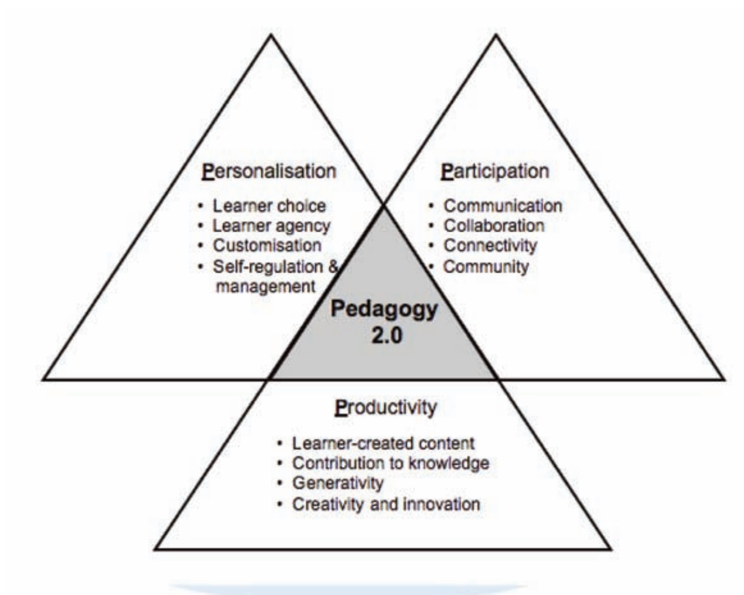
PEDAGOGY 2.0: A FRAMEWORK FOR INNOVATION

Evidence suggests that the boundaries of current pedagogies are being stretched and challenged by the potential offered by social software applications for dynamic, user-generated content, while pervasive computing and wireless networking tools ensure constant connectivity and promote participation in communities of learning and practice. With social software, there is a recognizable shift to include both formal and informal spaces for learning, and the tools afford greater learner autonomy and flexibility, as the learning experience becomes more personalized and responsive not only to the learners themselves, but also to their future needs in a knowledge based-society.

Earlier in this chapter, the importance of access to and use of social software tools and services was emphasized as these are integral to communicating, networking, and generating new ideas in the knowledge society. The need for pedagogical innovation is urgent and immediate. As Richardson (2006b) remarks: "In an environment where it's easy to publish to the globe, it feels more and more hollow to ask students to 'hand in' their homework to an audience of one. When we're faced with a flattening world where collaboration is becoming the norm, forcing students to work alone seems to miss the point. And when many of our students are already building networks far beyond our classroom walls, forming communities around their passions and their talents, it's not hard to understand why rows of desks and time-constrained schedules and standardized tests are feeling more and more limiting and ineffective" (para. 10).

The authors therefore propose a framework for innovative teaching and learning practices, *Pedagogy 2.0*, which capitalizes on the core energies and affordances of Web 2.0, while facilitating personal choice, collaboration and participation, as well as creative production. These overlapping elements are depicted in Figure 1.

Figure 1. Key elements of Pedagogy 2.0



Pedagogy 2.0 is envisioned as an overarching concept for an emerging cluster of practices that advocates learner choice and self-direction, and engagement in flexible, relevant learning tasks and strategies. Though it is intended neither as a prescriptive framework, nor a technology-driven mandate for change, it distills a number of guidelines characterizing effective learning environments, such as choice of resources, tasks, learning supports, and communication modalities. Each of the core elements, i.e., the three P's of personalization, participation, and productivity, can be applied to teacher and student roles and enables transformation and extension of current practices.

Participation as an Element of Pedagogy 2.0

More engaging, socially-based models for teaching and learning are needed to replace the traditional, "closed classroom" models, which place emphasis on the institution and instructor. A defining feature of Pedagogy 2.0 is that, alongside the increased socialization of learning and teaching, there is a focus on a less prescriptive approach, and greater emphasis on teacher-student partnerships in learning, with teachers as co-learners. As such, this element of Pedagogy 2.0 is reflective of the "participation model of learning" (Sfard, 1998), as opposed to the "acquisition" model.

While the use of popular social software technology in itself is of value in motivating learners, the tools also allow learners to engage deeply with their peers, instructors, other subject-matter experts, and with the wider community. The additional connectivity achieved by linking tools, people, and data is part of an emerging global network or "architecture of participation" (O'Reilly, 2005; Barsky & Purdon, 2006). Pedagogy 2.0 therefore adds a further dimension to participative learning by increasing the level of socialization and collaboration with experts, community, and peer groups, and by fostering connections that go beyond the walls of the classroom or institution.

Personalization as an Element of Pedagogy 2.0

The notion of personalization is not entirely new to educators and is often linked to the term "learner-centered" education, a desirable state where learners know how to choose and make decisions relating to their personal learning needs. However, there continue to be significant gaps and differences in espoused and enacted constructivist pedagogies (Lim & Chai, 2008). By harnessing digital technologies and social software tools, a number of key areas pivotal to the development of personalization through teaching are summarized by Green, Facer, Rudd, Dillon, and Humphreys (2005). According to them, pedagogy must:

- Ensure that learners are capable of making informed educational decisions;
- Diversify and recognize different forms of skills and knowledge;
- Include learner-focused forms of feedback and assessment.

For many students, the ability to socialize and study online already affords them a high level of personalization, as they can access resources aligned to their own needs and interests. In addition, Web 2.0 and social software tools enable choice and allow learners to make decisions about which tools best suit their goals and needs for connection and social interaction. Apart from choosing which resources and sites to subscribe and contribute to, which tools to use, and how and where to use them, we are witnessing a shift in the modalities of expression that are now available. Text alone is not always preferred mode of communication, as Web-based multimedia production and distribution tools incorporating rich audio (podcasting, Skype), photo (Flickr), and video (vodcasting, YouTube) capabilities are growing. Research attests to a growing appreciation of the learner's control over the whole learning process, with evidence suggesting that we can improve learning effectiveness by giving the learner control over, and responsibility for, his/her own learning. This is the foundation for such approaches as problem-based and inquiry-based learning (Desharnais & Limson, 2007), and is central to the grand vision of Pedagogy 2.0, where learners have the freedom to decide how to engage in personally meaningful learning.

One of the interesting developments in e-learning is the on-going discussion around the notion of Personal Learning Environments (PLE's). According to Siemens (2007), a PLE is "… a collection of tools, brought together under the conceptual notion of openness, interoperability, and learner control. As such, they are comprised of two elements – the tools and the conceptual notions that drive how and why we select individual parts" (para. 2). Moving on from LMS's, the PLE concept represents the latest step towards an alternative approach to e-learning. Unlike LMS's that take a course-centric view of learning, PLE's are learner-centric (Attwell, 2007). Instead of promoting centralized, instructor-controlled learning and relying on LMS's to deliver pre-packaged materials and activities, Pedagogy 2.0 challenges university and college teachers to harness the many resources that exist outside the formal spaces of the institution, to create opportunities for authentic learning that are relevant to learners personally, and to capitalize on the interests and digital competencies that learners already possess.

Productivity as an Element of Pedagogy 2.0

The knowledge creation metaphor of learning (Paavola & Hakkarainen, 2005) acknowledges that students are also capable of creating and generating ideas, concepts, and knowledge, and in the Web 2.0 era, the importance of encouraging and enabling this form of creativity and productivity is of vital significance. Educators are beginning to realize that instructor-supplied content has limitations, particularly if it pre-empts learner discovery and research, and active student involvement in the knowledge creation process. The importance and value of student-generated content, or student performance content (Boettcher, 2006) is becoming increasingly apparent.

For example, in recent years, the e-Portfolio (Love, McKean, & Gathercoal, 2002; Abrami & Barrett, 2005; Stefani, Mason, & Pegler, 2007) has emerged as popular strategy for capturing and organizing student-generated content, which, in addition to completed project/assignment work or deliverables, may also incorporate successive drafts of solutions, descriptions of mistakes made, or evidence of difficulties encountered. Such artifacts document the process of engaging in an authentic problem-based learning experience, and are representative of the complexity and "messiness" of an experience. Student-generated content may also include synchronous and asynchronous computer-mediated communication (CMC) discourse such as chat logs and discussion board postings, reflective writing in the form of diaries or blogs, summaries, and reviews, created by students working individually or in teams.

A few examples will illustrate the new forms of knowledge creation and productivity enabled by social software tools. Learners can now engage in creative authorship by being able to produce and manipulate digital images and video clips, tag them with chosen keywords, and make this content available to their friends and peers worldwide through Flickr, MySpace, and YouTube. Other individuals write blogs and create wiki spaces where like-minded individuals comment on, share and augment these sources, thereby creating a new genre of dynamic, self-published content. This outpouring of information and digital user-generated content between peers has been dubbed "personal publishing" (Downes, 2004). This trend stands in stark contrast to the control culture of education, where pre-packaged content and teacher-designed syllabi dominate, thereby denying students choice and autonomy in shaping their own learning trajectories. The challenge for educators is to enable self-direction, knowledge building, and learner control by providing options and choice while still supplying the necessary structure and scaffolding.

CURRENT EXAMPLES OF PEDAGOGY 2.0

Pedagogy 2.0 can be demonstrated by a number of exemplary practices by tertiary teachers at various institutions worldwide, as shown in Table 2. The 3 P's of Pedagogy 2.0 are exhibited by the examples in a variety of different ways. For example, to support his course in General Psychology at the University of Connecticut, Professor David B. Miller (2006, 2007) hosts weekly informal discussions with students following each week's lectures. During these discussions, students are able to seek clarification on the course material and talk about it in greater depth, while interacting and actively exploring and discussing issues not covered during the lecture that are of interest and relevance to the group (participation). The discussions are recorded and made available to other members of the class as a series of podcasts for individual listening at a convenient time and place (personalization). The process of creating and participating in the discussions becomes a form of student-generated content (productivity). All students in the cohort are welcome to submit questions in advance of the discussion via email; these questions, as well as those asked by students who attend in person, are answered during the discussion.

In another example, at the University of North Carolina at Pembroke (UNCP), Dr. Kenneth Mentor's courses make use of a wiki-based encyclopedia, with the goal being for students to create and maintain articles or entries on a variety of subjects related to law, criminal justice, sociology, and criminology. In previous courses, Mentor's students created Web pages as class assignments. The *Online Encyclopedia of Criminal Justice* (2007) project extends those efforts in two notably powerful ways: using a wiki enables the student-generated content to be readily shared in virtual "public spaces" and with a broader audience beyond the walls of the classroom, and the wiki's ease of use enables students to create substantial amounts of content within a short timeframe (productivity). In addition to generating and entering initial content, students also perform the roles of editing, revising, and organizing the content, which becomes part of the shared pool of resources accessible to all learners. The learning experience and activities are personalized in that students have a great deal of autonomy and choice in determining when, where, and how to contribute to the collection of information on the wiki, as well as in deciding which topics or entries to create, read, add to, and/or modify (personalization). Although UNCP students initially wrote all site content, the site is now available for educators to use for class assignments, and users outside the institution are allowed to register and contribute (Sener, 2007b). In this way, Mentor's students are active participants not only in the context of the course they are studying, but also in a wider, professional, academic community that transcends the walls of the classroom and institution in which they are based (participation).

POTENTIAL PROBLEMS AND PITFALLS IN IMPLEMENTING PEDAGOGY 2.0

It must be recognized that the implementation of a Pedagogy 2.0 approach is not without its issues and challenges. For example, although the advent of Web 2.0 and the open content movement significantly increases the volume of information available to students and exposes them to a raft of ideas and representations, many higher education students currently lack the competencies necessary

Table 2. Examples of Pedagogy 2.0 in tertiary teaching and learning

Reference/ author	Institution and Country	Description of technology use	Key pedagogical features
Read (2005)	Drexel University, USA	Drexel distributed iPod Photo players to their Education freshmen in September 2005. Read (2005) reported there were plans for a variety of learner-centered applications, including but not limited to having students record study-group sessions and interviews, as well as having them maintain audio blogs to connect with administrators and peers during the work experience semester.	Peer-to-peer learning; distributed intelligence approach
Lee, Chan, and McLoughlin (2006)	Charles Sturt University, Australia	Second year undergraduate students take charge of producing talkback radio-style podcasts to assist first year students undertaking a unit of study that the former group previously completed.	Learner-centered instruction; student-generated content
Evans (2006)	Swathmore College, USA	Students studying a literature course read short passages aloud and record them as podcasts, as well as creating separate podcasts discussing the passage they chose and its relationship to other material.	Development of digital and social competencies
Miller (2006, 2007)	University of Connecticut, USA	Three types of podcasts are used to support a General Psychology course: • *iCube podcasts* – Informal discussions with students following each week's lectures; • *Precasts* – Short enhanced podcasts previewing material prior to each lecture; • *Postcasts* – Short post-lecture podcasts containing re-explanations of selected concepts.	Blending of formal and informal learning; mobile, ubiquitous learning
Frydenberg (2006)	Bentley College, USA	Students in an introductory information technology class work in pairs or groups to produce vodcasts to teach topics from the course schedule to their peers.	Peer teaching; reciprocal learning
Edirisingha, Salmon, and Fothergill (2006)	University of Leicester, United Kingdom	Students make use of "profcasts," i.e. material designed to support learning distinct from that which is facilitated through structured on-campus or e-learning processes alone. e.g., weekly profcasts to supplement online teaching through updated information and guidance.	Extended learning, enrichment and extension activities; personalization of learning content
Kukulska-Hulme (2005)	Open University, United Kingdom	Students studying German and Spanish courses in distance mode use digital voice recorders and mini-camcorders to record interviews with other students and with native speakers, as well as to create audio-visual tours for sharing with their peers.	Peer-to-peer learning; student-generated content using mobile devices
McCarty (2005b, 2006); Sener (2007a)	Osaka Jogakuin College, Japan	Students are interviewed by their instructor, perform roles, and/or present their own creations, in contribution to the instructor's bilingual podcast feed and blog targeted to those studying Japanese or English as a foreign language. The podcast episodes cover Japanese culture, history, folklore, and comparative religions, as well as contemporary social issues such as the education system and the rights of minorities in Japan.	Role play and audio recording of students' own creations and interpretations of social and educational issues
McCarty (2005a); Sener (2007a)	Matsuyama Shinonome College, Japan	As part on an intensive course on translation, students from two East Asian cultures (Chinese and Japanese) participate in a recorded discussion in which they are asked to explain five proverbs in English as well as in their native language.	Cross-cultural collaborative work using student-generated content
Sener (2007b)	University of North Carolina at Pembroke, USA	A wiki-based encyclopedia is maintained by students, the goal being to create entries on a variety of subjects related to law, criminal justice, sociology, and criminology.	Student-generated content, collaborative writing, organizing and editing of content

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Table 2. Examples of Pedagogy 2.0 in tertiary teaching and learning

Reference/ author	Institution and Country	Description of technology use	Key pedagogical features
Wenzloff (2005); Richardson (2006a)	Macomb Independent School District, Michigan, USA	Social bookmarking is used to compile and share resources with teacher training participants / student teachers. The instructor also subscribes to the RSS feeds of his pre-service teachers' Furl sites, to see what they are reading as well as their comments about the sites.	Resource-based and collaborative learning
Lin, Li, Hu, Chen, and Liu (2007)	National Central University, Taiwan	Students enrolled in an introductory computer science course make use of a wiki to provide assistance and support to one another as they learn introductory programming concepts and techniques. They form project groups, taking on roles that model "real-world" software development teams to produce a computer game that is "marketed" to the rest of the class. During the course of the software development project, the wiki serves as a repository for managing and sharing knowledge and reflections on experiences, and as a mechanism for submitting deliverables.	Community of learning; peer support and mentoring; authentic learning and assessment
Chan, Frydenberg, and Lee (2007)	Charles Sturt University, Australia and Bentley College, USA	Undergraduate students studying first year (freshman) level introductory information technology subjects at Charles Sturt University and Bentley College work in teams consisting of a mixture of students from each institution. Each team is given the task of collaboratively producing a short podcast, to be recorded over the voice over Internet Protocol (VoIP) tool Skype (i.e. a "Skypecast"), in which members discuss issues of relevance to topics that are common to the curricula at both institutions.	Cross-cultural, Internet-mediated collaborative learning and exchange
Helms (2007b); D. Helms, personal communication	Mt. San Jacinto College, USA	Students use the social networking site Ning to create Web 2.0-based web sites to teach others about the dangers associated with drug use and abuse. Working in groups, they each take on one of four roles: Web Designer, Multimedia Designer, Researcher, and Copyrighter. The instructor assigns each group with a specific drug to research and provides "job descriptions" for each of the four roles. The instructor produces a sample Ning site for students to view as an example of the possibilities of the medium (Helms, 2007a). Students also use the blogging and threaded discussion features of Ning to engage in constructive and reflective discourse	Authentic, inquiry-oriented, and project-based learning, with an emphasis on student-generated content (The instructor also employs a form of modeling in the use of a sample Ning site.)
Chao (2007)	Bowling Green State University, USA	Wikis were used by students in a project-based software engineering course. The students used the wiki to support and augment collaborative software development activities, including but not limited to project planning, requirements management, test case management, and defect tracking, as well as the development of user documentation. While the instructor and the students were fully aware that there were a number of Computer-Aided Software Engineering (CASE) tools designed specifically for the above activities, the fact that wikis are available free of charge, combined with their ease of use and flexibility, made them an ideal choice for supporting the dispersed student project teams in this course.	Collaborative learning, authentic learning, project-based learning
Mateer (2008)	The Pennsylvania State University, USA	Dirk Mateer uses YouTube to support his teaching of Economics at Penn State University. Mateer digitizes his lectures, which involve a range of interactive learning approaches, and publishes them on his "Teaching Economics with YouTube" (Mateer, 2007) channel. In addition, he encourages students to find, view, and share with others a variety of freely available video clips provided by other YouTube users.	Multi-modal, peer-to-peer and collaborative learning

to navigate and use the overabundance of information available, including the skills required to locate quality sources and assess them for objectivity, reliability, and currency (Windham, 2005; Katz & Macklin, 2007). In a recently published EDUCAUSE Learning Initiative (ELI) white paper, it is recommended that students develop sound information literacy skills in effectively finding, evaluating, and creating information. Additionally, beyond search and retrieval, information is contextualized, analyzed, visualized, and synthesized, which involves complex critical thinking skills (Lorenzo & Dziuban, 2006; Jenkins, 2007). Fortunately, many of the examples presented earlier demonstrate that in combination with appropriate strategies, social software can also serve as levers for such critical thinking and meta-cognitive development (e.g. Sener, 2007b; Lee, et al., 2006).

Furthermore, in fostering learning processes that encourage the production and use of student-generated content, there is still a need for accountability and recognition of authoritative sources of information. As seen in this chapter, content supplied by experts such as teachers and textbook authors is but one of many resources available to assist students in developing knowledge and skills, and may have limitations, particularly if it pre-empts learner exploration and discovery, and active student involvement in the knowledge creation process. At the same time, in their desire to engage in emerging forms of collaborative scholarship and self-expression, students must be made aware of the expectations from the point of view of academic integrity. Practices such as "mix, rip, and burn" raise questions about the importance of originality, and give rise to concerns about copyright, ownership, and intellectual property, which must be carefully addressed by educators and educational institutions. There is also a need for quality assurance mechanisms to maximize the validity and reliability of student-generated content. Moving away from teacher-centered models of evaluation and assessment, the review, editing, and quality assurance of content can be done collaboratively and in partnership with learners, while simultaneously drawing on input from the wider community (i.e. "wisdom of crowds").

A further challenge is that educators may not be fully aware of the potential and range of social software tools, and may need opportunities for professional development to reveal how Web 2.0 applications can support teaching and assessment in meaningful and authentic ways. In addition, teachers who adopt social software tools need to do so not merely to appear conversant with the tools, but to integrate the tools into sound pedagogical strategies in order to add value to existing courses, and facilitate authentic exchange and dialogue with and among students. They must be wary of the fact that they may feel unwelcome in their students' online social networks and communities. Although there may be attempts by teachers to co-opt the technologies students use of communication and entertainment, such attempts may be perceived by students as intrusions into "their space" (Mazer, Murphy, & Simonds, 2007).

CONCLUSION: FUTURE LEARNING LANDSCAPES INFORMED BY PEDAGOGY 2.0 PRINCIPLES

Pedagogy 2.0 offers the potential for transformational shifts in teaching and learning practices, whereby learners can access peers, experts, the wider community, and digital media in ways that enable reflective, self-directed learning. While the adoption of social software tools may provide opportunities to meet the increasingly diverse needs of institutions and learners, they may also be used to support both local communities and wider professional contexts, facilitating both lifelong and life-wide learning.

These next-generation practices provide an opportunity for higher education institutions to look at wider implementation issues around technical infrastructure, but they must also address pedagogical challenges such as the integration of informal learning experiences, the limitations of existing physical and virtual learning environments, and the personalization of learning experiences. There may be a culture shock or skills crisis when "old world" educators are confronted with the expectation of working in unfamiliar environments and scenarios, and with tools with which they lack expertise and confidence. For these reasons, there is a need to make time for talking, awareness raising, and discussion of what pedagogic approaches and tools best target the desired learning outcomes.

In summary, Web 2.0 and social software tools promote autonomy and increased levels of socialization and interactivity, while enabling user-controlled, peer-to-peer knowledge creation and network-based inquiry. There are signs of optimism that existing Pedagogy 2.0 practices, by capitalizing on the three P's of personalization, participation, and productivity, will result in a learning landscape and a diverse range of educational experiences that are socially contextualized, engaging, and community based. However, obstacles and barriers remain. Can teachers, whose traditional frame of reference is formality, understand how informal learning can take place through social networking and beyond the formal spaces of classrooms, libraries, and laboratories? Can they extend these formal spaces to link with dynamic and open communities that are constantly sharing, revising, and creating new ideas? Can academia, with its established legacy of transmissive pedagogy, rise to the challenge and affect the kind of teaching revolution and changes that are both necessary and inevitable in the new age? The goal is to facilitate learning, be less prescriptive, and be open to new media, tools, and strategies, while nurturing innovation and creativity, independent inquiry, and digital literacy skills. This can be achieved by employing the new tools, resources, and opportunities that can leverage what our students do naturally – socialize, network, and collaborate. Overall, for the principles of Pedagogy 2.0 to be realized, institutional and sector-level change is needed to dissolve educational silos and to equip educators with the skills and facilities that make it possible to be responsive to learner needs, while encouraging learners to become active partners in creating educational pathways that will give them the skills and competencies needed to be successful in the networked age.

In describing the wave of social and technological changes affecting higher education, Hilton (2006) uses two competing metaphors to depict the challenges of the Web 2.0 era: "a perfect storm, born from the convergence of numerous disruptive forces … [and] the dawn of a new day, a sunrise rife with opportunities arising from these same disruptive forces" (p. 59). Taking a positive view, the authors of the present chapter believe that change is imminent. Student-driven demand, coupled with a new approach to pedagogy that leverages the flexibilities and creative options of Web 2.0 and social software tools, can and is already beginning to make the teaching and learning process much more dynamic, creative, and generative. As evidenced in Table 2, there is a great deal of innovation and experimentation with social software on an international scale, and many educators are transforming their pedagogy to create learning experiences that are participatory, personalized, and geared to the production of digital knowledge artifacts by learners. Pedagogy 2.0 therefore enables new pathways to learning with peers and connections to the wider community to flourish, and makes active, self-directed, self-managed learning a reality. Clearly, success in the knowledge economy demands that we leverage the educational value of social software tools to promote student-generated content and digital competencies that allow learners to develop their critical thinking, knowledge-building, and creative skills.

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KEY TERMS

Architecture of Participation: A term that describes the nature of innovation in the open source movement, whereby individuals can share, create, and amend software, thereby participating in the creation of improved forms of software. This can help turn a good idea, tool, or application into a best-quality product as many users and developers can adapt, change, and improve it.

Collective Intelligence: A form of intelligence that results from the cooperation, collaboration, and/or competition of a large number of individuals. *See also* wisdom of crowds.

Connectivism: A "learning theory for the digital age" developed by George Siemens, based on an analysis of the limitations of behaviourism, cognitivism, and constructivism. It employs a network with nodes and connections as a central metaphor for learning. In this metaphor, a node may be any entity, whether tangible or intangible, that is able to be connected to other nodes, including but not limited to information, data, feelings, and images. Learning is seen as the process of creating connections between nodes to form a network.

E-Portfolio: An electronic collection comprising self-assembled evidence demonstrating a learner's knowledge, skills, and abilities, including learner-generated artifacts in multiple media forms that showcase both the products and processes of learning. e-Portfolios are excellent tools for facilitating students' reflection on their own learning, as well sas serving a variety of purposes in assessment (including recognition of prior learning) within an academic course or program. Lifelong e-Portfolios are also increasingly being used for professional purposes such as certification/accreditation and career advancement (e.g. promotion).

Knowledge Creation Metaphor of Learning: Unlike theories that emphasize learning as knowledge acquisition (the acquisition metaphor) and as participation in a social community (the participation metaphor), this third metaphor foucses on mediated processes of knowledge creation that have become especially important in a knowldge society. This view focuses on mediated processes of knowledge creation that have become especially important in a knowledge society.

Learning Management System: *See* LMS.

LMS: Learning Management System. An integrated suite of software tools designed to manage learning interventions. Commercial examples are Blackboard and WebCT, although many open source alternatives, such as Moodle and Sakai, exist. In addition to the provision of online learning content and activities and the facilitation of online assessment, LMS's typically support a range of administrative functions including learner enrollment, workflow, records management (e.g. reporting of assessment results/outcomes), and resource management (e.g. instructors, facilities, equipment).

Object-Centered Sociality: A term coined by the Finnish sociologist Jyri Engeström to describe the phenomenon whereby shared objects are the means by which people connect to each other to form social relationships and networks. According to this concept, links are created not just between people, but between people and objects, or around objects. Engeström claims that the problem with some social networking services is that they focus solely on people and links, ignoring the objects of affinity that those linked people share. He invokes the concept of "object-centered sociality" to explain how the inclusion of shared objects including but not limited to photos, URLs, and events can enhance online social networking.

Pedagogy 2.0: Digital tools and affordances call for a new conceptualization of teaching that is focused on participation in communities and networks, personalization of learning tasks, and creative production of ideas and knowledge. McLouglin and Lee's concept of Pedagogy 2.0 is a response to this call. It represents a set of approaches and strategies that differs from teaching as a didactic practice of passing on information; instead, it advocates a model of learning in which students are empowered to participate, communicate, and create knowledge, exercising a high level of agency and control over the learning process.

Personal Learning Environment: *See* PLE.

Personal Publishing: A process in which an individual actively produces his/her own content and information and publishes it on the World Wide Web. For example, the maintenance of a personal blog as an online diary is an instance of personal publishing. *See also* user-generated content.

PLE: Personal Learning Environment. A system, application, or suite of applications that assists learners in taking control of and managing their own learning. It represents an alternative approach to the LMS, which by contrast adopts an institution-centric or course-centric view of learning. Key PLE concepts include the blending of formal and informal learning, participation in social networks that transcend institutional boundaries, as well as the use of a range of networking protocols (RSS, peer-to-peer [P2P], Web services) to connect systems, resources, and users within a personally-managed space. *See also* LMS.

Prosumer: A portmanteau formed by contracting word "producer" with the word "consumer," signifying the blurring of the distinction between the two roles in today's knowledge economy.

Student-Generated Content: Content that is produced by students, often for sharing with peers or a wider audience on the Internet, as distinct from instructor-supplied content such as course notes and textbooks. It is arguable that the main benefits to be gained from student-generated content lie in the process of content creation and knowledge construction, as opposed to the end product itself. *See also* user-generated content.

User-Generated Content: A term that refers to Web-based content created by ordinary people or users, e.g. pictures posted on Flickr or encyclopedia entries written in Wikipedia. Such "Read-and-Write" applications are key characteristic of the Web 2.0 movement, which encourages the publishing of one's own content and commenting on or augmenting other people's. It differs from the "Read-Only" model of Web 1.0, in which Web sites were created and maintained by an elite few. *See also* personal publishing.

Wisdom of Crowds: A concept that relates to the aggregation of information in groups and communities of individuals. It recognizes that the innovation, problem-solving, and decision-making capabilities of the group are often superior to that of any single member of the group. The term was used as the title of a book written by James Surowiecki, published in 2004. *See also* collective intelligence.

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 335-356, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.3
Electronic Classroom, Electronic Community:
Designing eLearning Environments to Foster Virtual Social Networks and Student Learning

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ABSTRACT

The capacity for online learning environments to provide good quality learning experiences for students has been the focus of speculation and debate in the higher education sector from the late 1990s to the present day. In this area, "quality" has become synonymous with engaging students in a learning community. This chapter reports on a qualitative research project designed to explore the significance of community for students studying online. Using three fundamentally different types of online learning environments as case studies, this research explored the relationship between the constructed online learning environment and the development of learning communities or what the author has termed social learning support networks (SLSN). Exploring the common themes to emerge from these three case studies, this research provides new evidence of the benefit of community for students studying online and argues that future online learning environments should be shaped by five key principles designed to foster a sense of social connection between students.

'I pay the schoolmaster, but 'tis the schoolboys that educate my son'.

—Ralph Waldo Emerson (1803-1882)

DOI: 10.4018/978-1-60566-735-5.ch006

INTRODUCTION

Many Australian universities grapple with both interpreting and responding to student engagement data (Coates 2006) and working through the effective use of online learning environments. Creating learning communities or a sense of belonging for students has emerged in the Australian higher education literature as a key goal for those interested in improving the student experience (Coates 2005; McInnis et al 2000). At the same time, many universities are coming to terms with the failure of their investments in eLearning to generate the new revenue streams forecast in the late 1990s, (Zemsky and Massy 2004; Reynoldson and Vibert 2005). This has required them to focus on developing sustainable eLearning policies that try to reconcile the demands of professional development for staff with increasing student demands for courses that are flexibly delivered (Minshull 2004). This chapter reports on research into the significance of community for students studying online and what role the constructed online environment can play in the development of community for students. This is particularly relevant for social work and human service students studying online because much of their education is predicated on the development of good interpersonal communication skills. The use of poorly designed online learning environments for the delivery of social work and human services study programs may well hinder the development of these interpersonal communication skills.

This research is significant because it provides a new way of thinking about "community" for students by showing the importance of community and how it works in both on-campus and online learning environments. But more importantly, it provides a new way of thinking about community that shifts our understanding away from a nebulous, ill-defined idea - to a practical, student-centred idea of community defined as Social Learning Support Networks (SLSN). The research findings indicate that the constructed online environment can facilitate the development of SLSN's for courses delivered fully online if it provides students with what Burbules (2000) calls, a *place* to inhabit. While the evidence for this second finding came from students who were effectively distance learners, it is likely that the elements of the online environment that supported their development of SLSN's are also relevant for the online environment we provide for on-campus students. In this chapter I draw together the common themes from three case studies and detail the significance of this research for future developments of eLearning in higher education by providing five significant challenges to the current design of Course Management Systems (CMS).

THE THREE CASE STUDIES

This research used a multiple-case study approach to explore three different online environments. The first case used a rudimentary web page with email communication and discussion boards. The second, a purpose built Virtual Social Space operating within a Course Management System (WebCT). The third, a text based virtual campus operating in a MOO environment (Multi user dimensions-Object-Oriented).

The first case study took a group of undergraduate social science students who were studying a single course online as part of a three-year on-campus program offered by the School of Social Science and Planning, RMIT University Melbourne, Australia. The online environment in which these students were studying was primitive using only a web page and email, and provided little or no opportunity for the participating students to develop a sense of connection with each other. Students' interactions were teacher driven and focused on course content and assessment activities. The students interviewed in this case were asked to explore their experiences of developing connections with other students both on campus and in the online learning environment they were studying in.

The second case study was a Masters in Information Technology Management program offered from Sheffield University, England. The academics responsible for this program decided to develop a Virtual Social Space (VSS) to act as an umbrella social space running across courses and throughout the program. The VSS provided discussion boards for social interaction, an area for student profiles and program information. Students in this program already displayed a high level of non-content related social discussions within the discussion boards provided in each course module. It was expected that students would use the VSS to further develop these social relationships. However, to the surprise of all concerned, after initial use of this environment, few students returned and no ongoing social contact occurred via the site.

The third case study was a group of students studying an undergraduate, context curriculum course offered by the School of Psychology, RMIT University, Melbourne, Australia. These context curriculum courses are offered to students from other faculties in order to provide them with an extra-discipline experience. As such, the students are from a wide variety of faculties and disciplines and are generally not known to each other. This course, *Personal Identity and Community in Cyberspace,* operated within a text based virtual environment of a Multi user dimensions-Object-Oriented (MOO). This environment provided students with a virtual environment that attempted to replicate a campus. A MOO is a real time, three-dimensional, text based virtual environment that provides users with both a sense of location and a sense of identity. A MOO replicates the real world by having separate spaces (rooms, buildings, etc) in which conversations and interactions can occur privately. A user literally moves between rooms and encounters others as they walk through the spaces. Creating the spatial distinctions between rooms is very important because it parallels aspects of the real world, for example when people in a room are talking, people in an adjacent room cannot see them or hear them unless they come into the room. One can choose to join someone in another room by either being transferred to the space (via a @join command) or you can choose to walk through the various gardens, corridors and stairways until you get to the room - bumping into others on the way. As Clodius (1994) suggests, the MOO creates a sense of place through location ‘The sense of “being” somewhere is reinforced by the illusion of moving through spaces - one types “north”, the description of the room changes, the objects in the room are different, and different options exist’ (para. 24). A virtual campus, the RMIT Tokyo Building was developed in the saMOOrai MOO. This MOO provided a virtual representation of Tokyo and surrounding countryside.

Data was gathered from each of these cases using a variety of methods including in-depth interviews, qualitative surveys and 13 weeks of ethnographic observations in the MOO. Over 50 students participated across the three cases. Data was analysed and key themes developed using the qualitative software computer program NVivo.

KEY THEMES

There are four major themes to emerge from the three cases and each influenced a student’s capacity or willingness to develop community. They are:

- *Community,* in the form of Social Learning Support Networks, was identified as a critical factor in supporting student’s learning in each case.
- *Work-life-study balance* - Students choosing to study online usually have significant demands outside of their study including family, work, recreational and social commitments. The development of Social

Learning Support Networks had to be integrated into their life as a student.

- *Modelling behaviour* - Understanding how to *be* online for students was a result of their interactions with others and the environment. University staff played a key role in establishing the culture of how to *be* online.
- *Physical/virtual environment* - turning space into place. The physical and virtual environments played a significant role in providing students with the opportunity to connect with each other and develop Social Learning Support Networks.

In exploring the significance of community for students, these factors emerged as core to understanding the value of community from a student's perspective. This research points to the value of stepping outside the electronic classroom and recognising that for many students, developing support networks is as much about what happens between them as it is about what the teacher either does or designs into the electronic classroom.

SOCIAL LEARNING SUPPORT NETWORKS

–*Arranged marriages vs. having mates: being pushed rather than pulled into connecting with each other.*

Stage one of the research explored definitions of community, trying to get to the heart of why the concept of "community" has been so important in the online learning literature. Interestingly, through the process of research, I have come to understand something fundamentally problematic about the way we theorise "community", and therefore how we try to operationalize it. For the most part in the literature and in many student engagement policy documents (Conrad, 2002; Palloff & Pratt, 2001; Tinto, 2000; The University of Melbourne Teaching and Learning Plan 2006), the term "community" is used in a very "objective" way. It is generally referring to something we should create for the students or that the students should have or be engaged in – because we know it will be good for them! In the interviews for the first case, students from the RMIT University undergraduate social science course often responded to the idea that they needed to be part of a community with a question. Typical of this, one student looked at me rather quizzically when I asked him if he felt part of a community at university. He paused and tentatively responded *'You mean like, have I got any friends!'*(Harris 2007, p. 209). I suspect community has become something we either do *to* people or it is represented as some utopian dream. This binary either results in people wanting to avoid it or else never feeling like they are quite part of it. It is worth exploring this binary because it shapes student's notions of what it means to be part of a community.

When we are "doing" community "to" people it is often represented by a deficit model, as if the people we want to be part of community suffer a lack of capacity (Frank and Smith 2006), that is there is a problem, and a bit of "community" will fix it. Typical scenarios go something like this. It is said that there has been a "break down" in community when young people in an area are rioting; community development workers are employed to improve 'troubled' housing estates, or people 'with problems' (for example drug users, the mentally ill or young people at risk of suicide) require support. In this deficit model, being someone who "needs" community equals being someone who has a problem or worse, is lonely. A student from the second case, reflecting on the Virtual Social Space (VSS), comments as if he is an outsider on a space he desperately does not want to be associated with:

The VSS as a social space is akin to sitting alone in a bar with no atmosphere drinking diet Tango *and, just before you leave, jot a cryptic message to say that you have been there on a post it note and stick it on the fruit machine. (a bit sad really) (Harris, 2007, p. 216)*

There is nothing in his reflections that might hold the slightest hope that he could get something positive out of such a space. Sticking the post-it note on the fruit machine is the desperate act of a lonely person – but it is not what he did or wanted to do. Everything about his reflection points to a resistance about the very idea of the space. Conrad (2002) suggests the desire to engage students in learning communities can result in teachers designing activities where "learners are pushed, not pulled, into a community framework, somewhat like an arranged marriage" and that doing this often results in "conscious restraint on the parts of learners in contributing to community" (p.4). Students from all three cases confirmed Conrad's point, with only two students from the first case mentioning that one of the ways they made connections with fellow students was through collaborative activities in an on-campus class. I am sure, that at some level this is not an accurate reflection, and that all the students, at some point, developed connections with other students via their engagement in class. The interesting thing however is that the students did not own those connections as their own. The connections they owned were those they made in spaces outside of the classroom. Importantly, for many students with quite established networks, they still did not identify as part of a community when the term was used without further explanation or clarification.

I suspect this was possibly because when students hear the term community they overlay a concept of community that represents some long-past utopian dream that has been important to the history of the social sciences (Toennies 1963). This dream is a representation of community that is outside of most peoples lived experience (Bauman 2001). Contemporary students are all too familiar with idealised stories of political campus life in the 1960s and 1970s – told by academics in their fifties who drift nostalgically back to the days of student activism, free love, drug use, no fees and seemingly no consequences for not passing your exams! It is unclear if this was ever an accurate representation of the student community life. Utopian ideals rarely are accurate. There is little wonder that students today do not identify their experience of university life as "feeling part of a community" if this is the kind of image of community that they are thinking about. Several students from across the three cases, at some point in our preliminary discussions regarding participating in this research, talked about their experience of university life as not being as good as X – "X" being what I call the X factor. For one student the X factor was her husband's university experience 20 years ago, for another it was a mate at a sandstone university. For another it was a friend studying in the U.S. and for another it was a student in the same school but in a different program. It may well be that these friends and relatives did have a better experience of university community life, but it is also possible, as Bauman (2001) argues, that the ideal of community is seemly never within our grasp. Student's resistance to identifying with the term community had a profound effect on this research. During the initial call for participants for the first case, a number of students commented that when they heard that the research was about community, they did not respond because they felt they did not know anything about community. It was from this point on I started to talk about the research in terms of understanding the connections students made with each other.

When community was put in these more subjective, practical and concrete terms it became a question. That question pointed to issues like – *what support do I get from my connection with fellow students, or what support do I give to someone I study with?* Students had no problem identifying the value this type of connection provided for their studies and why they would attempt, where possible, to create these connections. In each case students identified an understanding of how a social network of associations with peers might be of practical benefit. They provided their own examples of these types of relationships working within their lives. They could spell out how these relationships developed and existed. They could also detail how these relationships supported their learning, and they could say how these relationships were active inside and outside of the classroom. Students did not always talk about these connections in terms of strong friendships. For some they were more like “acquaintance-ships” that could be reliably called upon for assistance. These relationships represented an individual student’s network of support that existed outside of the constructed learning space and often extended beyond the duration of a single course. I define these as Social Learning Support Networks (SLSN) partially to distinguish them from both the intensity of a “friendship”, with its sense of longevity and intimacy, as well as from the less reliable concept of an “acquaintance”, with its sense of transience and lack of obligation to assist another.

The use of the term “Social” in SLSN, denotes these relationships as connections that exist outside of the designed learning space but are also social in that they are defined by people coming together (as opposed to learning support resources students might find on a university web site for example). And importantly, SLSN includes the term “Learning” because this dimension was critical for students. Students valued SLSN’s and put energy into creating and maintaining connections with others over time because they understood the importance of these connections during times of study stress, and importantly, that these personal networks actually assisted them in achieving their learning objectives. This was important for undergraduate students, but postgraduate students especially made the point that the choice to study was a choice to redirect resources - time, money and personal energy, from some other aspect of their lives.

WORK-LIFE-STUDY BALANCE

- I work hard and late, I have studies to do and somewhere fit in a social life. This schedule does not leave time to engage in VSS-ing (Sheffield student from 2nd case)

Students participating in this research clearly identified that juggling their study with other parts of their lives was stressful and affected the way they developed connections with each other. This research makes it clear how study is just one part of a multifaceted identity for students. While the depth of this feeling was very strong for the postgraduate students from Sheffield, the undergraduate students from the first case also confirmed that most students who choose to study online, do so in order to be able to fit their studies in with other parts of their life. Palloff and Pratt (2003) characterise the virtual student as someone who “tends to be older, working, and involved with family activities and the community” adding that “The convenience factor is what draws these students to the online environment, because it allows them the time for other equally important aspects of their lives” (p.113). The students in this research certainly reflected Palloff and Pratt’s profile of an online student. For the students in the first two cases, nothing in their constructed online environment facilitated their engagement with one another in the same way as the physical campus did for on-campus students, or the way the MOO did for students in the third case.

In the third case I did not explicitly set out to explore this work/life/study balance. However, students often commented in their daily interactions in the MOO on the pressures of fitting everything in. Interestingly, some students from the third case were able to integrate the time they spent in the MOO with their work life. Some worked in jobs that allowed them to have the MOO running in a background window on their computer. They organised for a pop-up message to hit their screen if someone else logged into the MOO and would click over to the MOO window and say "hello" to whoever had logged in. Spender (1995) and Turkle (1997) have pointed to multitasking as an emerging capability linked to the use of technology like windows-based computers, both in the practice of having multiple applications open on a computer as well as in terms of people's capacity to effectively be engaged in a number of different tasks at one time. This, in effect, allowed them to be in two places at once. These students tended to be the more active participants in the MOO in general but their behaviour also had the unintended consequences of making them available to offer support to fellow students in a "just in time" manner. In the MOO, the timeliness of this support facilitated the development of SLSN's and balanced out the study pressures associated with managing work, home life and study.

Students in the MOO started to establish patterns of online behaviour that colleagues could rely on for support *when* they needed it. These patterns included various practices: some students usually logged into the MOO and hung around the night before an assignment was due; certain students logged on at about 8pm most nights; and one or two students could usually be found in the MOO during the day. These patterns of behaviour and the synchronous nature of the MOO supported students in integrating their study period with other aspects of their lives in two ways. Firstly, the quality of the SLSN's they had developed with each other and the culture of the online environment meant they could confidently seek support from each other. Secondly, the knowledge of their colleague's availability in the MOO allowed students to seek support at common times of study stress. The students in the MOO developed SLSN's that were integrated into their lives as students but existed outside of the defined learning activities in their course.

The students from the first two case studies believed these connections were important but said they did not have either the time or the desire for contributing to a contrived online community. While wanting and valuing the connections between students that resulted in the development of learning support networks, the capacity to build these connections needed to be integrated into their learning processes and/or the learning environment, and modelled by those familiar with the space. In effect, as the literature on community development has suggested (Campfens 1997; Ife 1995), someone needed to take a leadership role in the online environment and model the type of behaviour that could then set the groundwork for students to develop SLSN's.

MODELLING BEHAVIOUR

It was significant that the students in case study one, from the RMIT Social Science program, talked about not knowing how to *be* in the online environment. Knowing how to *be* online is a mixture of both being familiar with the environment, and feeling a sense of presence from others in the space. For many students in this first case, there was uncertainty at a number of levels. They were uncertain about how formal they should be. There was a need for them to both familiarise themselves with the online medium, while at the same time, to understand the permanence of text in online spaces like discussion boards. They looked for clues from other students and from the teaching staff about how much of their personal life they should bring into the online environment, and how "academic" they should be in their contributions. In effect, the entire online environment represented an online classroom space in which their every comment remained permanently on show (for the life of the course). Students from all three cases talked about feeling nervous when going online to make contributions and waiting for others to have their say first, so they could follow their lead. This level of anxiety certainly had an effect on student's willingness to engage online.

However, there was some evidence from the students in case study one that teaching staff could reduce some of this anxiety by modelling the type of behaviour expected in the environment. A tutor from one version of the course started to model a very relaxed style of engagement with students. He did this by commenting in the discussion forums about his personal life and bringing his offline experiences into the discussions. Some of his students said this helped by reducing their sense of anxiety about contributing to the discussions and it provides evidence confirming the importance of teaching staff modelling the type of interactions and engagement they want from their students (Salmon 2001). Most of these students had very little experience in the online classroom and for many there was no sense of how to *be*. They had not developed an online voice or sense of identity in this environment.

The design of the Virtual Social Space that the students in the Sheffield University course encountered tried to reduce their anxiety by having the social environment completely separate from the prescribed learning environment. The Virtual Social Space was built in a separate online environment altogether. The project was designed to allow students to own this space through their management of it. However, knowing how to *be* and achieving a sense of social presence, a sense that the space was a lived place - was not modelled by anyone. Not only was this an unfamiliar environment for students, but activity in the space was not being driven or modelled by teaching staff. There were no course related learning activities in the space and it was not integrated into the students' online learning environment. The experiences of students from the first and second case studies confirms Salmon's (2001) arguments for the modelling of behaviour by teaching staff in what she defines as the "online socialization" stage of an online course (pp. 28-30). Salmon (2001) argues 'When participants feel "at home" with the online culture, and reasonably comfortable with the technology, they move on to contributing' (p. 29). There was little evidence in either the first or second case study of the online environment supporting students to feel "at home" and, as such, there was little online interaction between students that could be defined as social.

This was in contrast with the environment created within the MOO where students learnt how to *be* via their initial interactions with teaching and technical staff, and then through their daily interactions with each other. They developed the confidence and capacity to develop an online voice and a sense of identity. This environment brought together the elements lacking in the other two cases. Namely, the teaching and technical staff modelled the type of behaviour that encouraged casual, friendly, informal contact, and students inhabited the space in a way that ensured that it became a lived space, a place where a student knew they could go to catch up with another student.

This type of casual, just-in-time type of engagement was important in the development of SLSN's because it offered students a "place" they could drop into "without prejudice." Although students were required to log into the MOO for three group conferences, online behaviour outside of these conferences was not monitored or moderated (Salmon, 2001) by teaching staff at any other time. As such this meant that in logging into the MOO they were not publicly committed in their intent. This is similar to when a student comes onto campus. They may be intending to go to the library, they might be going to class, they might be meeting up with friends, they might be attending a counselling service or they might not have a clear intent – they are just coming onto campus as part of their life as a student. In a sense, the MOO provided a similar environment to this. Students could check who was logged on before logging in and some just logged on and went straight to one of the study orientated spaces (galleries or seminar rooms) to complete a task. Others just hung out in their dorm rooms while others wandered around the MOO space, exploring student's contributions to the notice boards or heading off on a virtual train to explore the MOO's virtual representation of Tokyo. Regardless, a MOO etiquette was established that ensured students always greeted each other on entry to the MOO. Teaching and technical staff spent a number of hours each day during the first two weeks of semester in the MOO, and students quickly recognised they could call on staff for assistance with technical issues and questions related to the course. Students developed clear communication processes that allowed them to ask for help in a casual way because of the behavioural etiquette established in the first few weeks. Evidence of the effectiveness of this modelled behaviour started to appear early in the course when some students started to organise to meet at arranged times so they could help each other with technical aspects of operating in the MOO. The MOO was both a familiar and foreign environment for most students. Although spaces had familiar labels, students had to gain technical skills as well as work through their relationships with each other to complete content related tasks. The modelling of behaviour initially by teaching and technical staff, and later between the students, not only reinforced a constructivist approach, it created the opportunity for informal "chat" which became one of the factors for people "getting to know each other" and the development of SLSN's. The environment supported them in this because of the patterns of engagement they had developed with each other.

PHYSICAL/VIRTUAL ENVIRONMENTS: PURPOSEFULLY TURNING SPACE INTO PLACE

The most significant theme to emerge from this research is the relationship between the environment and the development of Social Learning Support Networks. While the literature reviewed for this research related the development of community for students with the learning activities designed by teaching staff, there was no evidence in the literature of the need to understand the relationship between student's engagement with each other outside of the formal learning activities and the vital role the environment played in supporting the development of these relationships. This requires a more holistic understanding of the *environment* to include not just the activities designed in classrooms, nor just the constructed physical or virtual environment students study in, but to understand how students move and engage with each other in those areas not defined as classrooms.

For all three cases, students illustrated the significance of SLSN's and the effect the environment they encountered had on them developing connections with each other. Although students from the first case did not engage socially with each other online, they clearly illustrated how the physical campus environment supported the incidental contact between them that provided the foundations for the development of their SLSN's. Students from the second case went to great effort to ensure they spent social time with most of their colleagues around the on-campus workshop days held each semester, specifically because they understood the value of developing supportive relationships with others; and yet they did not use the virtual space provided online to facilitate these social connections. However, the most compelling evidence for the importance of the relationship between the constructed online environment and the development of SLSN's comes from the third case.

The MOO environment provided students who had no other opportunity to engage with each other, with the capacity to develop SLSN's. This is because the constructed environment of the MOO contained the key elements students required to transform an online space into a lived place - a place they could inhabit by creating things, engage in defined learning activities, play in, and importantly, a place students went to for support in times of study stress.

The idea that the design of the online environment can facilitate the development of community is certainly not new, nor is the idea that people will strive to create support networks using whatever means at their disposal. In 1993, Rheingold argued this in his seminal book *Virtual Community: Homesteading on the Electronic Frontier*:

My direct observation of online behaviour around the world over the last ten years have led me to conclude that whenever computer mediated communication technology becomes available to people anywhere, they inevitably build virtual communities with it, just as micro-organisms inevitably create colonies (Rheingold 1993, p. 6).

This research provides evidence to support the work of those interested in the development of online communities in an educational context and who recognise that the design of the online environment has a relationship to the sustainability of the connections students make with each other. Unlike most Course Management System based online learning environments, the MOO provided the type of environment that supported students' engagement with each other for a few simple reasons. As well as providing an environment that contained the defined learning activities and specified learning spaces (classrooms), it also provided a campus-like environment based on concepts that were familiar to students. This environment provided the capacity for synchronous contact that was not monitored (and therefore represented private space) and the students had the capacity to create objects that enabled them to extend a sense of social presence and their own personality into the MOO. These factors, together with the modelling of a "relaxed and supportive" behavioural etiquette or culture in the MOO by teaching and technical staff, ensured students made sustainable connections with each other that supported their learning.

The behaviour of the students in the MOO confirms the work of Prasolova-Forland and Divitini (2002). They have argued for the use of appropriate spatial metaphors to inform the design of online learning environments. Their work recognises the vital interplay of the spatial arrangements and incidental contact in the development of connections for learners in a way that was confirmed by the students in case study one when they talked about "bumping" into each other, and by the behaviour of students I observed in the MOO. According to Prasolova-Forland and Divitini (2002):

Communication plays a key role in keeping a community alive. Particularly important is the communication that is triggered by casual encounters. This communication is reported to be essential for knowledge sharing and strengthening the ties among community members. The communication is dependent on spatial arrangements, e.g. proximity of desks in a laboratory and attendance in the same classroom. A student that is not physically present in the "territory" of the community cannot take part in this communication. (pp. 259 - 260).

Importantly, Prasolova-Forland and Divitini discuss the implications of using different metaphors in the design and labelling of online environments. They make the distinction between labels that describe real spaces verses those that describe the intended purpose of the space. Key to their argument is the idea that the use of appropriate design metaphors, such as buildings and campuses, creates online environments that are familiar to students. The authors suggest this is in contrast to metaphors that describe the intended purpose of the space (i.e. a discussion board in a Blackboard or WebCT unit) which they suggest focuses 'on the information itself, not the person behind it', arguing that in these environments there is a need 'to strengthen the social aspect in such a system' (Prasolova-Forland and Divitini 2002, p. 262). Focusing on the person behind the information exchange requires an engagement with the environment using a more holistic understanding of the whole online space. It requires a shift in focus, moving beyond the electronic "classroom" to effectively include a student-centred view of a student's online life.

Focusing on a student feeling comfortable in a learning environment requires them to know how to *be* in that environment. This is reflected in Wilson's (1995) work when he talks about the outcome of learning not as "knowing that, know how" or knowing "names for knowledge" but rather as feeling like "we know our way around" in a subject. In advocating for the use of the term "learning environment", Wilson (1995) argues that the use of the metaphor "classroom" invariably starts the conversation from a teacher-led, teacher-centred perspective, as opposed to a learning environment that situates the learner and their experiences in the foreground. The MOO represented starting from this learning environment perspective. It required all involved to negotiate their relationship with both the constructed online environment and each other. In negotiating this relationship by authoring their own identity and social presence, the MOO, as an environment conformed to both Burbule's (2000) understanding of the conditions that mediate the existence of community and Goodyear's (2002) understanding of the learners' need to configure their own "learnplaces." In both these formulations, the learners have licence to act and the capacity to author their own spaces. The construction of the MOO represented this fluidity and the relationship between elements of the online environment and people's behaviour. Students knew how to *be*, and how to use of the environment to develop SLSN's because the environment felt familiar. They could create things and shape their own environment, while others were present in the MOO in ways that facilitated greater engagement. For example students created objects to carry around, authored their own identity via a text-based descriptor of themselves, decorated their own dorm rooms and developed objects for a virtual gallery.

IMPLICATIONS FROM THIS PROJECT FOR FUTURE RESEARCH AND THE DEVELOPMENT OF ELEARNING ENVIRONMENTS

The plague of academic research historically has been its failure to inform practice (Robinson, 1998). Whether research in teaching and learning has been misunderstood, refuted, or simply ignored, the result at the dawn of the new millennium is a mismatch between what we know and what we do. (Brown and Johnson-Shull 2000)

Reflecting on Brown and Johnson-Shull's lament on the failure of academic research to inform practice, it is a little daunting to speculate on the place of a piece of research such as this – one that uses the experiences of students to explore the three distinct fields of "online learning", "community" and "learning environment design" – and to argue for its capacity to inform a new approach to the development of online learning environments. And yet that is precisely the implications of this research. It provides a grounded understanding of the significance of community in the form of Social Learning Support Networks for student learning, and demonstrates that the design of the online learning environment plays a significant role in providing students with an opportunity to build connections and relationships with each other.

Is it right to suggest that all future online learning environments should look something like the MOO used in the third case? The answer to this is simply, no. The development of online learning environments and the use of the Internet in higher education is a rapidly evolving field - as is the technical capability of students - with teaching staff in most fields often lagging somewhat behind, but improving nevertheless. Certainly, we have some examples of graphics-based virtual online educational spaces (such as tappedin.org for K-12 teacher's professional development and projects in SecondLife – a virtual world which will be discussed in detail later). It is fair to suggest these virtual worlds have not really influenced CMS design to date. It is reasonable to argue that this is because the resource issues these environments create, both in terms of the need for broadband Internet access for students, and the technical capacities of teaching staff required to build learning environments in them, are still too great. The MOO was a text-based environment and was very accessible using a dial-up connection and was easy to develop for staff. Further research will be required to understand the changing capacity of the environment and the capacities of those who learn and teach in them. However, a project such as this, that has focused on the human elements of relationship building, our sense of place, and our capacity to know how to be in an environment, has a great deal to offer the field of eLearning particularly when it relates to the education of social work and human services student. The contributions from the students in these three case studies to our understanding of "community" certainly has much to contribute to those engaged in designing tomorrow's eLearning environments. In particular, for the next generation of course management systems, which are the mainstay of most university's commitment to online learning and the typical online environment encountered by social work and human services students.

The individual practice of teachers will always shape the student's learning experience, however, teachers work within the constraints of the learning environments provided in both the on-campus and online worlds. Just as on-campus teaching staff will attempt to move the desks in a room to reshape the learning activity into a more collaborative approach, or struggle to work interactively in large lecture theatres, the vast majority of teaching staff who venture into the online environment use the Course Management System provided by their institution. The findings from this research are a challenge to the designers of CMS to break out of the old paradigm of providing separate electronic classrooms - into creating rich online learning environments. These online learning environments will not only be rich in the various teaching tools educators like to use, but will also be rich in the sense that they take into account the way in which students engage with each other outside the classroom. The following five principles represent challenges from this research for future developers of enterprise-wide online learning environments. These principles bring together the various findings from this research and translate them into core design elements critical for improving the development of SLSN's:

- *Getting together outside the electronic classroom.* Tinto's (2000) research into the benefits of on-campus learning communities found, amongst other things, that members of learning communities developed their own self-supporting groups, they spent more time together outside of the classroom, and did so in ways students reported as supportive. The students' experiences from this research certainly support Tinto's work, but more importantly, their behavior in the MOO is a challenge to us to think outside of the classroom and to provide students with space to inhabit and make their own.
- *Learning environments need to be integrated into the social environment, not the other way round.* To date the development of online learning environments has been split between CMS and content. Effectively, the CMS has shaped the pedagogical approach used by most educators. However, students from these case studies owned and valued the SLSN's they developed outside of the formal learning environment. For students in the MOO and for those in on-campus courses, the learning environment is situated *within* the broader social environment they encountered.
- *Performance anxiety in a text based classroom: students need a space to bounce ideas off each other in their own time.* The

provision of "classroom" only type online spaces limits the opportunities for student to engage with each other and heightens the performance anxiety associated with a written medium. The MOO case study clearly demonstrated that students would take their learning processes outside of the "classrooms" provided and into the halls, dorms and cafes of their virtual university campus or other online sites. These interactions outside the formal learning environment provided them with a safe space to explore their learning with peers.

- *Student identity and social presence: deciding what color shirt to wear that day!* The provision of social spaces with the capacity for extended social presence by a student has both a sense of time and location. The capacity to author their identity and leave their mark on a virtual space transforms it into a *place* that students choose to inhabit.
- *Bumping into each other*. Lastly, the provision of real time (synchronous) opportunities for contact supported the incidental sharing of information between students, which proved to be important in the development of trust relationships and the building of Social Learning Support Networks.

Although the ideas of integrating working environments into social spaces and the importance of incidental, or what is often termed "chance encounters", is discussed in non-learning orientated online work environments [as detailed in the literature on Teleworking, Computer Supported Co-Operative Work and Collaborative Virtual Environments - see Avon (2001), McGrath and Prinz (2001), Buscher et al (2001), Sonnenwald et al (2001) and Wellman et al (1996)], these five design principles provide a radical departure from the dominant eLearning environments found in most universities. It requires us to reassess both how students use online environments and how we conceptualise the boundaries of the online environments we provide for students. The understanding of human interaction and the development of SLSN's from this research contributes to four emerging areas of research and thinking on eLearning, namely: understanding the learning principles designed in successful online computer games; the growth of identity based online communities related to university student life; the development of student portals by many universities; and the use of virtual environments (such as SecondLife) in higher education. While there are certainly commercial drivers involved with some of these projects (facebook.com for example), arguably their success or failure relates to their capacity to start from a student-centred approach and to understand what happens for students as they engage with the online environment.

It is clear that the success of online gaming environments in teaching complex concepts and context related knowledge to players is of interest to the academic community. Authors such as James Gee have started to explore these issues in publications such as *What video games have to teach us about learning and literacy* (2004). At the same time, authors such as Chen (2006) and others have started to explore the value of immersive and non-immersive virtual reality learning environments. Others are exploring Massively Multiplayer Online Games (MMOGs) to understand the education and engagement principles within them (Young et al 2006). Certainly, the remarkable growth of Facebook.com (a website designed for university students to create their own profile) relies on students wanting to make connections with each other and creating a web presence for themselves. In April 2006, Facebook.com reportedly had over seven million users and was worth more than \$1.30 Billion US (Kushner 2006). By 2007 the site had grown exponentially, with a reported seventeen million users (Robbins 2007a). The acceptance by students of sites like Facebook, has caused some authors to challenge educators to abandon their university CMS altogether and use social networking sites (such as Facebook) to deliver their courses:

Getting tired of the Learning Management System on your campus? Ever look to see how infrequently your students actually log in to see their assignments etc? Let me tell you, it's pretty darn infrequently. So why not create a course site on a social network where they already live? (Robbins 2007b, para. 1)

Trying to understand where students of the future will "live" online will be significant in the medium-to-long term as we move towards a more integrated idea of online life. However, the more short-term areas of interest, likely to directly effect the development of CMS, is the work being done by many universities in developing student portals, and the use of online environments such as SecondLife by more and more educators.

Many Australian universities have developed student portals in an attempt to provide 'more complete, holistic online environments for students and staff by converging a number of technologies' (Kennedy et al 2002, p. 24). A student portal attempts to provide an electronic entry point for students from which all the online services a student will use are available. This password protected environment includes everything from library access, to the course management system, student administration and student supports – usually with some capacity for students to provide some identity information about themselves which fellow students can access. While there has been the development of portals designed to improve student literacy skills (Hiscock and Marriott 2003), and other portals designed to improve critical aspects of the student's experience, such as transition (Nelson et al 2005), more universities are now looking towards portals as a way of providing a seamless administrative, communication and learning environment for students. While there is evidence of extensive use of these facilities (with sites like My.monash reporting 95% of students accessing the portal on a weekly basis (Kennedy et al 2002), there is little evidence appearing in the literature on the capacity of these environments to support the development of community for students in the form of SLSN's. This may be because this type of research is underway but just not reported yet or, more worryingly, that there are assumptions that the high usage of these environments will automatically translate to students developing communities. While most Australian universities work on their student portals, many educators, particularly in the US, Europe and UK are starting to explore virtual environments such as SecondLife.

SecondLife, developed in 2003 by the Linden Corporation, is evolving into a rich virtual world capable of sustaining its own economy and developing its own culture. The use of SecondLife for education has been supported by the Linden Corporation but has, until recently, been characterised mainly by individual academics venturing into the environment to teach individual courses (Kirriemuir 2007). The SecondLife environment has similar characteristics to that of the MOO used in this research and, as such, it should provide students with similar opportunities to develop SLSN's. Many higher education institutions are starting to commit resources into SecondLife, develop their own islands, replicate their campuses and run courses "in-world" - a term used to describe being logged in to a virtual world. These institutions have included universities such as Harvard University, New York University, Stanford University (SimTeach 2007) and Oxford University (Kirriemuir 2007). There is also significant research occurring in SecondLife with a view to understanding how the environment might be used in higher education. Kirriemuir (2007) details several projects including: work by Krotoski exploring social network; work by Childs on the learners' experience; work from the University of Portsmouth examining the strengths and weaknesses of virtual environments; and work by Imperial College London comparing two groups of students' experiences – one completing a module SecondLife and the other in WebCT. Recent research is also making the links between educators experience in MOO environments and what implication this might have for the use of SecondLife for tertiary education (Mazar and Nolan 2008)

Certainly many of the institutions building campuses within SecondLife are including the type of social spaces in which students are likely to "bump" into each other, and there is some evidence of 'students commenting on the confidence given them by the environment and how this has helped them as learners' (Kirriemuir, 2007, p. 22). However, there is no evidence of any universities choosing to move from their Course Management Systems fully into SecondLife. This is not unreasonable given that the high-level computer graphics and bandwidth requirements for SecondLife will continue to pose a barrier for many universities outside of the U.S., both for content development and student access. While academic staff can learn the SecondLife programming language and create the learning environments relevant to their course, this requires a significant commitment on the part of the academic and is likely to remain another barrier to the broad adoption of this environment without significant institutional support.

In a sense this is the "tough" question for universities. Build their own integrated online environment including administrative function, learning spaces (both virtual-immersive and CMS like), library resources and social environments - providing them with clear risk management of issues such as copyright and branding. Or choose a third-party environment, not just a third-party application such as BlackBoard run on their own servers, but a whole environment – which will inextricably link their online presence with the branding of the third-party provider and provide all the future-proofing issues universities have face when deciding to move from one CMS to another. While the findings from this research do not provide any clear direction on this question, the five design principles outlined will play an important part in the success of any future online learning environment's capacity to foster a sense of social connection for students.

CONCLUSION

While there is still significant debate about the quality of online learning in universities, it is clear that eLearning and the use of the online environment to support students in their studies will continue to be a dominant factor in university life – including for social work and human services students. While the last decade has seen the almost universal adoption of Course Management Systems by universities, the decades to come are likely to see new developments in online learning environments that will attempt to integrate the student's zeal for products like Facebook, with the richness of virtual environments such as SecondLife, while still proving the security and risk management associated with CMS. The findings from this research will contribute to this new environment.

This qualitative research project used three case studies to explore tertiary students' thoughts and expectations about community in the online environment. Evidence from the first case study suggested there was a need to explore the relationship between the constructed online learning environment and the development of learning communities or what I have termed Social Learning Support Networks. To explore this issue further, the project was expanded and subsequent cases were chosen that included fundamentally different types of online learning environments.

This research had two significant results. Firstly, students not only confirmed popular educational theories on the value of learning communities, but also described how this form of social connection might practically benefit their learning. Secondly, this research found that certain forms of synchronous online environments provided enhanced opportunities for students to form social connections that supported their learning.

These results have provided new evidence of the benefit of social connection, or what many term "community", for students studying online and have been translated into five key design principles. I have argued that future online learning environments should be shaped by these five key design principles to foster a greater sense of social connection between students and to aid in the development of Social Learning Support Networks. Emerson understood the overriding power and currency of the connections students make with each other and the subsequent shaping of their learning experiences. I think it is fair to say, that over a hundred years later, we are still working through how we translate the power of what "schoolboys" (and schoolgirls) have relied on for centuries – "having a mate to call on!" - into a vibrant, sustainable university eLearning environment. This research, while important for all students, is of particular significance for the design of online learning environments social work and human services students encounter. These students are often required to work on the development of interpersonal communication skills as part of their professional development and clearly an online environment, which fosters the development of Social Learning Support Networks, also provides them with the opportunity to develop these skills.

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This work was previously published in Information Communication Technologies for Human Services Education and Delivery: Concepts and Cases, edited by J. Martin; L. Hawkins, pp. 87-104, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 2.4
A Methodology for Integrating the Social Web Environment in Software Engineering Education

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ABSTRACT

The aim of this article is a technological revitalization of software engineering education from human and social perspectives. It adopts a systematic approach towards integrating the Social Web environment (including technologies and applications based on those technologies) in software engineering education, both inside and outside the classroom. To that regard, a feasibility-sensitive methodology for incorporating the Social Web environment in software engineering education that supports a heterogeneous combination of objectivism and constructivism is proposed and explored. The potential prospects of such integration and related concerns are illustrated by practical examples. [Article copies are available for purchase from InfoSci-on-Demand.com]

INTRODUCTION

In the last decade, the discipline of software engineering has gained increasing significance in computer science and engineering education. It is evident that software engineering education (SEE) needs to be sensitive to the variations and evolution of the social and technical environment around it. In particular, any changes in the information technology (IT) environment need to be reflected in SEE, if it leads to viable opportunities and demonstrated benefits. Indeed, there have been calls for a reform of SEE in which technology is given a prominent place (Frailey, 1998; Kamthan, 2008; Shaw, 2000).

The Social Web, or as it is more commonly referred to by the pseudonym Web 2.0 (O'Reilly, 2005), is the perceived evolution of the Web in a direction that is driven by 'collective intelligence', realized by IT, and characterized by user participation, openness, and network effects. For the sake of this article, the Social Web *environment* includes Social Web technologies, applications based on those technologies, and tools for managing both. The focus of this article is to assess the implications of the Social Web environment as it pertains to logistical and pedagogical issues arising in teaching and learning of software engineering, including interaction between teachers and students, and between students.

The rest of the article is organized as follows. First, the background necessary for later discussion is provided and related work is presented. This is followed by a proposal for a methodology (labeled as SW4SE2 henceforth) that aims for a systematic introduction of the Social Web environment in SEE, both inside and outside the classroom. The prospects of SW4SE2 are illustrated using practical examples. Next, challenges and directions for future research are outlined. Finally, concluding remarks are given.

BACKGROUND AND RELATED WORK

There is a need to foster a social environment in software engineering at several different levels and is increasingly being seen as significant to SEE (Layman et al., 2005). The software process environments, with the client and user involvement, have become increasingly collaborative, of which agile methodologies and Open Source Software (OSS) ecosystems are exemplars.

The human aspect and indeed the social aspect of software engineering trickle down to process workflows. It has long been recognized that requirements elicitation is a social process (Macaulay, 1993). The crucial design decisions, such as selection and application of architectural styles or patterns, often depend upon mutual cooperation. The success of Pair Programming, one of the core practices of Extreme Programming (XP) (Beck & Andres, 2005), intimately depends on the acknowledgement of its social nature (Chong & Hurlbutt, 2007).

However, the technological infrastructure enabling the social component of software engineering has taken time to get established. In the 1970s, the environment to support the social aspect of software engineering was not mature, and in the 1980s, the environment was largely limited to the use of electronic mail (e-mail). It was the 1990s, particularly the ascent of the Web, that opened new vistas for people that were non-proximal to communicate in a variety of ways on a global scale.

The three primary factors that can be attributed to bringing the vision of the Social Web to a mainstream realization are: (1) the enablement of a many-to-many communication paradigm in which people are primary, technology is secondary, and the Web is merely a broker, (2) the maturation of the underlying technological infrastructure and the availability of its implementations as open source, and (3) the awareness and large-scale participation by the public at-large.

There have been relatively few initiatives so far for integrating the Social Web environment in education. The uses of Wiki for teaching software engineering have been reported (Decker et al., 2006; Decker et al., 2007; Gotel et al., 2007; Parker & Chao, 2007). However, the correspondence to any teaching strategy or learning theory is unclear. A learning process based on the Socialization, Externalization, Combination, Internalization (SECI) model of knowledge management that uses Social Web technologies has been suggested (Chatti et al., 2007). However, the treatment is largely peripheral and one-sided: the precise advantages of Social Web towards teaching and learning are not given and the corresponding limitations have not been pointed out. This is one of the motivations for this article. The limitations of conventional computer-supported collaborative learning (CSCL) are pointed out and, via the introduction of an application, namely eLogbook, the usefulness of next generation of social software in engineering education has been demonstrated (Gillet et al., 2008). However, the treatment of Social Web technologies in it is largely one-sided, and eLogbook is not yet mature and its relationship to other Social Web applications is unclear.

INTEGRATING THE SOCIAL WEB ENVIRONEMENT IN SOFTWARE ENGINEERING EDUCATION

SW4SE2 is a specialization of IT4SE2 (Kamthan, 2008), a methodology for integrating IT in SEE. It consists of a nonlinear and non-mutually exclusive sequence of steps as shown in Table 1.

In order to be practical, it is imperative that the steps 1–3 of SW4SE2 given in Table 1 be feasible. It is expected that this is part of the overall instructional design and institutional resource management policy. These steps are stated at a high-level and could be granularized further if necessary. For example, a step for evaluation could be added to SW4SE2.

Step One: Deciding the Scope of Software Engineering Knowledge

The initial step in realizing SW4SE2 is a characterization of software engineering knowledge embedded in the curriculum.

The software engineering topics could correspond to the knowledge areas of 'standards' of software engineering knowledge, namely the Guide to the Software Engineering Body of Knowledge (SWEBOK) and the Software Engineering Education Knowledge (SEEK). It is likely that the selection of the topics may be influenced by their correspondence to the software engineering state-of-the-art; their technological necessity and technological reacheability for the purpose of communication; and their relevance to future careers of students, including industrial significance.

Step Two: Adopting a Learning Theory and a Teaching Strategy

The two theories of learning on which pedagogical strategies are being modeled today are *objectivism* and *constructivism* (Smith & Ragan, 1999). From an objectivist view, knowledge is external to an individual (and therefore objective), and therefore learning involves a "transfer of knowledge" from the instructor to the learner. From a constructivist view, knowledge is not external to an individual, and therefore learning involves constructing one's own knowledge from one's own experiences. Constructivism has been broadly classified into the categories of individual, radical, and social. In particular, social constructivism is especially relevant to the context of this article. In recent years, constructivism has received attention in SEE (Hadjerrouit, 2005).

There has been much debate over the years in the educational community on the virtues and drawbacks of objectivism and constructivism; however, there are signs of reconciliation (Cronjé, 2006). Indeed, for the sake of this article, the two views are seen as *complementary* rather than competing and, in certain cases, non-mutually exclusive rather than conflicting.

A teaching approach (strategy) must be sensitive to the theories of learning that have been adopted and currently in practice but should not be

Table 1. A feasibility-sensitive methodology for integrating Social Web environment in software engineering education

1. Deciding the Scope of Software Engineering Knowledge 2. Adopting a Learning Theory and a Teaching Strategy 3. Selecting and Applying Suitable Social Web Technologies/ Applications to Software Engineering Educational Activities	Feasibility

constrained by any one of them. A classroom use of Social Web technologies/applications in SEE could be more objectivist than constructivist where the educator plays the role of an "instructor." This could, for example, entail preparing Social Web technologies/applications-based lesson plans and lectures, and encouraging questions from students on a timely basis without severely interrupting the flow of the lectures. The teacher may also have to exercise some degree of discipline in the role of a "manager" outside the classroom) such as by moderating a course Wiki) where it is necessary to maintain a level of decorum.

A project use of Social Web technologies/applications in SEE could be more socially constructivist than objectivist where the educator plays the role of a "guide." This could, for example, entail providing a balance between discipline and flexibility to the students in carrying out a software project with minimal guidance and timely feedback by the educator as and when needed: the crucial aspect being that the students play the primary role and the educator plays the secondary role.

Table 3 summarizes the possible interactions in a typical SEE setting. It also forms the basis for step 3.

Table 2. A mapping between activities in SEE and corresponding Social Web technologies

Activity	Social Web Technology/Application
Syndication	News Feed (RSS, Atom)
Classroom Demonstrations, Audio/Video Interviews	Mashup, Podcast, Shared Presentation (YouTube)
Core Lecture Material, Supplementary Course Material	Collaborative Note Taking (NoteMesh), Folksnomy, Wiki, Social Bookmarking (del.icio.us, Google Bookmarks, Yahoo! Bookmarks)
Asynchronous and Synchronous Communication, Discussion	Blog, Mailing List, News Group (Yahoo! Groups, Google Groups), Podcast
Researching for Assignment or Software Project	Collaborative Annotation (Google Notebook, Microsoft OneNote, NoteScribe)
Scheduling	Web Calendar (Google Calendar)
Brainstorming	Mind Map (bubbl.us)
Development of Software Process Artifacts	Collaborative Read/Write Application (Wiki, Google Docs)
Management of Software Source Files	Collaborative Source File Sharing (SourceForge)

Table 3. A mapping between the types of possible interaction, communication, and educational contexts

Interaction Type	Communication Type	Educational Context
Teacher–Student	Synchronous	Inside Classroom: Lecture
	Asynchronous	Outside Classroom: Assessment Mode (Assignment, Project), Support
Student–Student	Asynchronous	Outside Classroom: Assessment Mode (Assignment, Project)

Step Three: Selecting and Applying Suitable Social Web Technologies/Applications to Software Engineering Educational Activities

Table 2 highlights the relationship between common types of activities manifesting from student–student or teacher–student interactions in SEE and Social Web technologies. It is not meant to be exhaustive. For a given educational context, there may be more than one applicable Social Web technologies, and they may not necessarily be equally suitable.

The following criteria could be used for selection of a Social Web technology/application: (1) nature of information (such as sensory modality) being communicated, (2) alignment with teaching and learning goals, (3) considerations for openness (proprietary versus non-proprietary), (4) maturity (stability), and (5) feasibility (availability and cost-effectiveness). The criteria are minimal and non-mutually exclusive. An objective third-party review of a candidate technology can also help in making the decision for adoption.

EXAMPLES OF INTEGRATING SOCIAL WEB TECHNOLOGIES AND APPLICATIONS IN SOFTWARE ENGINEERING EDUCATION

As evident from Tables 2 and 3, the Social Web lends various opportunities for communicating. A sample of these is considered next.

Collaborative Learning

For the sake of this article, collaborative learning is a social interaction that involving a community of teachers and students that acquire and/or share experience or knowledge. In an objectivist approach to SEE, lectures and tutorials are still the norm where a teacher (or a teaching assistant) often makes use of black/white board or overhead projector for delivery. It is (at theoretically) expected that each student will attend all of these lectures and tutorials from beginning to the end, and be attentive all the time during the session.

However, in practice, this need not be the case. The author has come across dedicated students who for one reason or another had to come in late, had to leave early, or for reasons of fatigue or otherwise, missed the essence of the session. A partial solution is to make the slides available for download, however, at times, there is implicit knowledge being communicated by the teacher that is not always made explicit. In such cases, students could benefit from their peers. NoteMesh is a Social Web application that allows students in the same courses to share notes with each other as well as edit each others notes. Its motto is 'collaborate to graduate.'

For the reason of time constraints or otherwise, the introduction of a topic during a lecture or tutorial is often relatively 'local' and from a single viewpoint. However, during assignments or tests, the students are expected to see the 'big picture.' Using the notion of folksonomy or social tagging (Smith, 2008), the students could associate other relationships with the lecture as they see fit. For example, phrases from past lecture(s) or the textbook could be candidates for tags.

A collection of tags can lead to the formation of a tag cloud. A tag cloud is set of related tags with associated weights that represent frequency of use of each tag. The frequency of use of each tag within a tag cloud is illustrated by visual cues such as distinct font color and size. Figure 1 shows a tag cloud for the BREADCRUMBS pattern (Ballard, 2007) used in the design of a variety of software applications.

It should be noted that folksonomy (as opposed to taxonomy) is an uncontrolled vocabulary, and the lack of terminological control can have linguistic implications due to synonymy, homonymy, and polysemy. It is also not automatic that all tags that are created by the students may be relevant to the context. For example, a tag labeled as ‘bread’ or ‘crumbs’ is not related to the BREADCRUMBS pattern in the context discussed above.

Syndication

Every so often a teacher needs to keep the students informed of the latest developments, including critical announcements, related to the course. However, individually informing each student of the developments is inconvenient for a teacher; arbitrarily visiting the course Web Site is somewhat unsystematic and time consuming for a student.

The subscription to periodically refreshable news feeds via syndication helps ameliorate this issue. Syndication is a type of metadata implemented in form of channels that the students can subscribe to. There are a variety of syndication technologies of which Really Simply Syndication (RSS) and Atom are beginning to find broad support in conventional user agents and news feed readers. For example, the following RSS markup fragment represents news for a specific day from a single channel:

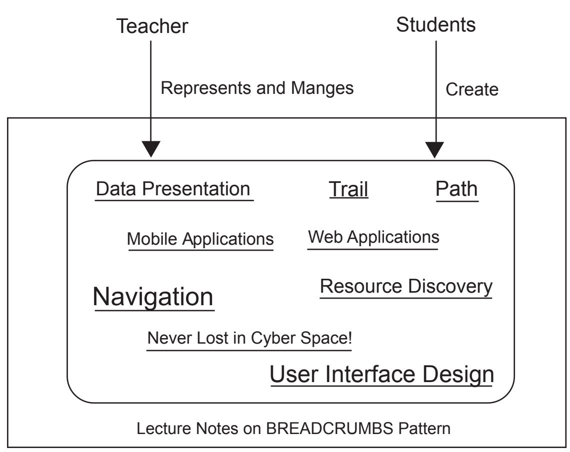
```
<?xml version="1.0"?>
<rss version="2.0">
<channel>
<title>Software Design Course Channel</title>
<link>http://www.see.ca/</link>
<description>
This is a news channel for software design.
</description>
<item>
<title>News for January 15, 2008</title>
<link>http://www.see.ca/2008/01/15/</link>
<description>
A new presentation is available as a podcast.
</description>
</item>
</channel>
</rss>
```

It could, for instance, be stored in a file named `course.rss` and linked from a place that channel readers could readily discover.

Collaborative Researching

The Social Web can be an indispensable source for students researching for information for assignments, or during the realization of a software project. There are Social Web applications like

Figure 1. A tag cloud embedded in the lecture notes on the BREADCRUMBS pattern



Google Notebook, Microsoft OneNote, and NoteScribe that allow one to attach notes to and clip text, graphics, and links during researching. These ‘notebooks’ can be saved, and can subsequently be used for collaboration and sharing with others. The annotations associated with the resources found during researching can take various useful forms including comments on the relevance of the resource to the specifics of the software project, individual perceptions of the quality of the resource, reminders for comparing them with other resources, and so on.

Bookmarking has traditionally been one of the most common ways of remembering the resources of interest visited while browsing on the Web. However, these bookmarks reside on the user’s computer and are not accessible by other devices (and therefore are not shareable). Social bookmarking goes beyond traditional bookmarking and enables management (for example, storage, organization, search, and sharing) of bookmarks residing remotely at third-party services. There are several social bookmarking services in use today including del.icio.us and Google Bookmarks. By unifying their knowledge base, social bookmarking can help both teachers and students to collaborate and share their links to resources.

Social Scheduling

To be able to communicate in person is a critical component in SEE. For example, a team working on a software project has to often schedule a face-to-face meeting with each other or with the teacher (and/or the teaching assistant playing the role of a client). Often, a critical component to education is communication in person. To realize that, a team working on a software project has to often schedule a face-to-face meeting with each other or with the teacher (and/or the teaching assistant). In general, it can be difficult to manage a schedule that is agreeable and flexible to all. Furthermore, seeking consensus can become increasingly difficult as the number of persons involved increases.

The use of Social Web applications that facilitate calendar sharing (such as the Google Calendar) can reduce some of the tedium involved in scheduling a meeting agenda. These applications move the focus away from one person (say, meeting chair) being in-charge of gauging others’ preferences via several bi-directional contacts to each person interacting with the calendar to seek an optimal solution. Furthermore, these applications offer other conveniences such as being reachable at any time of a day, access to the latest schedule, privacy by access to restricted/registered users, and so on.

Brainstorming

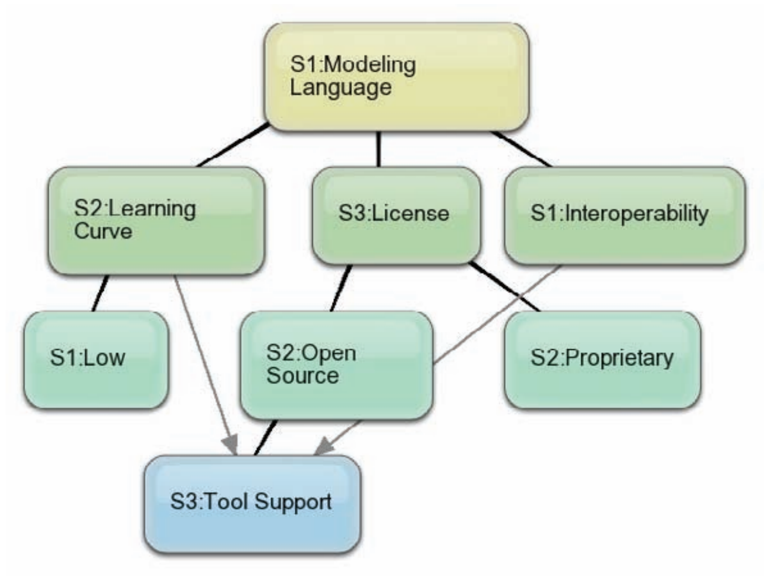
In a collaborative approach to discussing an assignment or the details of a software project, students often engage in brainstorming. One way to brainstorm is through visualization, and mind mapping is a graphically-oriented approach to realize it. A mind map is a diagram that represents goals, tasks, or other concepts linked to and arranged radially around a central theme or an idea. It is used to generate, visualize, and organize ideas, and as an aid to understanding, problem solving, and decision making. The students can share these mind maps over the Web and, depending on the permissions, read and/or edit others’ maps.

Figure 2 illustrates a snapshot in time (work in progress) of a mind map using bubbl.us. In it, three students, namely S1, S2, and S3 are in a brainstorming session on the feasibility of a proposed modeling language. The ‘bubbles’ reflect respective inputs by students.

Collaborative Modeling and Prototyping

The activities of conceptual modeling and prototyping are critical to the success of software projects. They are becoming increasing common in

Figure 2. An example of a partial mind map reflecting a brainstorming session on the viability of a modeling language



SEE (Cowling, 2005), particularly in model-driven approach to software development and interaction design, respectively. The task of creating a large and complex model may need to be decomposed, where parts of it would be created by different students. For example, a conceptual model such as a domain model or a use case model being created by one student could benefit from informal inspections and feedback by another.

Figures 3 and 4 illustrate snapshots of Gliffy, a Social Web application that allows collaboration and sharing of diagrams. Gliffy appears to have a low learning curve and supports version control. However, it has limited capabilities compared to its desktop counterparts like Microsoft Visio or IBM Rational Rose XDE. For example, the support for the Unified Modeling Language (UML) is partial and it is not possible for users to extend a given template.

Collaborative Authoring

The Social Web presents a suitable environment for collaborative authoring of software process artifacts using various means including Google Docs and Wiki.

Google Docs is a Social Web application that provides capability to create word processing documents, spreadsheets, and presentations, as well as there import and export in various commonly-used formats. It also allows real-time collaboration and sharing of these resources using the Web. However, Google Docs has yet to completely replace a conventional office suite. The support is limited to certain user agents and there are currently physical limits on files sizes and designated storage space that may be constraining.

The concept of Wiki was invented in the mid-1990s as a group communication utility. It allowed open editing of information as well as the organization of the contributions and, with various enhancements, continues to serve well in that vein. There are several, opens source flavors of Wiki available today addressing different target groups and organizational needs. Most flavors of Wiki, including MediaWiki and TinyWiki, can be easily acquired, installed, and administered under commonly-deployed computing platforms (Ebersbach, Glaser, & Heigl, 2006).

There are various uses of a Wiki in a software engineering course. A Wiki can be used both by teachers for the course and by students for the course project.

Teacher Uses of Wiki

A teacher could administer a Wiki as means for the electronic entry point for the course (namely, the "Home Page"), as a placeholder for threaded discussions, or as a place for an evolving list of course-related frequently asked questions (FAQ) that is shareable by all. The teacher could also invite students to provide open feedback (anonymous or otherwise) on the progression of the course, including comments and suggestions for improvement. Once the course has ended, the accumulated feedback can be useful in a course retrospective, which may lead to improvements in teaching.

Even if administering a Wiki is not an option, course material pertaining to the lectures could be placed on the Web and Wiki could be used to supplement them. For example, as shown in Figure 5, key topics and terms in a classroom lesson could point to resources from the projects of the Wikipedia Foundation (such as Wikibooks, Wikipedia, Wiktionary, and so on). This enables

Figure 3. The construction in progress of a domain model for a file system showing four concepts and four relationships

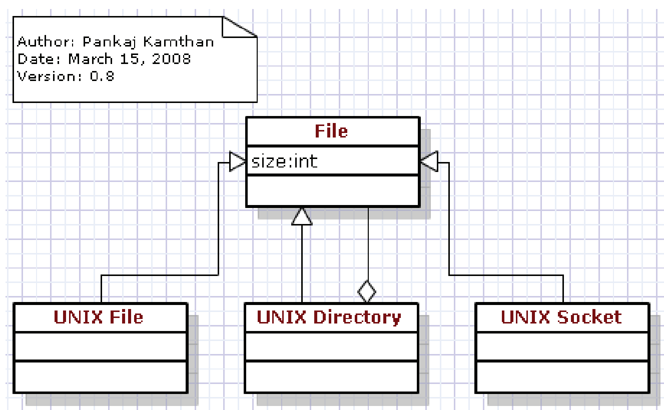


Figure 4. The construction in progress of a low fidelity prototype showing eight user interface elements

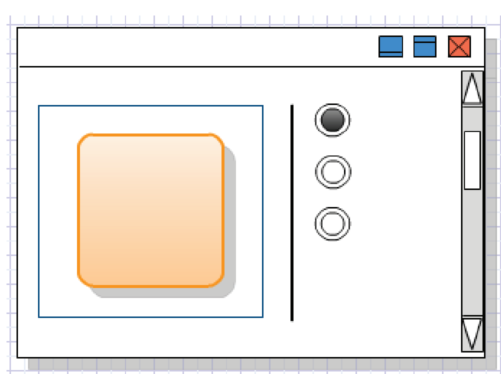
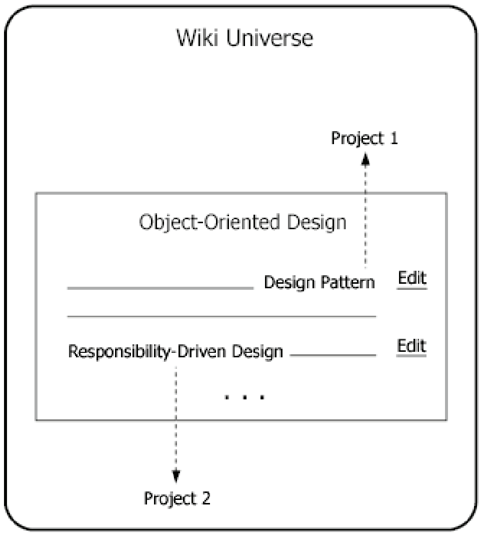


Figure 5. A classroom lesson on object-oriented design using external resources in the Wiki environment



teachers to demonstrate to the students that the discipline of software engineering is not 'closed' (in form of books) and allows teachers to present the course material at different levels of abstraction; that is, highlighting the details on the topic at hand, while suppressing ancillary topics or sub-topics.

Student Uses of Wiki

A team of students could also run its own Wiki specific to course project and limited to its members (and perhaps to the teacher and to the teaching assistants). This has numerous benefits including negotiation of use cases and requirements, centralized availability, ease of modifiability, and traceability of project artifacts such as conceptual models, data dictionary, glossary, and software process documents.

A common problem in software projects is that the details of actually carrying out the process often remain suppressed. However, this implicit knowledge is critical for future projects, particularly those in the same or a similar domain. The versioning and feedback information in software documents based on a Wiki helps make some of the *experience* of the team members in carrying out the process *explicit*. This experience, including triumphs and tribulations, is relevant to social constructivism and can be useful in a project retrospective.

The disadvantages of a Wiki are that student participation is not guaranteed and, while some students may be extrovert in nature and prolific writers, others may not. They are also known for impertinent information and discussions that have morphed into endless debates. Therefore, some form of monitoring and control, perhaps initiated by the teacher, is essential.

Software Engineering is 'Living'

The fact that software engineering is still a young, constantly evolving discipline is not always apparent to undergraduate students. Furthermore, once published, textbooks attempt to merely communicate static knowledge. The teachers who wish to communicate new developments to students are faced with the dilemma of keeping the focus on the core software engineering knowledge while still being able to inject occasional spikes of novelty in their lectures that are within the scope of the curriculum.

Utilities such as Google Trends could be used (Rech, 2007a) by teachers to convey some of the dynamism and excitement of the discipline of software engineering. As an example, based on Google Trends (with the query string q=Agile+Development), Figure 6 shows that in the last few years, the adoption of agile development has been on the rise around the world.

It should, however, be noted that Google Trends is limited by the nature of query formulations expressed in a natural language. For example, searching for 'RDD' on Google Trends yield several irrelevant results, and for the 'Responsibility-Driven Design' (for which the data set was low) there were no results at all. It also turns out that this behavior is not unique to RDD.

From Participants to Innovators and Metaphysical Implications

The Social Web lends a unique opportunity to computer science and software engineering students. As shown in Figure 7, there is a symbiotic relationship between the Social Web technologies/applications and SEE. By participating in the Social Web, the students can become co-producers of information. Moreover, with an appropriate software project, they can even become innovators of Social Web applications. Thus, the students can not only benefit from the Social Web but can also help create technologies/applications that can benefit others in the future. An educational setting provides a starting point towards that goal.

Indeed, some of these applications could be a computer-aided software engineering (CASE) tools themselves. For example, course projects that can potentially make this synergy explicit while still being within the conventional SEE curriculum could involve making minor/major improvements to the core of an open source Social Web application like Wiki to serve as a platform for software process workflows, integrating two or more open source Social Web applications, transitioning a 'legacy' application to a Social Web application while preserving the original functionality, and so on.

There are metaphysical, especially holistic, implications to the synergy between the Social Web and SEE. The benefits of crosspollination can only be optimally realized if the focus of the students carrying out the aforementioned course projects goes beyond the treatment of technical issues pertaining to technologies/applications. The students must be made cognizant of the fact that technologies/applications are not the end, not the means to the end itself and must provide verifiable value to users. In other words, the human and social aspects of the course projects are (at least) as significant as the technical issues.

Figure 6. A snapshot of the adoption of agile development

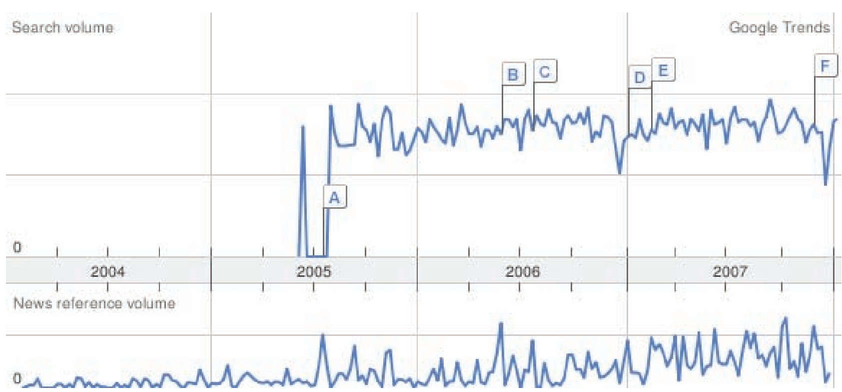
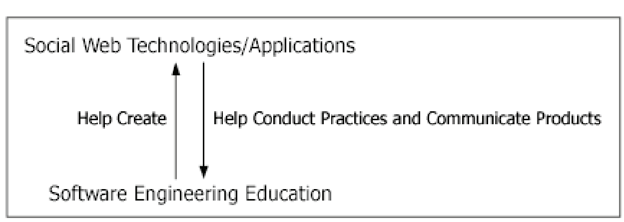


Figure 7. The synergy of mutual benefit between the Social Web technologies/applications and SEE



Guidelines for Adoption of Social Web Technologies/Applications in Software Engineering Education

It is known that teachers can face various obstacles in enabling an environment for e-learning at Universities. The following set of guidelines that may help prospective teachers in making an informed decision towards integrating Social Web technologies/applications in software engineering-related courses:

- **Administration:** It is needless to say that the teachers must be aware of the current policies of the institution pertaining to (1) legal and privacy issues regarding students, and (2) security issues regarding information and computing infrastructure. In order to build a learning 'culture' acquiescent to new technologies/applications, it can also be useful to keep the administration (such as the department Chair or the Dean) abreast of any new endeavors, and periodically inform them of successes as well as failures.
- **Students:** The students should be a 'first-class' participants in any integration efforts. In particular, they should be (1) informed of any 'social experiments' being pursued as part of the course, (2) made aware of their rights and responsibilities that comes with flexibility of Social Web technologies/applications, and (3) introduced to the ethical issues in software engineering before they embark on a software project.
- **Infrastructure:** The introduction of Social Web technologies/applications could be incremental. Indeed, it may be useful to initially (1) select technologies/applications that originate from authoritative sources, are relatively stable, and in which the teacher does not have to relinquish control completely, and (2) the presence of technologies/applications is not apparent to students (that is, technologies/applications are transparent to and do not interfere with the learning goals). Then, based on a retrospective, the use of technologies/applications can be scaled appropriately.

DIRECTIONS FOR FUTURE RESEARCH

The work presented in this article can be extended in a few different directions, which are briefly discussed next.

Evaluating the Effectiveness of SW4SE2

It is still early to predict the outcome of the Social Web phenomenon in general and its impact on SEE in particular. To that regard, further evaluation based on surveys of actual teaching experience, and distillation of the experiences in form of 'best practices' could be useful.

The introduction of a new technology/application in education is susceptible to indirections. For example, a sustained integration of Social Web technologies/applications in SEE needs to address quality-related concerns that can arise. In particular, an assessment of the impact on the credibility of information emanating from relaxation of control (from teacher's viewpoint) and emergence of privacy issues (from student's viewpoint) is of research interest.

In the context of global software development, it has been experienced (Gotel et al., 2007) that not all students may have the same exposure to Social Web technologies/applications and as a consequence or otherwise may perceive such technologies to be peripheral rather than essential. In such cases, the significance of communication may need to be reinforced, perhaps with examples of software project successes and failures due to communication.

The use of Social Web applications can be demanding. The hardware and software demands of Social Web applications on both server-side and client-side can not be ignored. For example, the mashups in which aggregation of information takes place on the client-side expect hardware and software capabilities that a consumer may not have or the file sizes of podcasts that are not streamed but are available only as download could be prohibitive to those on low bandwidth. In general, 'Rich Internet Applications' of the Social Web are resource-intensive. To that regard, an investigation into associated cost estimation is of interest.

It is evident that SW4SE2 will change as both software engineering and Social Web evolve. For example, the underlying philosophy of agile methodologies makes them more perceptive to the adoption of Social Web as the communication medium, and a verification of this hypothesis in actual software projects could be useful. Furthermore, Web Services are important to a number of Social Web applications such as mashups, and their impact on the SEE curricula in general and SW4SE2 in particular could also be worth investigating.

Implications of the Social Web in Pattern-Assisted Software Engineering Education

In many cases, any teaching initiative could be viewed as a collection of one or more {problem–solution} pairs that occur in specific contexts. Since education has a long history of lessons learnt from both successes and failures, it is likely that these pairs are not entirely novel. The conceptually reusable experiential knowledge embedded in these pairs, if described appropriately, could be useful in the practice of SEE.

In its simplest form, a pattern is an empirically proven solution to a recurring problem in a given context (Buschmann, Henney, & Schmidt, 2007). The reliance on patterns garnered from past experience and expertise is important for any endeavor, including SEE. For novice teachers, *pedagogical patterns* (Bennedsen & Eriksen, 2006) can serve as a source of guidance and/or reference.

There are limited reports of actual use of pedagogical patterns in SEE (Seffah & Grogono, 2002). However, a pedagogical-pattern-assisted approach can be worthwhile, if appropriately realized. Therefore, an assessment of software engineering teaching based on pedagogical patterns that uses Social Web technologies/applications for realization of the solutions recommended by the patterns could be of interest. This dynamic is shown in Figure 8.

It should however be noted that, in general, such an approach would need to take into account several factors including availability of suitable pedagogical patterns that can sufficiently 'map' learning activities, the selection of pedagogical patterns based on their alignment with the adopted teaching strategy, and clearly identified value to students.

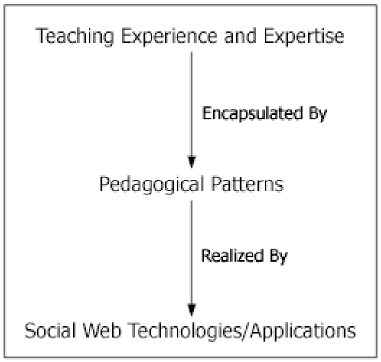
CONCLUSION

The challenges facing the practice of software engineering today are as much technical as they are social in nature. The social and organic aspects of software engineering not only need to be acknowledged by teachers but also made explicit to the students in a feasible manner.

The Social Web provides an avenue for both teachers and students to communicate both inside and outside the classroom. It can open new vistas for teachers as well as stimulate students to become 'first-class' participants in-charge of their own learning.

In conclusion, an adoption of the Social Web may require a re-examination of the current software engineering culture at the institution, both at administrative and at the educational level. The technologies/applications underlying the Social Web can be disruptive: they require change and, in some cases, radical departure from conventional approaches to which not all

Figure 8. The confluence of software engineering teaching, pedagogical patterns, and the Social Web



may be a willing participant. Furthermore, for a long-term sustainability of integrating Social Web technologies/applications in SEE, the likelihood for any technological determinism must be minimized and, as with any other investment, the benefits alongside the associated costs must be kept in perspective.

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This work was previously published in International Journal of Information and Communication Technology Education, Vol. 5, Issue 2, edited by L. Tomei, pp. 21-35, copyright 2004 by IGI Publishing (an imprint of IGI Global).

Chapter 2.5
Ambient Pedagogies, Meaningful Learning and Social Software

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ABSTRACT

This chapter will present a new approach to designing learning interactions and experiences that reconciles relatively stable learning processes with relatively new digital practices in the context of social software and Web 2.0. It will begin with a brief position on current educational articulations of social software before offering some theoretical pointers and methodological perspectives for research and development in this area. The authors will then explain how an ongoing initiative in advanced learning design has developed notions of "ambient learning design" and "experience design" to address these issues and describe a new methodology for developing digital tools that incorporate these concepts. This approach is exemplified through ongoing work within an initiative in Digital Dialogue Games and the InterLoc tool that realises them. Finally, the implications this work has for future trends in designing for inclusive, highly communicative and engaging learning interactions and practices for the digital age are discussed.

DOI: 10.4018/978-1-60566-208-4.ch027

INTRODUCTION

One of the problems with recent educational articulations of social software and Web 2.0 is the misalignment of social practices that are ostensibly oriented towards and motivated by 'interest' with those that are oriented towards and motivated by 'learning'. This has been demonstrated in many ongoing projects, such as those supported by the UK JISC (Joint Information Systems Committee), although there is little mature research in this area as yet. Whilst these purposes and the practices they entail are not mutually exclusive, they often involve different processes of meaning making. In learning situations there is usually a defined or identifiable context, that may be organised or emergent, which involves some management, structure or scaffolding. This operates as an ‘interaction narrative’, and is usually required to promote suitable sorts of thinking, collaborative meaning making and content assimilation and generation that corresponds to learning. In other words, whilst specific practices such as personal content creation and expression, communication, media sharing, multimodal dialogue and social networking are relevant to communities of interest and learning, these will usually be orchestrated differently in both. And furthermore, understanding these differences is important if we want to harmonise interest driven informal learning with more formal learning activities, given that all these activities are now increasingly performed within the same digital landscape. So a question we are tackling in this Chapter is: What forms of contextualisation and support are needed with more open and social software to stimulate, catalyse and realise meaning making that corresponds with attested notions of learning through social interaction and dialogue?

Based on substantial previous work emphasising the centrality of dialogue in learning (e.g. Vygotsky, 1978; Mercer, 2000; Ravenscroft, 2001, Wegerif, 2007) and particularly in the context of promoting productive conceptual change (e.g. Hartley, 1998; Ravenscroft and Pilkington, 2000) we hold that a key component in social networking and communication for learning will be the quality, educational efficacy and general value of the dialogue and media-rich interaction between digital interlocutors. Indeed, it may be the case that the degree of learning that occurs with open and social software corresponds to the quality of the multimodal dialogues that are being performed. But how can we design for these inclusive and valuable multimodal learning dialogues? Or more generally: how can we embrace and exploit the opportunities offered by open digital technologies to support contemporary approaches to dialogue, thinking and meaning making in ways that support new and relevant learning practices? When we start to unpack these questions we have to address some additional emphases that characterise contemporary digital practices, such as participation and collaboration, and the production of shared and yet more provisional knowledge representations.

The remainder of this Chapter will present theoretical pointers, a research and development perspective, and a specific approach and methodology to design that aims to address these questions. This work is based on the notion that we will typically need to introduce some appropriate organisation and structure to direct learning whilst ‘working with’ students developing digital literacies. Or for learning we will usually need some pedagogically derived and ‘managed openness’ to support meaningful learning practices We will then show how this approach is realised through an ongoing initiative in Digital Dialogue Games.

BACKGROUND

Before launching into contemporary approaches to designing learning interaction for the digital age it is useful to consider what fundamental learning processes and practices at which we are looking to emphasise and foster meaningful learning experiences. In considering this challenge Ravenscroft, Wegerif and Hartley (2007) have recently argued for a re-conceptualisation of ‘learning dialogue’ through developing and synthesising notions of dialectic and dialogic. Their arguments that are relevant to this article are summarised below.

Dialectic and Learning

The dialectic that was used by Socrates (470-399 BC) during what has become known as 'the Socratic method' is one of the earliest recorded educational approaches, which is also receiving considerable attention in contemporary education through computer-mediated tutorial approaches used by Bjork (2001). Hegel (1770-1831) turned dialectic into a more abstract notion of a dynamic logic proceeding from thesis to antithesis and then synthesis. Hegel's approach rested on a coherence theory of truth, where the truth relies not on a single proposition but a whole system of propositions, and only within this complete system can contradictions be recognised and falsity removed. Similarly, the process of synthesis preserves the rational and removes the irrational but then also provides another thesis that can become the subject of the same triadic process, and so on. So for Hegel, although "The true is the whole", this is a developing whole that develops through contradiction. Applying Hegel's dialectic Marx argued that culture and consciousness arise as 'tools' in the dialectic interaction between humans and nature. Vygotsky took this as a model of how an individual consciousness is formed through the internalisation of tools. So Vygotsky's (1978) theory of the development of higher mental processes can remain a foundation and inspiration for approaches to technology enhanced learning that emphasise collaborative, argumentative and reflective discourses, along the lines that have been emphasised by Mercer (2000), Ravenscroft (2001, 2004) and Wertsch (1991). However, we now need to take full account of the mediational power offered by new and evolving digital tools and semiotic systems.

Dialogic and Learning

Bakhtin (1986), a contemporary of Vygotsky, argued that dialectic had become over formalised and we needed to return to real dialogues because logic itself has no meaning, holding that it is only the clash of different voices that gives meaning. So he opposed what he called 'Hegel's monological dialectic' with his notion of dialogic that refered to the interanimation of real voices where there is no necessary 'overcoming' or 'synthesis' (Wegerif, 1999). Following Wertsch the socio-cultural approach has tended not to recognise this and combine together two notions of mediation, Vygotskys account of mediation by tools including words as sign-tools (dialectic) and Bakhtin's account of mediation by the voices and perspectives of others (dialogic). While mediation by tools is not incompatible with mediation by the perspective of the other person and both happen in education, it is important to point out that these are different kinds of mediation, that can be conceived as different dimensions, or features, of the dialogue process. For each participant in a dialogue the voice of the other is an outside perspective that includes them within it. The boundary between subjects is not therefore a demarcation line, or an external link between self and other, but an inclusive 'space' within which self and other mutually construct and re-construct each other. So, as emphasised by Wegerif (2006), a dialogic approach to learning considers that the main mechanism for learning is taking the perspective of another in a dialogue, where the dialogue is an end to be valued in itself as perhaps the most important goal of education. Recently, Wegerif (2007) has argued powerfully for this perspective to 'expand the spaces of learning' through digital technologies and emphasised that it's not just the use of explicit reasoning but the ability to change one's mind and see things from a new perspective that is essential for learning.

Dialectic or Dialogic? Relative Dimensions for Learning Dialogue and Meaning Making

Ravenscroft, Wegerif and Hartley (2007) also questioned the relationship between these two characterisations of dialogue. Do they work together or in opposition? The work of Ravenscroft and his colleagues in designing dialogue games for conceptual change in science (e.g. Ravenscroft & Hartley, 1996; Ravenscroft & Pilkington, 2000; Ravenscroft & Matheson, 2004) has shown that an argumentative and dialectical approach was needed for a student and tutor to achieve a synthesis around a correct conceptual understanding of the physics of motion. In contrast Wegerif (2006) has argued and demonstrated that in some circumstances, especially when dealing with younger children and those with emotional and behavioural problems, a more dialogic approach, with its emphasis on 'taking the perspective of another' is more important than progression towards some sort of synthesis around a common understanding. So considering their previous work collectively, they argued that dialectic and dialogic are two relative dimensions that are not in opposition, as they focus on different yet equally important features of the dialogue process relevant to learning. Dialectic emphasises the epistemic and cognitive dimensions of learning that are realised through social processes that occur when an appropriate dialogic state is established. Dialogic emphasises emotional and interpersonal dimensions, or the sort of 'relationships' and 'intersubjective orientations' (Habermas, 1991) that enable the spaces where learning can happen. These are a complementary emphasis. The desire to reason to progress towards a rational synthesis does not have to override the need to understand others, and likewise, the desire to understand others does not have to override that pragmatic need to reach a rational consensus that links to purposeful action in a context. The two will always interplay and vary in emphasis based on what is wanted from a learning situation.

"To paraphrase Kant (Kant, 1781/1982, A 51/B75): dialectic without dialogic is blind (as in machine cognition), dialogic relations without dialectic is empty of content (as in the mother child couple): it is through their union that new shared understandings can arise." Ravenscroft, Wegerif and Hartley (2007), p 47

Contemporary Contexts for Learning

An essential point that is entailed by the argument made above is that through social and more open technologies we are creating new spaces and contexts which have the potential for dialectic and dialogic learning through new and developing digital literacies. These contexts can often be conceived as 'democratic spaces' that are either generated or populated by the users, whose relationships mediate learning as much as the processes and tools that are in play. These contexts are clearly creating new forms of intersubjective orientations where learning can happen, that are shaped through open participation, collaboration, multimodal language, the provisionality of representations and could potentially contribute, generally, to a more 'democratic epistemology'. So drawing together the relations we have introduced in connection with dialogue, thinking and the potentially empowering role of social software - our position is similar to that of Friere (2001).

"To think correctly implies the existence of subjects whose thinking is mediated by objects that provoke and modify the thinking subject. Thinking correctly is, in other words, not an isolated act or something to draw in isolation but an act of communication…For this reason, a correct way of thinking is dialogical not polemical." (Friere, 2001, p 42-43)

So in embracing these new (social software) contexts and possibilities, our position also aligns with what tends to be called 'egalitarian dialogue', which foregrounds the assessment of contributions in terms of the validity of the arguments presented rather than according to any power positions of those who advocate them. The remainder of this article will attempt to demonstrate how we can design to support well attested and fundamental approaches to thinking, learning and meaning making through exploiting learners developing digital literacies and practices. Where a key question is: how can we create or support, through design, the pedagogical contexts that realise contemporary forms of learning and digital meaning making? A first step in this process is identifying a suitable research and development perspective that is capable of working in harmony with the rapid evolutions in technologies and related practices that typify the digital age.

DESIGN-BASED RESEARCH FOR CONTEMPORARY LEARNING INTERACTION AND PRACTICE

A central tenet of design-based research, relevant to the work described in the rest of this article, is:

The challenge of design-based research is in flexibly developing research trajectories that meet our dual goals of refining locally valuable innovations and developing more globally usable knowledge for the field. (Design Based Research Collective, Educational Researcher, 2003, p.7).

In the context of the work described in the rest of this article, the locally valuable innovations we will consider are digital dialogue games (Ravenscroft and McAlister, 2006a, Ravenscroft, 2007) and the InterLoc (Collaborative Interaction through scaffolding Locutions) tools that implement them (Ravenscroft & McAlister, 2006b, Ravenscroft, Sagar and Baur, 2007). The latter of these is described and discussed later. More generic insights about the dialogue processes required for learning and conceptual development have been provided through discourse analysis and dialogue modelling methods that are embodied by these tools or led to their development, along with the evaluations of the delivered designs (e.g. Ravenscroft 2000; Ravenscroft and Matheson, 2002; McAlister, Ravenscroft and Scanlon, 2004b; Ravenscroft, McAlister & Baur, 2006).

But a key additional argument for adopting design-based research in our digital age is that it can allow us to fully articulate the role of technology as a mediating tool for social and intellectual development, rather than seeing technology as the organisational 'means' to deliver traditional learning. Given the increasingly pervasive nature of technology, an approach which considers design-based research within a sociocultural scientific frame (e.g. Vygotsky, 1978; Wertsch, 1991; Engestrom, 1987) is particularly powerful for investigating and promoting contemporary learning. This stance emphasises the mediating role of technological tools and social relationships that these tools may operate within or give rise to in the context of contemporary learning practices. So this perspective is particularly relevant to the development of dialogue and social software and the ways these are articulated within the learning landscape.

Following this approach and building on their discourse analysis work (e.g. Pilkington, 1999) Ravenscroft and Pilkington (2000) developed the methodology of "investigation by design" (hereafter IBD) to investigate educational dialogue and design models that support reasoned discourse leading to conceptual change and development. This method combines discourse analysis and other dialogue game techniques (e.g. Levin and Moore, 1977; MacKenzie, 1979; Walton, 1984) to specify models that can be implemented as digital tools. These game designs and tools are developed through modelling key social and pragmatic level features of effective dialogue interaction, such as the roles of the interlocutors (e.g. learning manager, facilitator, player), the ground rules for commitment and turn-taking, and the type of speech-acts (Searle, 1969) that may be performed (e.g. assertion, question, challenge). The dialogue games that are developed, whilst sharing the same categories of features (e.g. pre-defined goals, numbers of players, roles, moves and rules, etc.) are distinctive in terms of the actual configurations of these features. They are also different in terms of the particular learning problems they address (e.g. critical, creative or exploratory dialogue) and the learning processes they support whilst retaining certain 'family resemblances' (Wittgenstein, 1953). The methodology has been successfully used to design a number of digital dialogue game tools (e.g. DIALAB, CoLLeGE, CLARISSA, AcademicTalk and InterLoc) that, along with a more detailed explanation of the IBD and dialogue game approach, are given in Ravenscroft (2007). This educationally and socially derived definition and articulation of games is justified in some detail and contrasted with 'video-game' approaches (e.g. Prensky, 2001; Gee, 2003) in Ravenscroft and McAlister (2006a), and our conception of dialogue games is illustrated in some detail later in this Chapter, in the sections that demonstrate how our InterLoc tool realises them. This technology creates contexts and process-oriented learning designs to support and scaffold collective inquiry, critical thinking and collaborative argumentation through the orchestration of social games that are performed synchronously amongst small groups (of 4 – 8 students). These environments are inclusive and personalised, and yet, also provide structuring and scaffolding, through pre-defined features and rules of interaction - that follow well-established pedagogical frameworks derived from sociocultural and dialogue theory that were referred to earlier. This and earlier dialogue game tools, such as AcademicTalk, have been used and evaluated in a range of Higher Education contexts, from ODL to campus-based institutions (e.g. see Ravenscroft, 2007 for a review).

The latest tools have been produced through a refinement of the IBD methodology. This has involved introducing new concepts of 'ambient pedagogy' (realised through ambient learning designs) and 'experience design' whilst also considering recent research into more personalised approaches to learning design that are suitable for the technology enabled learner (Ravenscroft and Cook, 2007) and their widespread use of social software. So the IBD approach has been extended to support the design of contemporary learning practices that are suitable for social, inclusive and participative approaches within the social software and Web 2.0 landscape. In essence, this has represented an elaboration of pedagogical process design into a more experiential pedagogical practice and context design. However, to signal any potential misconceptions, note that our approach to design needs to be considered within a broader frame than the existing family of social software and conceptions of Web 2.0. Our emphasis on designing highly inclusive, social and collaborative learning is intended to harmonise with developing digital literacies in the context of social software rather than being predicated upon their specific aims and functionality, that can be quite narrow (e.g. based around social networking and media sharing). To clarify this position we will demonstrate how this perspective and methodology is being applied within our ongoing multi-partner dialogue game initiative (see www.interloc.org). This 'serious gaming' approach is inclusive, social and collaborative, and yet focussed on the fundamental need to structure and scaffold learning dialogues that support types of thinking and meaning making that are relevant within the digital landscape and conveyed through the production of a 'collaborative text'. These texts (see Figures 2 and 3 later) are more formal than records of unstructured Chat or dialogue that is typical in conferencing software, and yet are less formal – in terms of textual representation - than a typical wiki or blog, and they are significant in that they capture 'live thinking'. So they can provide unique intermediary representations between collaborative thinking and thoughtful writing. Our approach is also motivated by research that has highlighted the difficulty of supporting truly engaging, critical and reasoned learning dialogue (McAlister, Ravenscroft and Scanlon, 2004a,) combined with the potential of new technologies to help remedy this (e.g. Wegerif, 2007). Note also that this approach does not deny the value of social software as platforms for generating and sharing diverse ideas and media. It instead, attempts to harmonise with these practices and yet manage and coordinate them along pedagogical lines in ways that lead to more focussed and coherent interaction and meaning making that aligns with learning. In a sense, the current dialogue game approach is a way of generating and capturing thinking on the net in ways that realise and satisfy accepted ambitions for learning that also 'sits with' more informal and media driven digital practices with social software.

Ambient Pedagogy and Experience Design

In succinct terms: ambient pedagogy holds that the structure or scaffolding supporting the learning interaction is 'behind the scenes' and yet also implicit in the digital practice that is supported; and, 'experience design' emphasises that the learning occurs through the production of an experiential context, in contrast to foregrounding the management of instruction and pedagogical or learning design. Of course we are not saying that we should literally aim to directly design experiences, instead the term is meant to be interpreted more circumspectly, as 'design that aims to give rise to a particular type of learning experience', that bears some significant similarities with other, typically less formal activities with social software.

Our initial design principles that represent this approach are:

1. Realise digital naturalism: Build on and integrate with developing social software and practices that are familiar to learners, so their educational interaction 'feels like' a natural digital practice.
2. Consider proximal practices: Support highly social, communicative, relevant and engaging experiences that are in harmony with learners' commonplace informal digital behaviour.
3. Emphasise semi-formal activities that reconcile organisational and personal activities and requirements (or constrain interaction for a purpose).
4. Provide flexible, open and yet configurable experiences, or 'managed and structured openness'.
5. Make the complex simple: Design interfaces that incorporate narrative and contingent features, so users only experience the interactions and contexts that are relevant to them. In other words, do not expose the full complexities of the machine, but instead emphasise the experiences that functionalities give rise to.

Note that this approach should not be considered as a simple 'layer above' conventional notions of learning design, but instead considered as a philosophy incorporated into the learning and interaction design process. The following sections demonstrate how these principles are articulated through a design based research initiative in digital dialogue games for learning.

DIGITAL DIALOGUE GAMES: A DESIGN-BASED APPROACH TO DIGITAL LEARNING DIALOGUE

Our Dialogue Game approach has proven efficacy for a range of learning problems and contexts, as documented in a range of research projects over the past ten years that are summarised in Ravenscroft (2007). It is currently realised through the Open Source tool, called InterLoc that realises the dialogue games through creating and organising a suitable learning context and mediating learning processes through supporting a structured practice and a unique method of collaborative text production. This approach has been supported through three successive multi-partner projects over the past three years (see www.interloc.org). The current project that is supported by the UK JISC and has partners at London Metropolitan University, UK Open University, Universities of Exeter and Teesside and, Queen Mary (University of London).

InterLoc3: Attractive, Inclusive and Reusable Learning Dialogues

Our current dialogue game technology, Interloc3, embodies the need to reconcile learners developing digital literacies with the well-established requirements for reasoned and purposeful dialogue. Specifically, through incorporating the notions of 'ambient pedagogy' and 'experience design' we have provided a managed and yet attractive and inclusive learning context and experience that provides a structured, collaborative and engaging learning practice. This practice, in turn, allows learners to incorporate media and generate text and content that are relevant and valuable through linking their digital dialogue to their thinking and the production of collaborative and personalised texts or knowledge assets. So this practice aims to link learners interest-driven, and typically media-centric behaviours, to more learning-driven dialogue and textual practices. There is also the incorporation of multimodal and multimedia aspects into learning interactions to further enrich the learning experience.

In brief, InterLoc3 is Web-technology with low barriers to participation that is easily used and deployed to address relatively generic learning problems and opportunities. So it is pedagogically inclusive and technically pervasive1. In the pedagogical sense, it is inclusive because its ease of operation means that virtually any learner or tutor is capable of using it to support digital learning dialogues and linking these to related learning and pedagogical practices. In the technical sense, it is pervasive because it is easily deployed, is cross platform, and is flexible and extensible. The way that these features are operationalised in the InterLoc3 design and the practices it supports are given later, after briefly describing the technical model that implements them.

Technical Model and Realisation

To address these requirements (above) in the context of a distributed and collaborative application involved the development of a new methodology involving four related layers:

1. Client-server architecture, based on Jabber messaging protocol (sophisticated Open Source messaging protocol);
2. JAVA application programming (for sophisticated learning and interaction design);
3. HTML interface (for a natural and attractive user-experience);
4. Client deployed through Web-start technology (for flexible and robust deployment, e.g. from within institutional infrastructures).

Further details of how the design is technically realised is given in Ravenscroft, Sagar and Baur (2007a). Adopting this development approach and methodology allowed us to develop a sophisticated Web-technology that is easily deployed and feels like a typical 'Web experience'. The design was derived, ostensibly, from two different and yet typical Web-experiences; the first being the use of the Web in the normal sense of the word - such as Web browsing, social networking etc., and the second based on the use of Instant Messaging applications.

The way in which the interface design has taken into account the experience most Web users have with Instant Messaging applications (IM software) is shown in Figures 1 and 3. Users who are familiar with applications like MSN, Yahoo and Skype find using InterLoc extremely easy since the interaction builds on these experiences. As an example, IM users expect to be presented with a simple login page which requires the input of usernames and passwords before gaining access and being presented with content. While logged in, users expect to view the status (online/offline) of their friends (other users) and to be able to communicate informally with them (InterLoc provides an informal chat feature to support this aspect). Also, the layout of the dialogue window (the main venue where the communication between participants is taking place) has typical layout where an upper part is used to present the communication that's taking place (the actual contributions) and a lower part allows the player to enter their contributions to the discussion. InterLoc3 was designed to take into account such subtle layout and design familiarity with 'similar' applications to accommodate the realisation of its design. This allows new users to quickly learn the 'interaction basics' that allow them to increase the sophistication of their dialogue game practices in a cumulative way.

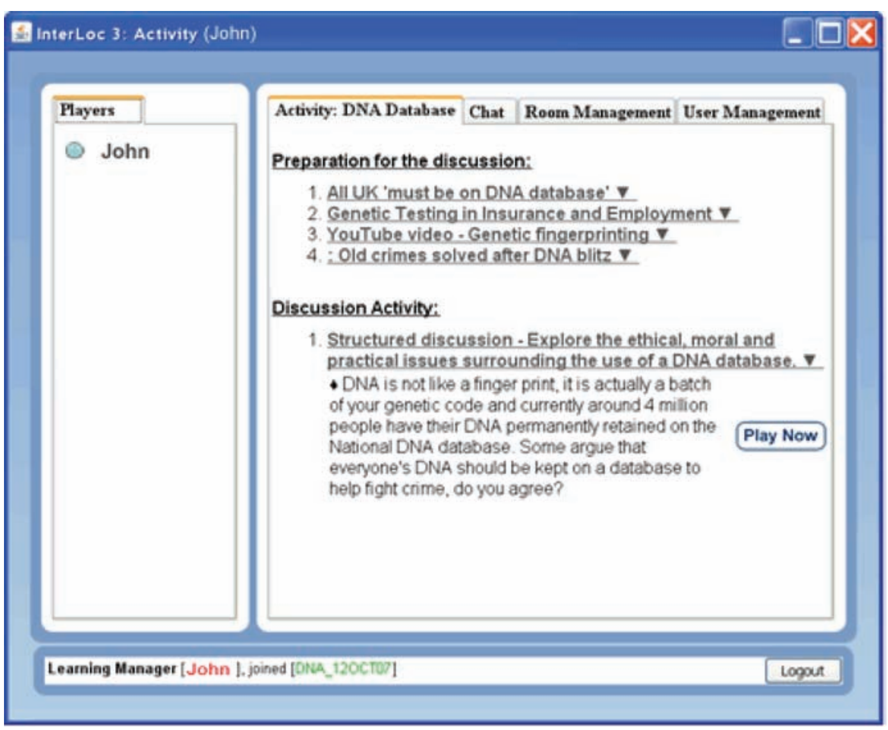
InterLoc3: Interface Design for Organising and Playing the Dialogue Games

Essentially, through following the methodology above InterLoc3 incorporates the same proven pedagogy as previous dialogue game tools (e.g. Interloc1, see Ravenscroft and McAlister 2006b), but has re-engineered this into the Web-technology that realises ambient pedagogy and experience design, so it is more pervasive, intuitive and attractive than previous designs that made their learning design more explicit. Put simply, InterLoc3 makes its complex learning and interaction designs look and feel simple.

Roles and Setting the Learning Context

Users of InterLoc are assigned one of three roles, namely Learning Manager, Facilitator or

Figure 1. The activity screen



Player. The Learning Manager, who is usually a tutor, takes the initiative to set the context for the dialogue games through assigning the roles, selecting any preparatory materials, deciding on a specific dialogue game and setting a question, or questions, that seed the game. Once the users login - using the username and password that has been assigned to them - they are presented with the interfaces that reflect the rights for their role and the functionality that is specific to their role. So for the players - logging in takes them to a realisation of the context and (ambient) learning design that has been set up for them. This is typically a number of preparation materials and media along with the particular dialogue game that has been selected or configured for them. This demonstrates how InterLoc provides the means to realise flexible, open and yet configurable learning experiences.

A user with a Facilitator role sees the same interfaces presented to players in addition to being able to broadcast a message to all players to manage the synchronous game. Figure 1 shows an Activity screen for a discussion topic about using and storing DNA. Here John is a Learning Manager because he has access to Room Management and User Management in addition to having Activity and Chat screens – that are available to all user roles

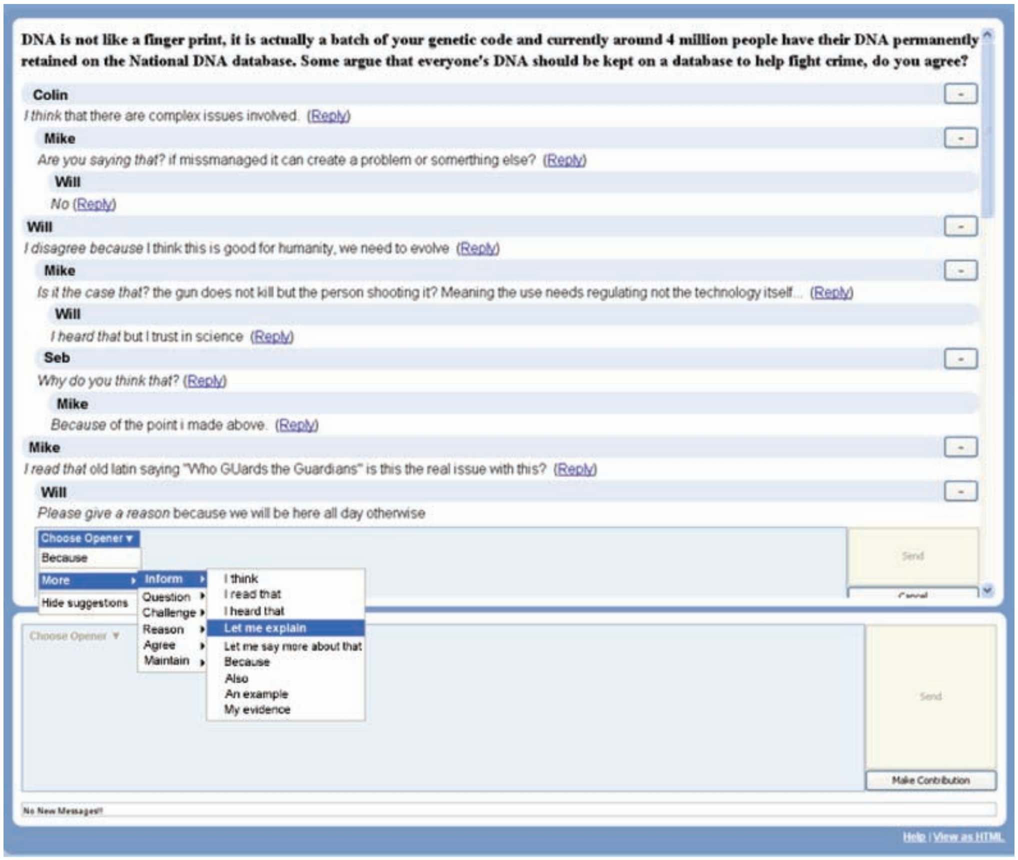
The above example shows how the contextual aspects of the ambient pedagogy are set through linking the preparation tasks to a suitable dialogue game. This activity uses four preparation tasks associated with the topic of DNA testing, but the Learning Manager could use more or less depending on the preparation requirements. Most dialogue games require such preparation, to give the learners sufficient prior knowledge and understanding, or grounding, to perform an engaging and meaningful dialogue game. The second part of the screen displays the actual question, which seeds this dialogue game entered through selecting the “Play Now” button. Typically players will perform the preparation asynchronously, in advance of the scheduled game activity, in their own time. The bottom window pane displays the participant’s role and status.

Playing the Dialogue Game

The interface in Figure 2 shows how each player performs the dialogue game. They can either Contribute to the current state of the developing dialogue through selecting “Make Contribution” or Reply to a specific previous contribution by selecting “Reply”. Contributing to the dialogue places a response at the bottom of the display and Replying indents the responses below the specific contribution that is replied to - in a threaded way. This model contains affordances that achieve a balance of ‘keeping the dialogue moving forward’ whilst allowing reflective asides and specific responses to previous contributions. So players need to distinguish whether they are “Contributing” to the developing dialogue (using the large reply bar at the bottom), typically responding to the latest ‘state of the dialogue’, or replying to a specific previous contribution (by selecting “Reply” next to each contribution). Also, all contributions or replies are made using the pre-defined Move categories (Inform, Question, Challenge etc.) and the specific locution openers (“I think…”, “I disagree because…”, “Let me elaborate…” etc.) that have to be used to perform the dialogue. Similarly, rules about the legitimate and logical responding openers, based on the specific Openers that are replied to, are offered selectively - but these can be overridden to select the full range of options through selecting “More”. For example Figure 2 shows a player called Seb2 deciding to access the full range of moves and openers through selecting “More” instead of using “Because…” - which is the prompted response to the “Please give a reason…” opener.

This interface shows how the adoption of html, CSS and common design colours and idioms (e.g. threading, menu operation and expansion boxes) ensures the dialogue game experience is attrac-

Figure 2. The Interloc3 Interface: Realising ambient pedagogy and experience design



tive and 'feels like' a typical and intuitive Web experience and realises our principles of 'Realise digital naturalism'. Similarly, it operationalises the principle of 'Consider proximal practices' through supporting a style of interaction that builds on students experiences with technologies like MSN and Skype.

Figure 2 also shows how the structuring and scaffolding works. It shows Seb replying to a previous contribution by Will – who has requested a reason for a position offered by Mike. So Seb has responded to Will's Challenging move of "Please give a reason…" using an Informing move "Let me explain…" and is about to enter the content of his response. Even this brief excerpt, which was taken from a user-test performed during a work shop with members of the Learning Technology Research Institute (LTRI), most of whom were using InterLoc for the first time, demonstrates coherent reasoned dialogue about using DNA technology.

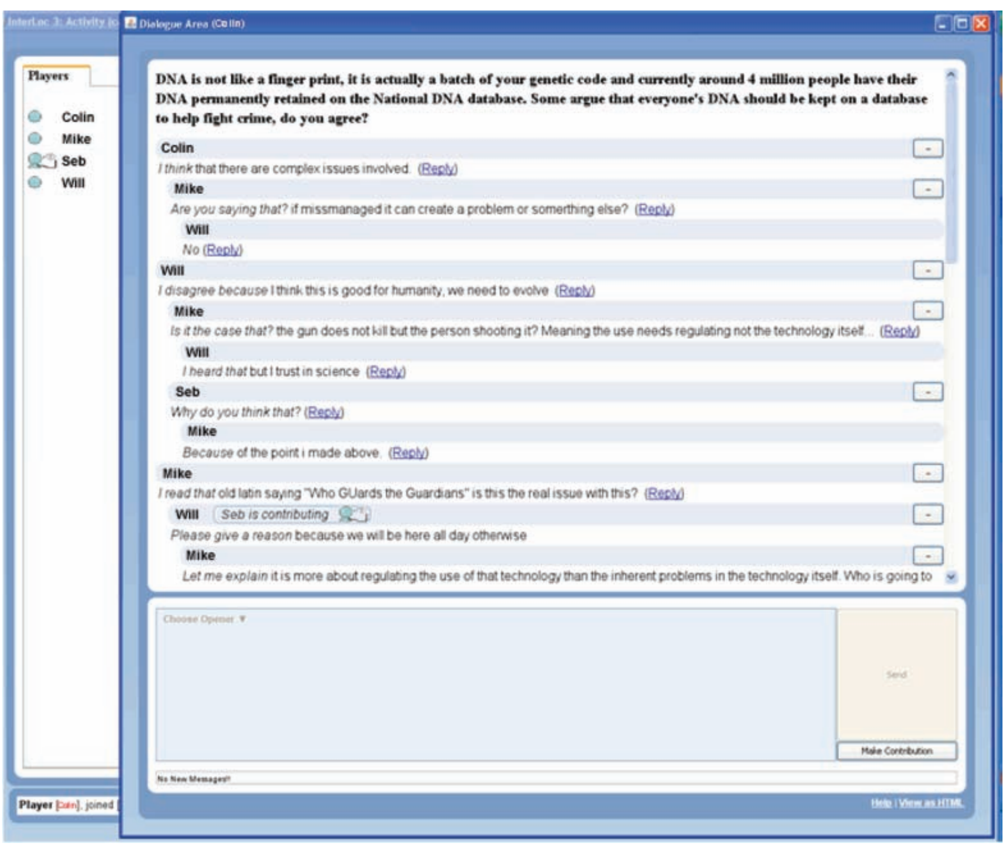
This activity started with all players watching a video about Genetic fingerprinting on YouTube, which was the third preparation activity listed in Figure 1. Figure 2 shows how the question that seeds the dialogue game is bolded and located at the top of the screen. This interchange shows how in addition to the Challenge described above the dialogue game approach supports features such as a clarification requests - "Are you saying that?…", reasoned disagreements - "I disagree because…", various probing questions – "Is it the case that?…", "Why do you think that?…", and referring to evidence – "I read that…". So it should also be clear how this learning and interaction design is semi-formal in nature, in that is supports a scholarly practice that is realised in an engaging way and linked to the types of digital assets that students may frequently use for either informal or formal learning.

Turn-Taking and 'Listening'

To ensure the dialogues remain coherent a turn-taking model is employed, that is shown in Figure 3, which allows each player to 'hold the floor' whilst making a response, which is automatically signalled to the other players, 'blocks out' other responses to the same contribution and generally allows the dialogue to be logically and coherently displayed and managed. So this feature is a good exemplification of our principle of 'Make the complex simple', as without it we would have confusing dialogues and a confusing representation of them. This also means that players don't 'rush' to make their contributions, and instead observe and 'listen' to the developing dialogue. If any player holds the turn for too long (e.g. more than 90 seconds) they are prompted to Contribute or Cancel, and of course players can always attend to another contribution if the specific one they wanted to reply to is in the process of being responded to by another player.

So the turn-taking and awareness features ensure logically (i.e. reasoned) and sequentially coherent dialogue is performed and sequential incoherence (e.g. that is experienced with chat) is avoided. This leads to a more considered, reflective and thoughtful dialogue. Note that problems of sequential and semantic incoherence that are

Figure 3. Turn-taking and listening



addressed by the InterLoc design are significant problems in virtually all other tools that support synchronous communication. In contrast this mechanism realises a balance between fairly managed dialogue and a 'pace of interaction' that leads to thoughtful and yet 'forward moving' dialogue. In Figure 3 we can see what Colin and the other players observe when Seb is making the response referred to in Figure 2. which 'locks out' the Contribution input field for the selected reply for all players of the game until he has finished.

To summarise the interchange in Figure 2 and 3, which although brief, demonstrates how collaborative arguments, and texts, are developed through InterLoc. Colin initiates the dialogue (about storing and using DNA) using "I think…" to assert that there are complex issues involved. Mike replies to this using "Are you saying that…" to probe what these complex issues might be, which Will then disagrees with by saying "No". Will then contributes using "I disagree because…" to explain he's in favour of using DNA technology because it shows 'evolution in humanity'. Mike then replies to this using "Is it the case that…" to question and suggest that its not the technology itself but the people using it that need regulating. Will replies to this with "I heard that…" to acknowledge Mike's point but affirm his own position. Seb then contributes using "Why do you think that…" to question the points made by Mike, who refers him to previous contributions and uses "I read that…" to elaborate his position in terms of "Who GUards the Guardians". This stimulates Will to reply to Mike's contribution, using "Please give a reason…" to press Mike to clarify his position, who then does so using "Let me explain…". A number of previous papers (McAlister, Ravenscroft and Scanlon, 2004a; Ravenscroft and McAlister, 2006a, 2006b) give a considerable number of longer and more varied dialogue game interactions along with their analysis and evaluation.

Saving, Replaying and Reusing the Dialogues

As the content of the dialogue games can be saved as a html file – it forms a valuable learning resource that contains a collaborative, structured and semi-formal textual argument. This may be used as personal notes, the pre-cursor to an essay or assessment exercise, or as content that could be posted to another forum, a blog or a wiki. The html format can de replayed using a standard text to speech translator, such as the one freely available with the Opera browser. This provides an accessible 'replay' facility that can be performed after the dialogue games so that players can decide whether to further manipulate or edit the generated content. Of course, this replay facility could be performed via a Web-enabled mobile phone. This flexibility, across platform, device and modality also demonstrates our principles of 'Realise digital naturalism' and 'Consider proximal practices'.

Amending the Pre-Defined Dialogue Games

Note that all the textual contents contained in the Menus that realise the dialogue games are read in from xml files and so can be easily edited and amended, to provide flexible configuration of the ambient learning design. So the Learning Manager can choose to modify particular Move categories, alter the wording of the Openers or alter some of the rules of the interaction in ways they think will fit their pedagogical purposes. Ongoing work with early adopters is making this process easier, through the development of a dialogue game editing tool.

Ongoing Evaluation of InterLoc3 and Preliminary Findings

There are currently ongoing implementations and evaluations of InterLoc3 across four HE Institutions, involving a range of courses and hundreds of students, so at the moment we can only report some early findings from London Metropolitan University, where the dialogue game approach was initially adopted and used by two tutors and 53 students studying software engineering within the Department of Computing. This total number of students was divided into twelve groups based at two campuses, which accounted for approx 75% of the total cohort of students studying this module.

The course leader set up the dialogue game activities covering pre-examination questions in ‘formal methods for specification’ and specifically included two reading tasks for student preparation. So in this context the aim was to ‘get the students thinking, working and revising’. Two researchers from the project and the course tutor (who are co-authors of this article) observed the student groups, as these initial trials were performed in a computing lab. In a de-briefing interview within a month of these sessions the tutor made the following comments that give a flavour of the anticipated impact of InterLoc and what the student experience might be:

“But with Interloc, what’s different is once students engage with it they realise it’s different and they have to think about what they are doing and that is the difference. They are not just uploading things or downloading things they have to read something and understand whatever they have read. And while they are within the InterLoc sessions they realise that they need to think about what they’ve got to do before they do it. “

“The main thing is that they are thinking while they are within InterLoc. The thinking that they are doing is slightly different from their normal thinking. In as much as they are thinking about other people within the group: everybody’s thinking about what each other’s thinking, about what’s going on, which is very, very important. So it’s almost like meta-thinking activity.”

One clear finding from these initial studies was that the introduction of this innovation requires more contextualisation than originally anticipated, precisely because it is a practice that as the quotes above indicate, whilst clearly beneficial and important, is not typical of the ‘instruction and assessment’ nature of conventional teaching. So the dialogue game activities need careful introduction in terms of the direct and indirect benefits they offer, in terms of improving students understanding of a topic, generating suitable content to support related learning activities and, providing the means for them to develop and practice fundamental skills of critical thinking and collective inquiry. Also, the process of ‘question-setting’ performed by the Learning Manager to seed the dialogue games cannot be underestimated and needs careful thought. In brief, although InterLoc3 is so far being successfully deployed and adopted in this exemplar context, it has to be conceived of holistically, as a practice that needs to be contextualised within a wider pedagogical and technological context, and ideally built into the broader learning designs (e.g. courses).

FUTURE TRENDS

Interestingly, it was over twenty years ago that we were promised a revolutionary cyber-reality, most famously characterised by William Gibson’s (1984) Neuromancer. Then both Scientists and Science Fiction writers predicted the spread of an all-encompassing cyberspace that would tear apart our conventional notions of reality, replacing them with a virtual reality that would drastically change the way we learn, think and behave. But as far as our work and the explosion in social software has shown it has not happened in this way. The work reported in this article suggests that we are not creating a new landscape for ‘e-learning’ or ‘learning in cyberspace’, but instead we are supporting hyper-interactions that are fundamentally human. In this sense the internet is a landscape that provides the technologies that can catalyse, scaffold and amplify learning processes and re-shape learning practices. So contemporary learning will inevitably involve the close interplay of minds, machines and practices.

Hyper-Interactions for Learning

Our work that has been reported in this article demonstrates how specially designed tools, such as InterLoc, support the sort of collaborative thinking and collective inquiry, through blending dialectical and dialogic dialogue, in ways that are virtually impossible to achieve in more naturalistic ways. Studies of our dialogue games have demonstrated how they: empower learners to engage in 'thinking conversations'; scaffold the development of dialogue and reasoning skills; and, promote inclusive and fairly balanced dialogue practices. Also in some of our studies the students frequently commented that these dialogue games were better than face-to-face dialogues for a number reasons, and especially because some were particularly enthusiastic about being given a 'voice' in critical discussions in ways that overcame significant emotional and social barriers that they had previously experienced. So this clearly demonstrates what we have called 'hyper-interactions for learning', where the technological mediation enables the sort of relationships, dialogue and thinking to be developed and realised that could not have been, or would be very difficult to achieve, without this specialised social software.

CONCLUSION

We accept that the ideas, approach and technologies that are reported in this article, along with the synthesis we attempt, are somewhat ambitious. But they represent a serious attempt to reconcile 'classical' learning practices, such as the development of thinking, reasoning and discussion skills, with the opportunities offered by more open, inclusive and social software - and the developing digital practices that these support. It is early days in this initiative, as the educational and epistemological implications that are entailed by emerging digital practices with social software have arisen very much 'from under the radar', and so academic institutions are trying hard to assimilate their significance. Implicit in the argument that has been developed in this Chapter is a call, through design, to re-focus on fundamentals of learning, through reclaiming notions like 'thinking', 'meaning making', 'understanding' and 'collaborative inquiry'. It is strange that when compared with a lot of the current terminology of learning technology, that has tended to be dominated by somewhat mechanistic and content-centric terms like 'managed learning environments', 'delivering learning', 'content repositories' and such like these more fundamental terms seem somewhat fanciful and alien. But it's also reassuring that when we think of designing future learning practices through embracing more open and social software we have the opportunity to focus on these fundamental human processes.This can be achieved through setting up or promoting new contexts, conditions and catalysts for meaningful learning, as an alternative to using technology to emphasise more sophisticated ways to 'teach'.

ACKNOWLEDGMENT

The authors are very grateful to the many colleagues who have significantly contributed to this line of work. In particular, all members of the Dialogue Game project teams at London Metropolitan University, UK Open University, Exeter University, Oxford University, Queen Mary (University of London), University of Teesside and Bolton University, see www.interloc.org. Recent work on InterLoc tool has been carried out with the support of the UK Joint Information Systems Committee (JISC) "Capital Programme". The content of this paper does not necessarily reflect

the position of the JISC, nor does it involve any responsibility on the part of the JISC.

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KEY TERMS

Advanced Learning Design: This is an approach to learning design which accepts that contemporary learning is becoming more personalised, social and emergent - rather than the outcome of highly structured and pre-planned institutional practices

Ambient Pedagogy: An approach to pedagogy and learning design that foregrounds the experiences that are produced through the realisation of the pedagogy, that is present but 'behind the scenes', in a learning situation. So this contrasts with approaches that focus on and externalise the structural complexities of the learning design. Instead, here there is a deliberate effort to render the complexities of learning designs into accessible learning practices that are performed 'naturally'

Dialectic: An approach to dialogue which holds that knowledge and understanding develops through 'rational argument' and 'reasoned inquiry', with an emphasis on the clarification of meaning

Dialogic: An approach to dialogue which holds that knowledge and understanding develops in a dynamic and relational way, through a process that involves the continuous development of descriptions, or re-descriptions, that arise from being able to 'adopt the perspective of another' in a dialogue

Digital Dialogue Games for Learning: A well attested approach to learning through dialogue that is organised and managed according to computer-mediated social games (such as InterLoc above) that are performed synchronously amongst small groups.

InterLoc: A 'state of the art' Web-technology that implements digital dialogue games for reasoned dialogue, collaborative inquiry and learning

Investigation by Design (IBD): A methodology for investigating and modelling educational dialogue in ways that: identify and examine the dialogue features and processes that are in play and provides specifications that can be implemented as digital tools

Meaningful Learning: An approach to learning which emphasises the human social and cognitive processes that are in play, such as 'thinking', 'meaning making', 'understanding' and 'collaborative inquiry', and articulates the value of knowledge representations in these terms. So this term foregrounds the processes that give rise to the, usually collaborative, development of knowledge and understanding, in contrast to approaches that locate meaning and knowledge ostensibly within media and content

ENDNOTES

1. Note that here we use the term 'pervasive' to give recognition to the fact that this technology can be used on any Web-enabled platform and from within institutional infrastructures, which currently is not common for an application with InterLoc's level of complexity.
2. Note that the actual names have been anonymised but the gender retained.

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 415-433, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.6
A Social Framework for Software Architectural Design

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ABSTRACT

Information systems are deeply linked to human activities. Unfortunately, development methodologies have been traditionally inspired by programming concepts and not by organizational and enterprise ones. This leads to ontological and semantic gaps between the systems and their environments. The adoption of Multi-Agent Systems (MAS) helps to reduce these gaps by offering modeling tools based on organizational concepts (actors, agents, goals, objectives, responsibilities, social dependencies, etc.) as fundamentals to conceive systems through a development process. Socio-technical design is concerned with the direct involvement of users in software design. To this respect the DesCARTES framework presented in this paper offers three main contributions: 1) the use of agents modeled according to organizational concepts, 2) the use of social patterns in software design that better match with users' organization structures, and 3) the inclusion in an iterative development methodology that involves the user intensively in software development.

DOI: 10.4018/978-1-60566-264-0.ch025

If you think good architecture is expensive, try bad architecture.

—Brian Foote and Joseph Yoder

1. INTRODUCTION

Information systems are deeply linked to human activities. Unfortunately, development methodologies have been traditionally inspired by programming concepts and not by organizational and enterprise ones. This leads to ontological and semantic gaps between the systems and their environments. The adoption of Multi-Agent Systems (MAS) helps to reduce these gaps by offering modeling tools based on organizational concepts (actors, agents, goals, objectives, responsibilities, social dependencies, etc.) as fundamentals to conceive systems through all development process. Moreover, software development is becoming increasingly complex. Stakeholder expectations are ever more demanding, while development times are supposed to be shorter. Project managers, analysts and software developers need adequate processes to model the organizational context, capture requirements and build efficient and flexible software systems. Those methodologies have to cover the whole life cycle (Kruchten, 2003) of the project while reducing risk as much as possible, offer tools to manage the complexity of human organizations and provide features to develop applications in a correct way.

At the architectural design level, an important technique that helps handle software construction and documentation complexity is the reuse of development experience and know-how. Styles and patterns have become an attractive approach to reusing architectural design knowledge. Architectural styles are intellectually manageable abstractions of system structure that describe how system components interact and work together (Shaw & Garlan, 1996). Design patterns describe a problem commonly found in software designs and prescribe a flexible solution for the problem, so as to ease the reuse of that solution. This solution is repeatedly applied from one design to the next, producing design structures that look quite similar across different applications (Gamma, Helm, Johnson, & Vlissides, 1995).

Taking real-world social structures as metaphors, the DesCARTES[1] (Faulkner, Kolp, Coyette & Do, 2004) framework proposes a set of generic architectural structures (Kolp, Giorgini & Mylopoulos, 2001). It, as well as i*, Tropos and SPEM, is supported by the DesCARTES tool (Kolp & Wautelet, 2007). The aim is to offer and validate a software architectural design process specifically for agent-based systems:

- At the architectural level, organizational styles inspired from organization theory and strategic alliances are used to design the overall MAS architecture. Styles from organization theory describe the internal structure and design of the MAS architecture, while styles from strategic alliances model the cooperation of independent architectural organizational entities that pursue shared goals.
- At the detailed design level, social design patterns drawn from research on cooperative and distributed architectures, offer a more microscopic view of the social MAS architecture description. They define the agents and the social dependencies that are necessary for the achievement of agent goals.

The paper uses a running example to illustrate our approach: E-Media is a typical business-to-consumer application supporting the following features:

- An on-line web interface allows customers to examine the items in the *E-Media* catalogue, and place orders;
- Customers can search the on-line store by either browsing the catalogue or querying the item database. An online search engine allows customers to search title, author/artist and description fields trough keywords or full-text search;
- Internet communications are supported;
- On-line financial transactions including credit card and anonymity are protected;
- All web information (e.g., product and customer turnover, sales average, …) of strategic importance is recorded for monthly or on-demand statistical analysis;
- Based on this statistical and strategic information, the system permanently manages and adapts the stock, pricing and promotions policy. For example, for each product, the system can decide to increase or decrease stocks or profit margins. It can also adapt the customer on-line interface with new product promotions.

The chapter is organized as follows. Section 2 describes the main contributions of the framework to socio-technical design. The objectives of each discipline as well as the workflow and artifacts used as input or output are described.

Section 3 overviews architectural organizational styles, details one of them, the structure-in-5, and applies it to design the architecture of the e-business application. Section 4 presents the social design patterns, details one of them, the broker, and applies them to design in details part of the e-business application. Section 5 overviews the agent oriented e-business system implementation. Section 6 overviews related work. Finally, Section 7 concludes the paper.

2. TOWARDS A SOCIO-TECHNICAL DESIGN ORIENTED DEVELOPMENT FRAMEWORK

Socio-technical design is an under development discipline in which contributions are coming from different aspects of literature. We claim that the development framework proposed in this chapter contributes to the development of socio-technical design on different levels.

Indeed, following (Scacchi, 2004), *socio-technical design is concerned with advocacy of the direct participation of end-users in the information system design process*, furthermore the paper highlights the system environment as being a part of it. The software process described in this chapter contributes to the development of socio-technical approaches in three distinct ways.

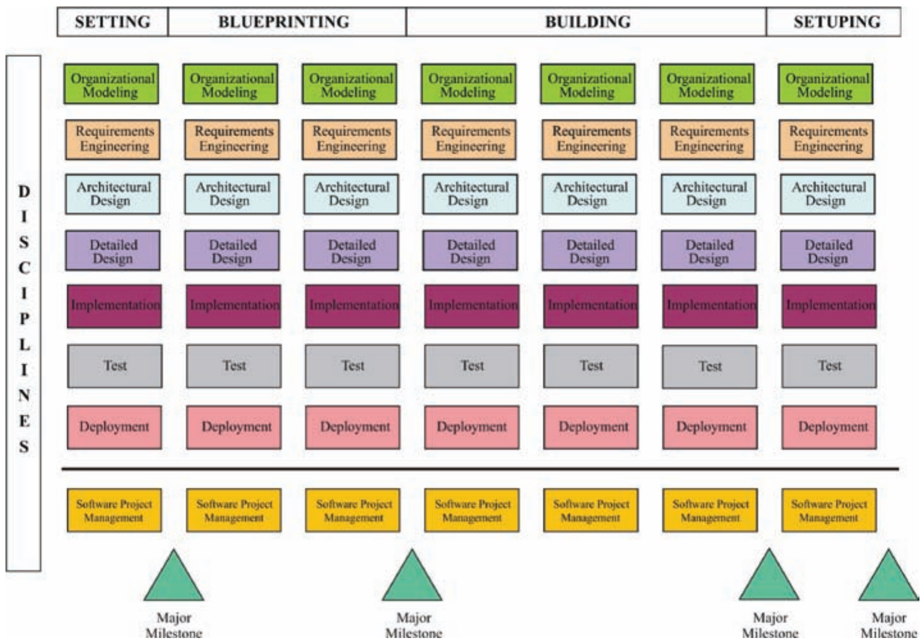
First of all, the use of the agent oriented paradigm allows modeling concepts and techniques in accordance to the reality of human organizations. Indeed, when developing multi-agent systems (MAS) the system being modeled can be represented by using organizational concepts (actors, agents, goals, objectives, responsibilities, social dependencies, etc.) as fundamentals to conceive systems through all development process. Moreover, the i* approach (Yu, 1995) included in our framework proposal allows one to model the actors inside and outside the system as well as their collaborations in terms of goals, tasks, resources or softgoals.

Secondly, by the use of social patterns into software design, some human organizational structures are directly used/mapped into software design which emphasizes even more the benefits from using MAS conceptualization into a socio-technical approach.

Finally, the process presented into this paper is part of a broader (iterative) development methodology called I-Tropos (Wautelet, 2008). Figure 1 offers a two dimensional view of the I-Tropos process: it shows the disciplines and the four different phases to which they belong. This methodology is by essence iterative so that users are intensively involved into the system development; their participation, feedbacks as well as environmental evolutions/changes are directly incorporated into the development process. Such a process leads to a better user involvement and the development of software product with a higher perceived quality. Software users, enterprise workers, other project stakeholders and their environment are thus centric in our approach; this is perfectly in accordance with the principles of socio-technical design. This makes our approach different of a traditional software engineering one based on the activities performed by professionals designed to build a set of solution-driven development artifacts. Due to a lack of space we cannot document the complete I-Tropos software process in this chapter, the interested reader can refer to (Wautelet, Kolp & Achbany, 2006; Wautelet, 2008) for such a documentation using the Software Process Engineering Metamodel (Object Management Group, 2007) concepts.

The case study developed in this chapter, e-media, is interesting from the socio-technical design point of view since it has involved intensively into the development a large number of users having various profiles (the social system) and other physical devices (the technical system). A broader illustration of the framework also pointing the advantages of iterative development on a coking plant production management system development is available in (Wautelet, 2008).

Figure 1. The I-Tropos process: Iterative perspective



The latest case study is also very illustrative of socio-technical design especially onto the technical system in which various machines behaving as agents are involved.

3. ARCHITECTURAL DESIGN WITH ORGANIZATIONAL STYLES

System architectural design has been the focus of considerable research during the last fifteen years that has produced well-established architectural styles and frameworks for evaluating their effectiveness with respect to particular software qualities (Bass, Clements, & Kazman, R., 1998). Examples of styles are pipes-and-filters, event-based, layered, control loops and the like (Shaw & Garlan, 1996). Examples of software qualities include maintainability, modifiability, portability etc (Kruchten, 2003). We are interested in developing a suitable set of architectural styles for multi-agent software systems. Since the fundamental concepts of a Multi-Agent System (MAS) are intentional and social, rather than implementation-oriented, we turn to theories which study social structures for motivation and insights. But, what kind of social theory should we turn to? There are theories that study group psychology, communities (virtual or otherwise) and social networks. Such theories study social structure as an emergent property of a social context. Instead, we are interested in social structures that result from a design process. For this, we turn for guidance, in DesCARTES, to organizational theories, namely ***Organization Theory*** and *Strategic Alliances*. Organizational Theory (e.g., Mintzberg, 1992; Scott, 1998; Yoshino & Srinivasa Rangan, 1995) describe the internal structure and design of an organization, while Strategic Alliances (e.g., Dussauge & Garrette, 1999; Morabito, Sack & Bhate, 1999; Segil, 1996) model the strategic cooperation of independent organizational stakeholders who pursue a set of shared goals.

3.1 Organizational Theory

"*An organization is a consciously coordinated social entity, with a relatively identifiable boundary, that functions on a relatively continuous basis to achieve a common goal or a set of goals"* (Morabito, Sack & Bhate, 1999). Organization theory is the discipline that studies both structure and design in such social entities. Structure deals with the descriptive aspects while design refers to the prescriptive aspects of a social entity. Organization theory describes how practical organizations are actually structured, offers suggestions on how new ones can be constructed, and how old ones can change to improve effectiveness. To this end, schools of organization theory have proposed models patterns to try to find and formalize recurring organizational structures and behaviors.

In the following, we briefly present organizational styles identified in Organization Theory. The structure-in-5 will be studied in detail in Section 3.3.

The Structure-in-5 style. An organization can be considered an aggregate of five sub-structures, as proposed in (Mintzberg, 1992). At the base level sits the *Operational Core* which carries out the basic tasks and procedures directly linked to the production of products and services (acquisition of inputs, transformation of inputs into outputs, distribution of outputs). At the top lies the *Strategic Apex* which makes executive decisions ensuring that the organization fulfils its mission in an effective way and defines the overall strategy of the organization in its environment. The *Middle Line* establishes a hierarchy of authority between the Strategic Apex and the Operational Core. It consists of managers responsible for supervising and coordinating the activities of the Operational Core. The *Technostructure* and the *Support* are separated from the main line of authority and influence the operating core only indirectly. The Technostructure serves the organization by making the work of others more effective, typically by standardizing work processes, outputs, and skills. It is also in charge of applying analytical procedures to adapt the organization to its operational environment. The Support provides specialized services, at various levels of the hierarchy, outside the basic operating workflow (e.g., legal counsel, R&D, payroll, cafeteria).

The pyramid style is the well-know hierarchical authority structure. Actors at lower levels depend on those at higher levels. The crucial mechanism is the direct supervision from the Apex. Managers and supervisors at intermediate levels only route strategic decisions and authority from the Apex to the operating (low) level. They can coordinate behaviors or take decisions by their own, but only at a local level.

The chain of values merges, backward or forward, several actors engaged in achieving or realizing related goals or tasks at different stages of a supply or production process. Participants, who act as intermediaries, add value at each step of the chain. For instance, for the domain of goods distribution, providers are expected to supply quality products, wholesalers are responsible for ensuring their massive exposure, while retailers take care of the direct delivery to the consumers.

The matrix style proposes a multiple command structure: vertical and horizontal channels of information and authority operate simultaneously. The principle of unity of command is set aside, and competing bases of authority are allowed to jointly govern the workflow. The vertical lines are typically those of functional departments that operate as "home bases" for all participants, the horizontal lines represents project groups or geographical areas where managers combine and coordinate the services of the functional specialists around particular projects or areas.

The auction style involves competitively mechanisms, and actors behave as if they were taking part in an auction. An auctioneer actor runs the show, advertises the auction issued by the auction issuer, receives bids from bidder actors and ensures communication and feedback with the auction issuer who is responsible for issuing the bidding.

3.2. Strategic Alliances

A strategic alliance links specific facets of two or more organizations. At its core, this structure is a trading partnership that enhances the effectiveness of the competitive strategies of the participant organizations by providing for the mutually beneficial trade of technologies, skills, or products based upon them. An alliance can take a variety of forms, ranging from arm's-length contracts to joint ventures, from multinational corporations to university spin-offs, from franchises to equity arrangements. Varied interpretations of the term exist, but a strategic alliance can be defined as possessing simultaneously the following three necessary and sufficient characteristics:

- The two or more organizations that unite to pursue a set of agreed upon goals remain independent subsequent to the formation of the alliance;
- The partner organizations share the benefits of the alliances and control over the performance of assigned tasks;
- The partner organizations contribute on a continuing basis in one or more key strategic areas, e.g., technology, products, and so forth.

In the following, we briefly present organizational styles identified in Strategic Alliances.

The joint venture style involves agreement between two or more intra-industry partners to obtain the benefits of larger scale, partial investment and lower maintenance costs. A specific joint management actor coordinates tasks and manages the sharing of resources between partner actors. Each partner can manage and control itself on a local dimension and interact directly with other partners to exchange resources, such as data and knowledge. However, the strategic operation and coordination of such an organization, and its actors on a global dimension, are only ensured by the joint management actor in which the original actors possess equity participations.

The arm's-length style implies agreements between independent and competitive, but partner actors. Partners keep their autonomy and independence but act and put their resources and knowledge together to accomplish precise common goals. No authority is lost, or delegated from one collaborator to another.

The hierarchical contracting style identifies coordinating mechanisms that combine arm's-length agreement features with aspects of pyramidal authority. Coordination mechanisms developed for arm's-length (independent) characteristics involve a variety of negotiators, mediators and observers at different levels handling conditional clauses to monitor and manage possible contingencies, negotiate and resolve conflicts and finally deliberate and take decisions. Hierarchical relationships, from the executive apex to the arm's-length contractors restrict autonomy and underlie a cooperative venture between the parties.

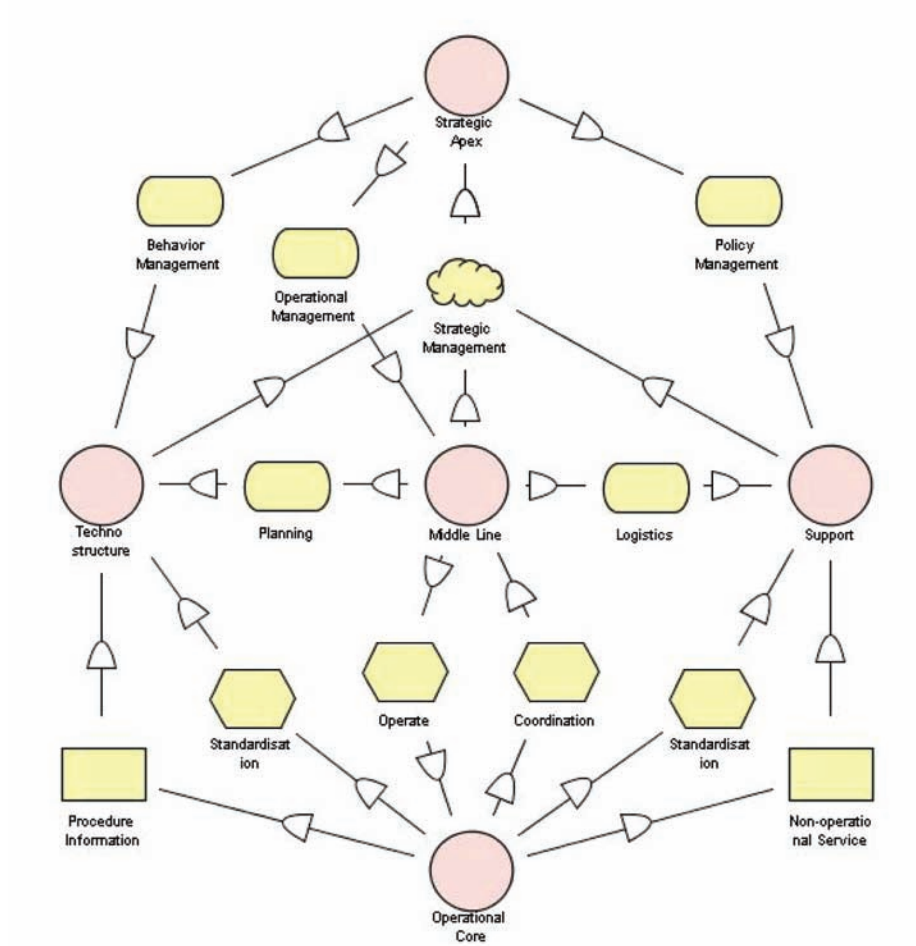
The co-optation style involves the incorporation of representatives of external systems into the decision-making or advisory structure and behavior of an initiating organization. By co-opting representatives of external systems, organizations are, in effect, trading confidentiality and authority for resource, knowledge assets and support. The initiating system has to come to terms with the contractors for what is being done on its behalf; and each co-optated actor has to reconcile and adjust its own views with the policy of the system it has to communicate.

3.3. An Organizational Style in Detail

Figure 2 details the structure-in-5 style using the *i** framework. As said, i* diagrams in this chapter are drawn with DesCARTES.

The Technostructure, Middle Agency and Support actors depend on the Apex for strategic man-

Figure 2. The Structure-in-5 style

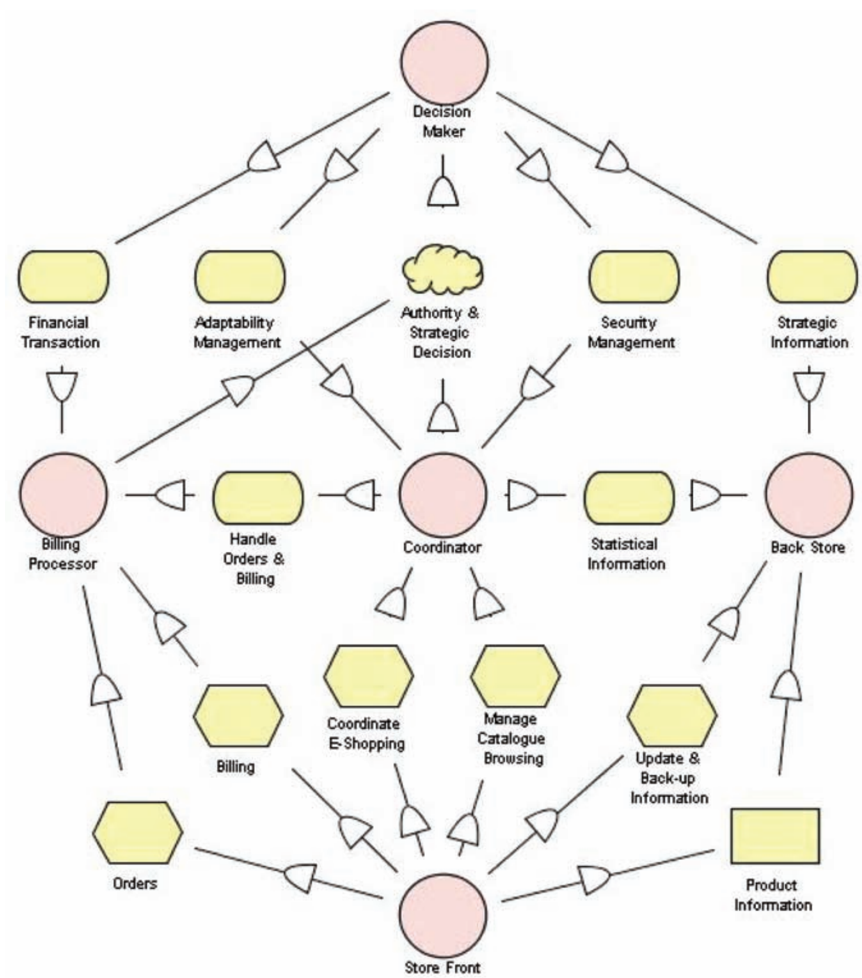


agement. Since the goal Strategic Management does not have a precise description, it is represented as a softgoal (cloudy shape). The Middle Agency depends on the Technostructure and Support respectively through goal dependencies Control and Logistics represented as oval-shaped icons. The Operational Core is related to the Technostructure and Support actors through the Standardize task dependency and the Non-operational Service resource dependency, respectively.

A number of constraints can also be applied to supplement the basic style:

- The dependencies between the Strategic Apex as depender and the Technostructure, Middle Line and Support as dependees must be of type goal;
- A softgoal dependency models the strategic dependence of the Technostructure, Middle Line and Support on the Strategic Apex;
- The relationships between the Middle Line and Technostructure and Support must be of goal dependencies;
- The Operational Core relies on the Technostructure and Support through task and resource dependencies;

Figure 3. The E-Media architecture following the structure-in-5 style



- Only task dependencies are allowed between the Middle Line (as depender or dependee) and the Operational Core (as dependee or depender).

3.4. Applying Organizational Styles

Figure 3 models the agent-oriented architecture for E-Media following the structure-in-5 style.

The Store Front plays the role of the structure-in-5's Operational Core. It interacts with customers and provides them with a usable front-end web application for consulting, searching and shopping media items.

The Back Store constitutes the structure- in-5's Support component. It manages the product database and communicates to the Store Front relevant product information. It stores and backs up all web information about customers, products and sales to be able to produce statistical information (e.g., analyses, average charts and turnover reports). Such kind of information is computed either for a predefined product (when the Coordinator asks it) or on a monthly basis for every product. Based on this monthly statistical information, it provides also the Decision Maker with strategic information (e.g., sales increase or decrease, performance charts, best sales, sales prevision, …).

The Billing Processor plays the role of the structure-in-5's Technostructure in handling customer orders and bills. To this end, it provides the customer with on-line shopping cart capabilities. It also ensures the secure management of financial transactions for the Decision Maker. Finally, it handles, under the responsibility of the Coordinator component, stock orders to avoid shortages or congestions.

As the structure-in-5's Middle Agency, the Coordinator assumes the central position of the architecture. It is responsible to implements strategic decisions for the Decision Maker (Strategic Apex). It supervises and coordinates the activities of the Billing Processor (initiating the stock and pricing policy), the Front Store (adapting the front end interface with new promotions and recommendations) and the Back Store.

3.5. Selecting an Architecture

Software quality attributes (i.e., non-functional requirements describing how well the system accomplishes its functions) relevant for multi-agent systems have been studied in (Kolp, Giorgini, & Mylopoulos, 2001). These are, for instance: predictability, security, adaptability, coordinability, cooperativity, competitivity, availability fallibility-tolerance, modularity, aggregability.

Three of them (adaptability, security, availability) have been identified as particularly strategic for e-business systems (Do, Faulkner, & Kolp, 2003). Due to the lack of space, we will only focus on these three qualities for the structure-in-5 style and refer the author to the bibliography for the other attributes and other styles.

Adaptability deals with the way the system can be designed using generic mechanisms to allow web pages to be dynamically changed. It also concerns the catalogue update for inventory consistency.

The structure-in-5 separates independently each typical component of the E-Media architecture isolating them from each other and allowing dynamic manipulation.

Security. Clients, exposed to the internet are, like servers, at risk when using Web applications. It is possible for web browsers and application servers to download or upload content and programs that could open up the client system to crackers and automated agents. JavaScript, Java applets, ActiveX controls, and plug-ins represent a certain risk to the system and the information it manages. Equally important are the procedures checking the consistency of data transactions.

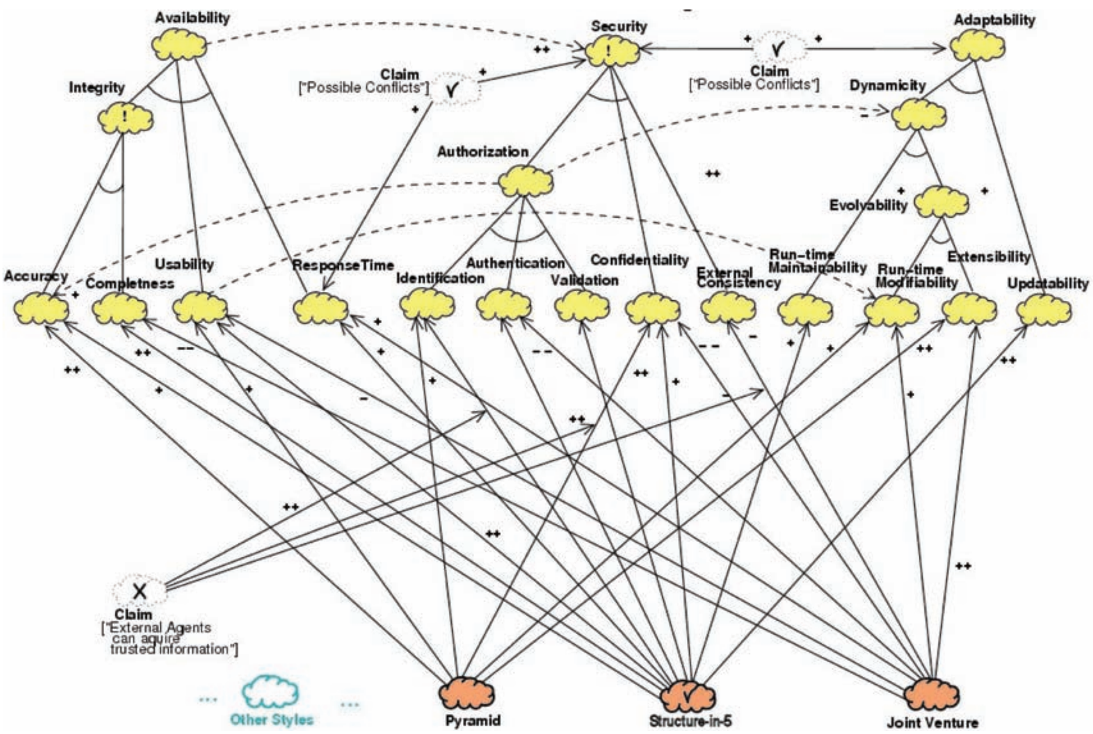
In the structure-in-5, checks and control mechanisms can be integrated at different levels assuming redundancy from different perspectives. Contrary to the classical layered architecture (Shaw & Garlan, 1996), checks and controls are not restricted to adjacent levels. Besides, since the structure-in-5 permits the designer to separate process (Store Front, Billing Processor and Back Store) from control (Decision Maker and Monitor), security and consistency of these two hierarchies can also be verified independently.

Availability. Network communication may not be very reliable, causing sporadic loss of the server. There are data integrity concerns with the capability of the e-business system to do what needs to be done, as quickly and efficiently as possible in particular with the ability of the system to respond in time to client requests for its services.

The structure-in-5 architecture make agents more tolerant to network availability problems by differentiating process from control. Besides, higher levels are more abstract than lower levels: lower levels only involve resources and task dependencies while higher ones propose intentional (goals and softgoals) relationships.

To cope with software quality attributes and select the architecture of the system, we go through a means-ends analysis using the non-functional requirements (NFRs) framework (Chung, Nixon, Yu & Mylopoulos, 2000). In the

Figure 4. Selecting an architecture



NFR framework, software quality attributes are called non-functional requirements represented as softgoals (cloudy shapes). The analysis involves refining these softgoals to sub-goals that are more specific and more precise and then evaluating alternative architectural styles against them, as shown in Figure 4. The styles are represented as operationalized softgoals (saying, roughly, "make the architecture of the new system pyramid-/joint venture-/co-optation-based,…"). Design rationale is represented by claim softgoals drawn as dashed clouds. These can represent contextual information (such as priorities) to be considered and properly rejected into the decision making process. Exclamation marks (! and !!) are used to mark priority softgoals. A check-mark "✓" indicates a fulfilled softgoal, while a cross "×" labels an unfulfillable one.

In Figure 4, Adaptability is AND-decomposed into Dynamicity and Updatability. For our e-commerce example, dynamicity should deal with the way the system can be designed using generic mechanisms to allow web pages and user interfaces to be dynamically and easily changed. Indeed, information content and layout need to be frequently refreshed to give correct information to customers or simply be fashionable for marketing reasons. Frameworks like Active Server Pages (ASP), Server Side Includes (SSI) to create dynamic pages make this attribute easier to achieve. Updatability should be strategically important for the viability of the application, the stock management and the business itself since *E-Media* administrators have to very regularly update the catalogue for inventory consistency.

Availability is decomposed into Usability, Integrity and Response Time. Network communication may not be very reliable causing sporadic loss of the server. There should be data integrity concerns with the capability of the e-business system to do what needs to be done, as quickly and efficiently as possible: in particular with the ability of the system to respond in time to client requests for its services. It is also important to provide the customer with a usable application, i.e., comprehensible at first glimpse, intuitive and ergonomic. Equally strategic to usability concerns is the portability of the application across browser implementations and the quality of the interface.

Security has been decomposed into Authorization, Confidentiality *and* External Consistency.

Eventually, the analysis shown in Figure 4 allows us to choose the structure-in-5 architectural style for our e-commerce example (the operationalized attribute is marked with a "✓"). More details about the selection and non-functional requirements decomposition process as well as evaluation and comparison of the styles with respect to architectural criteria can be found in (Castro, Kolp, & Mylopoulos, 2002; Kolp, Giorgini & Mylopoulos, 2001).

4. DETAILED DESIGN WITH SOCIAL PATTERNS

The organizational abstraction sketched during the architectural design discipline gives information about the system architecture to be: every time an organizational style is applied, it allows to easily pointing up, to the designer, the required organizational agents.

Next step in MAS architectural design requires detailing and relating identified (organizational) agents to more specific ones in order to proceed with the agent behavior characterization. Namely, each agent in Figure 3 is much closer to the real world system actor behavior than software agent behavior that we consequently aim to achieve. Consequently, once the organizational architectural reflection has figured out the MAS global structure in terms of actors and their intentional relationships, a deepener analysis is required to detail the agent behaviors and their interdependencies necessary to accomplish their roles in the software organization.

To effectively deal with this objective, design patterns are used to describe a problem commonly found in software designs and prescribe a flexible solution for the problem, so as to ease the reuse of that solution. In DesCARTES, we adopt social patterns (Do, 2005) that are design patterns focusing on social and intentional aspects that are recurrent in multi-agent or cooperative systems. Similarly to organizational styles, social patterns are generic structures that define how (a small number of) agents are interacting together in order to fulfill their obligations.

DesCARTES classifies social patterns in two categories. The Pair patterns describe direct interactions between negotiating agents. The Mediation patterns feature intermediate agents that help other agents reach agreement about an exchange of services. These patterns are then applied to design in detail the E-Media application.

4.1. Pair Patterns

The **Booking** pattern involves a client and a number of service providers. The client issues a request to book some resource from a service provider. The provider can accept the request, deny it, or propose to place the client on a waiting list, until the requested resource becomes available when some other client cancels a reservation.

The **Subscription** pattern involves a yellow-page agent and a number of service providers. The providers advertise their services by subscribing to the yellow pages. A provider that no longer wishes to be advertised can request to be unsubscribed.

The **Call-For-Proposals** pattern involves a client and a number of service providers. The client issues a call for proposals for a service to all service providers and then accepts proposals that offer the service for a specified cost. The client selects one service provider to supply the service.

The **Bidding** pattern involves a client and a number of service providers. The client organizes and leads the bidding process, and receives proposals. At each iteration, the client publishes the current bid; it can accept an offer, raise the bid, or cancel the process.

4.2 Mediation Patterns

In the **Monitor** pattern, subscribers register for receiving, from a monitor agent, notifications of changes of state in some subjects of their interest. The monitor accepts subscriptions, requests information from the subjects of interest, and alerts subscribers accordingly.

In the **Broker** pattern, the broker agent is an arbiter and intermediary that requests services from providers to satisfy the request of clients.

In the **Matchmaker** pattern, a matchmaker agent locates a provider for a given service requested by a client, and then lets the client interact directly with the provider, unlike brokers, who handle all interactions between clients and providers.

In the **Mediator** pattern, a mediator agent coordinates the cooperation of performer agents to satisfy the request of a client agent. While a matchmaker simply matches providers with clients, a mediator encapsulates interactions and maintains models of the capabilities of initiators and performers over time.

The **Wrapper** pattern incorporates a legacy system into a multi-agent system. A wrapper agent interfaces system agents with the legacy system (source) by acting as a translator. This ensures that communication protocols are respected and the legacy system remains decoupled from the rest of the agent system.

More details about the evaluation and comparison of the styles with respect to architectural criteria can be found in (Do, 2005).

4.3 A Social Pattern in Detail

Figure 5 details the Broker social pattern in *i**.

It is considered as a combination of (1) a Subscription pattern (shown enclosed within dashed boundary (a)), that allows service providers to subscribe their services to the Broker agent and where the Broker agent plays the role of yellow-page agent, (2) one of the other pair patterns—Booking, Call-for-Proposals, or Bidding—whereby the Broker agent requests and receives services from service providers (in Figure 5, it is a Call-for-Proposals pattern, shown enclosed within dotted boundary (b)), and (3) interaction between broker and the client: the Broker agent depends on the client for sending a service request and the client depends on the Broker agent to forward the service.

Figure 6 depicts the Broker pattern components. For brevity, each construct described earlier is illustrated only through one component.

Broker is one of the three agents composing the Broker pattern. It has plans such as QuerySPAvailability, SendServiceRequestDecision, etc. When there is no ambiguity, by convention, the plan name is the same as the name of the service that it operationalizes. The private belief SPProvidedService is used to store the service type that each service provider can provide. This belief is declared as private since the broker is the only agent that can manipulate it. The ServiceType belief stores the information about types of services provided by service providers and is declared as global since its must be known both by the service provider and the broker agent.

The constructor method allows the programmer to give a name to a broker agent when created. This method may call other methods, for example loadBR(), to initialize agent beliefs.

SendServiceRequestDecision is one of the Broker pattern plans the broker uses to answer the client: the BRRefusalSent event is sent when the answer is negative, BRAcceptanceSent when the broker has found some service provider(s)

Figure 5. The broker pattern in i*

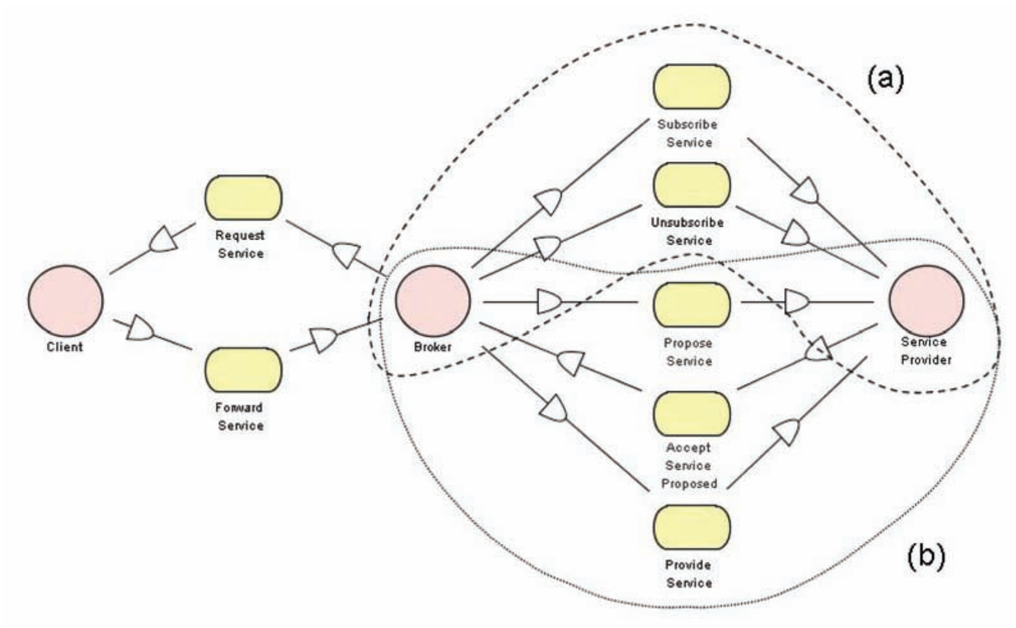


Figure 6. Structural diagram: Some components of the broker pattern

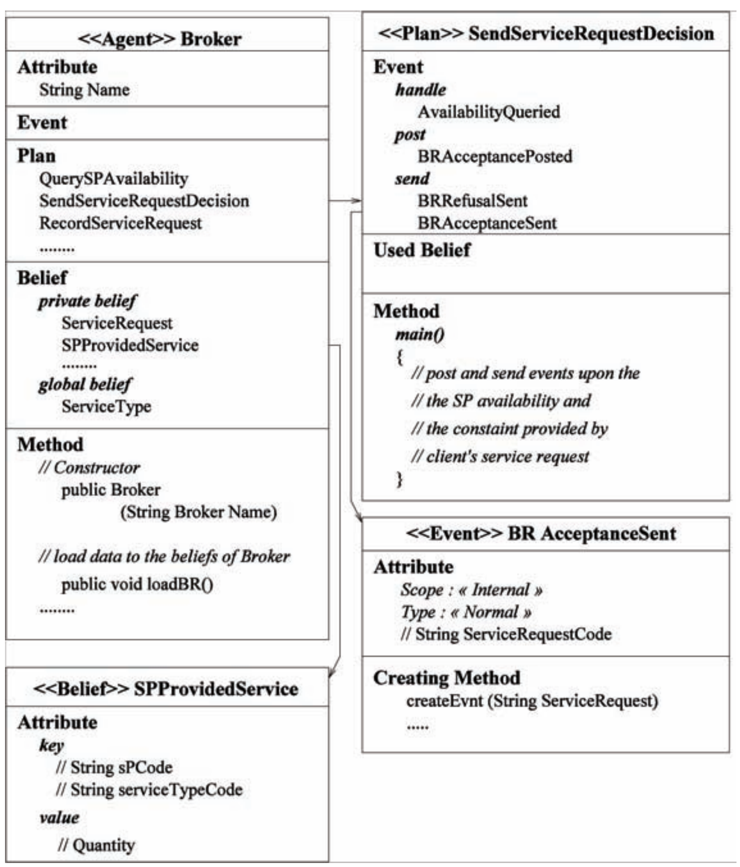
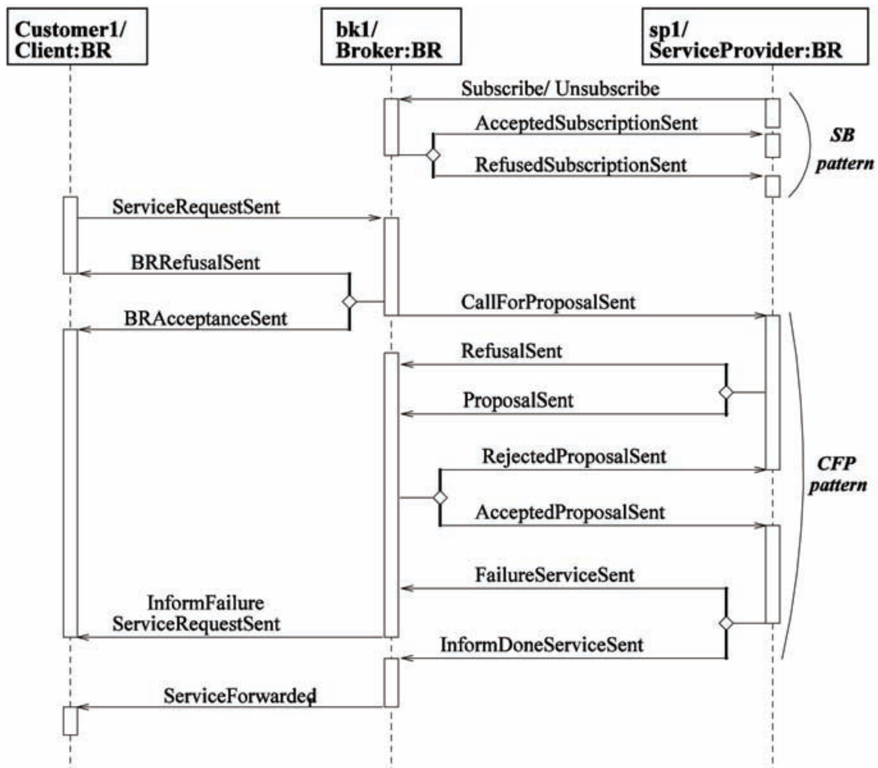


Figure 7. Interaction diagram for the broker pattern



that may provide the service requested by the client. In the latter case, the plan also posts the BRAcceptancePosted event to invoke the process of recording the client's service request and the process of 'call for proposals' between the broker and the services providers. The SendServiceRequestDecision plan is executed when the AvailabilityQueried event (containing the information about the availability of the service provider to realize the client's request) occurs.

SPProvidedService is one of the broker's beliefs used to store the services provided by the service providers. The service provider code sPCode and the service type code serviceTypeCode form the belief key. The corresponding quantity attribute is declared as a value field.

Figure 7 shows a sequence diagram for the Broker pattern. The client (customer1) sends a service request (ServiceRequestSent) containing the characteristics of the service it wishes to obtain from the broker. The broker may alternatively answer with a denial (BRRefusalSent) or a acceptance (BRAcceptanceSent).

BRAcceptanceSent is an event that is sent to inform the client that its request is accepted.

In the case of an acceptance, the broker sends a call for proposal to the registered service providers (CallForProposalSent). The call for proposal (CFP) pattern is then applied to model the interaction between the broker and the service providers. The service provider either fails or achieves the requested service. The broker then informs the client about this result by sending a InformFailureServiceRequestSent or a ServiceForwarded, respectively.

The communication dimension of the subscription pattern (SB) is given at the top-right and the communication dimension of the call-for- proposals pattern (CFP) is given at the bottom-right part of Figure 7. The communication specific for the broker pattern is given in the left part of the figure.

We omit the dynamic dimension of the Subscription and the CFP patterns, and only present in Figure 8 the activity diagram specific to the Broker pattern. It models the flow of control from the emission of a service request sent by the client to the reception by the same client of the realized service result sent by the broker. Three swimlanes, one for each agent of the Broker pattern, compose the diagram. In this pattern, the FindBroker service is either operationalized by the FindBR or the FindBRWithMM plans (the client finds a broker based on its own knowledge or via a matchmaker).

4.4. Applying Social Patterns

Figure 9 shows a possible use of the patterns for the Store Front component of the e-business system of Figure 3. In particular, it shows how to realize the dependencies Manage catalogue browsing, Update Information and Product Information from the point of view of the Store Front. The Store Front and the dependencies are decomposed into a combination of social patterns (Kolp, Giorgini & Mylopoulos, 2002) involving agents, pattern agents, subgoals and subtasks.

The booking pattern is applied between the Shopping Cart and the Information Broker to reserve available items. The broker pattern is applied to the Information Broker, which satisfies the Shopping Cart's requests of information by accessing the Product Database. The Source Matchmaker applies the matchmaker pattern to locate the appropriate source for the Information Broker, and the monitor pattern is used to check any possible change in the Product Database. Finally, the mediator pattern is applied to dispatch the interactions between the Information Broker, the

Figure 8. Dynamic diagram: Broker

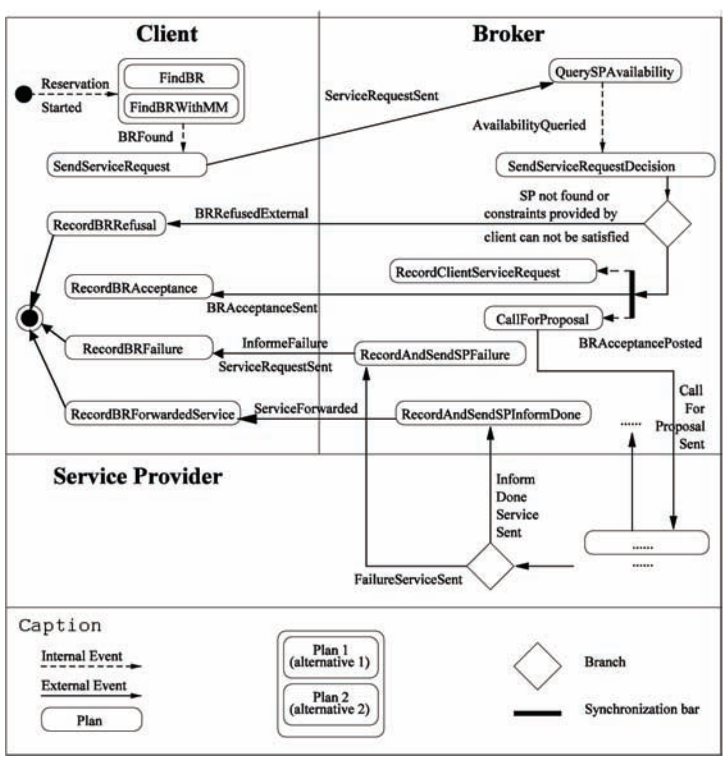
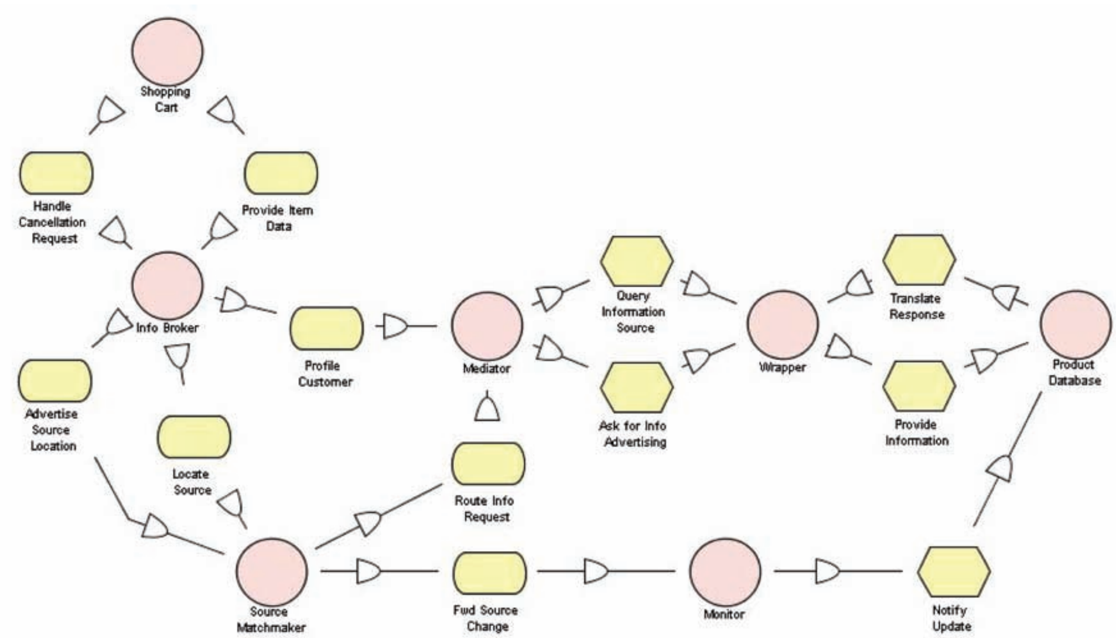


Figure 9. Decomposing the Store Front with Social Patterns



Source Matchmaker, and the Wrapper, while the wrapper pattern makes the interaction between the Information Broker and the Product Database.

5. IMPLEMENTATION

We briefly describe in this section the E-Media system itself by focusing on the role of the *agents* and how they interact. The implementation has been derived from the architectural design explained previously. It has been realized on the JACK agent-oriented development environment (Agent Software, 2007).

When a user gets connected to E-Media, the Front-Store is instantiated and displays the interface depicted on Figure 10. It allows the new coming user to register on the web-site (1). The information provided by the users is handled by the Back-Store which checks the validity (2). Once this has been done, the users can perform purchases on E-Media by adding product to the shopping cart (4). The shopping cart is managed by the Billing-Processor. At any moment during the session the user can use the navigation-bar (3) to switch from one to another section. Promotions (5) and the top 5 best sales (6) are part of the strategic behaviour. The promotion policies are initiated by the Decision-Maker from the strategic information provided by the BackStore. The Coordinator chooses the best promotions and adapts the promotion interface. The coordinator acts in the same way with the best sales, the Back-Store computes the five best sellers and the coordinator is in charge of updating the Front-Store interface.

Figure 11 describes the Store-Front interface when the "DVD" button of the navigation-bar is activated. To start a search the users must fill one or several fields from the search engine (1). The Front-Store sends the query parameters to the Back Store which provides the results to the Front-Store (2). At any moment during the session, if the user clicks on a product (best seller, query result, shopping cart…) a request is sent to Back-Store to provide more information on this product (3).

Figure 10. E-Media main interface

The E-Media administrator has also the possibility of consulting information computed by the various agents. For instance Figure 12 gives indications on the Billing-Processor. The administrator can either displays the current stock for each product or the orders that have been sent for a certain period.

Particularly for the broker pattern implementation, Figure 13 shows the remote administration tool for the information broker described in Figure 2. The customer sends a service request to the broker asking for buying or selling DVDs. He chooses which DVDs to sell or buy, selects the corresponding DVD titles, the quantity and the deadline (the time-out before which the broker has to realize the requested service). When receiving the customer's request, the broker interacts with the media shops. The interactions between the broker and the media shops are shown in the bottom-right corner of the figure.

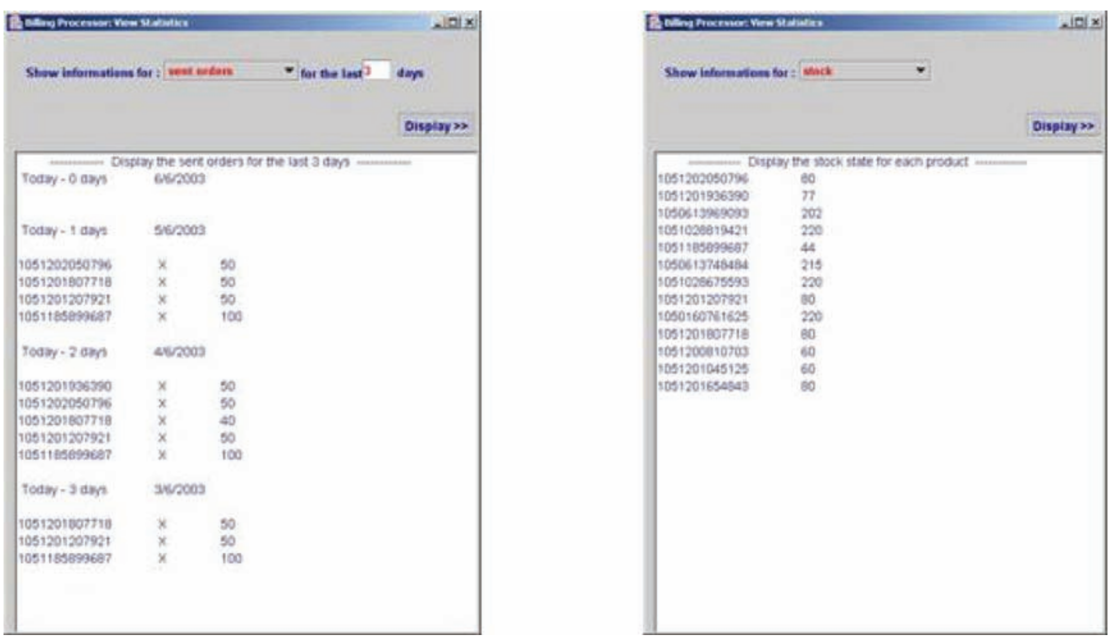
6. RELATED WORK

Literature on MAS offers many contributions on using social concepts to design MAS. Fox (1981) has introduced the idea that using such metaphors can be useful to *describe* the organization of distributed systems. Our motivation is different: we focus on how to use organizational and social concepts to effectively *design* multi-agent architecture and how to apply them in a software engineering perspective while Fox studies organizations as an emergence of social behavior.

Computational methods have been used to better understand the fundamental principles of structuring MAS (Lesser, 1999) based on an organizational perspective. Although they can be extremely useful for detailed design (modeling sophisticated capabilities, alternative methods, activity-related effects, and complex interactions), they are not suitable for architectural design, where more abstract concepts, such as actor, goal and strategic dependencies are needed.

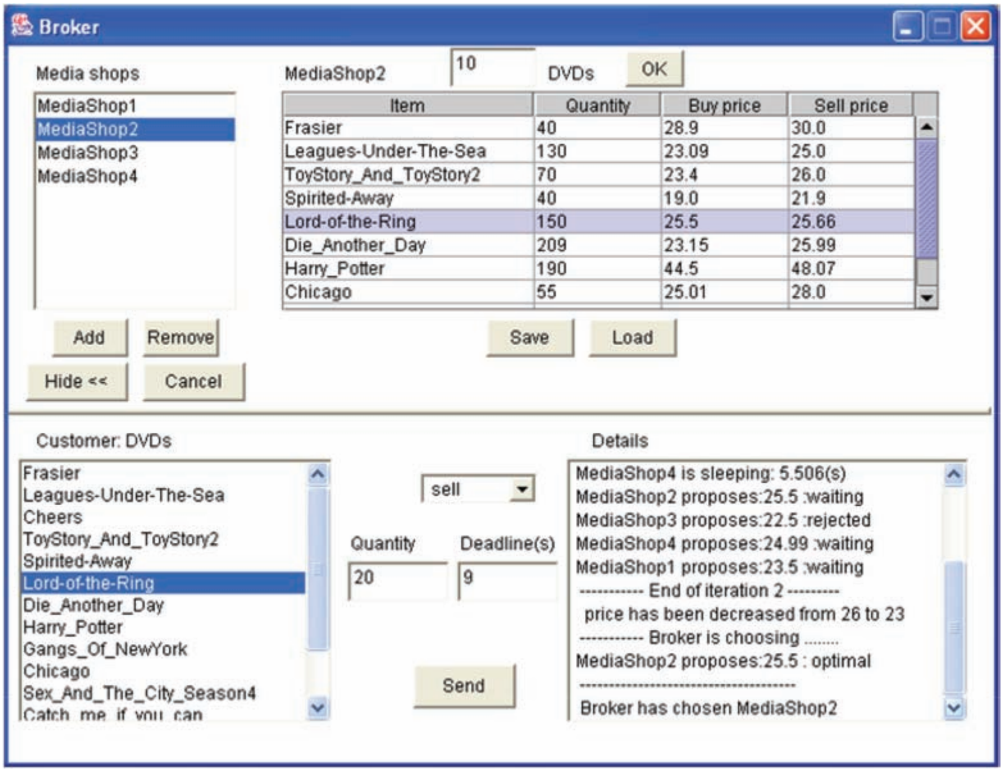
Figure 11. E-Media main interface, DVD section

Figure 12. Statistics on stock and sent-orders



Other research work on multi-agent systems offers contributions on using social concepts such as agent (or agency), group, role, goals, tasks, relationships (or dependencies) to model and design system architectures. Aalaadin (Ferber & Gutknecht, 1998) uses such concepts to

Figure 13. The Information Broker of E-Media



model the organizational structure of multi-agent systems. Different types of organizational behavioral requirement patterns have been defined and formalized. Similarly, in the Gaia methodology (Wooldridge, Jennings & Kinny, 2000), role and interaction models are used for analyzing the understanding of the system and its structure. The main difference with our approach is that in both Gaia and Aalaadin, the organization description does not include the goals associated to the agents.

On a design patterns perspective, the proposals of agent patterns (see e.g., Do, Kolp & Faulkner, 2005) are not intended to be used at a design level, but during implementation when low-level issues like agent communication or information gathering are addressed.

7. CONCLUSION

Agent-Oriented modeling and design is an engineering discipline still under development. But the interest of this recent software paradigm comes from that it can better meet the increasing complexity and flexibility required to develop software built in open and distributed environments while deeply embedded in social and human activities. Nevertheless, the emergence of a new approach requires time to be absorbed by the software community and market. Indeed, it needs standardization, productivity gains, proven efficiency on huge and complex user-interactive software development projects, well-designed development frameworks, etc. to review its standards.

Architectural design for MAS has not yet received the attention object-oriented architectures have had during the past decade. Collection of well-understood architectural styles and patterns exist but for object-oriented rather than agent-oriented systems.

Considering the social intrinsic nature of MAS, this chapter has proposed a social-driven framework to design architectures for such systems. The framework considers MAS architectures at two social levels: Organizational architectural styles constitute a macro level; at a micro level it focuses on the notion of social design patterns.

In particular we have detailed and adapted the structure-in-5, a well-understood organizational style used by organization theorists and the Broker social design pattern viewed as a combination of several other social patterns.

The chapter has proposed a validation of the framework: it has been applied to develop E-Media, an e-business platform implemented on the JACK agent development environment.

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KEY TERMS

DesCARTES: Design CASE Tool for Agent-Oriented Repositories, Techniques, Environments and Systems (DesCARTES) is a framework proposes a set of generic architectural structures. It is also constituted of the DesCARTES Architect, a CASE Tool for the edition of i* and other Tropos diagrams.

Tropos: Tropos is a novel methodology for building agent-oriented software systems. Tropos is based on two key ideas. First, the notion of agent and all related mentalistic notions (for instance goals and plans) are used in all phases of software development, from early analysis down to the actual implementation. Second, Tropos covers also the very early phases of requirements analysis, thus allowing for a deeper understanding of the environment where the software must operate, and of the kind of interactions that should occur between software and human agents.

Architectural Design: The objective of Architectural Design is to organize the dependencies between the various sub-actors identified in the previous phases in order to meet functional and non-functional requirements of the system.

Detailed Design: in Detailed Design the behavior of each architectural component is defined in further detail. This discipline is concerned with the specification of the agent micro level taking into account the implementation platforms. The objective is to perform a design that will map directly to the code.

ENDNOTE

1. Design CASE Tool for Agent-Oriented Repositories, Techniques, Environments and Systems (http://www.isys.ucl.ac.be/descartes)

This work was previously published in Handbook of Research on Socio-Technical Design and Social Networking Systems, edited by B. Whitworth; A. de Moor, pp. 367-387, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.7
From Pragmatism to Interaction Design:
A Sociotechnical Design Space

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ABSTRACT

This article presents an approach to interaction design that is inspired by sociotechnical systems (STS) and grounded in sociocultural theory. The focus is on the early phases of the design process and in particular how theoretical ideas can stimulate design. It starts by surveying key works in theory-based design in HCI and CSCW. The notion of 'externalized design' of buildings has been adopted as a framework for how to incorporate conceptual (non-computational) artifacts in user interfaces. The framework is applied to the retrospective analysis of an interactive system developed by the author (Janus). The system was stimulated by the notion of reflection-in-action. A three-staged process provides gradual steps for translating reflection-in-action into a concrete user interface: 1) selection, 2) appropriation, and 3) translation. The article ends by discussing strengths and limitations of the approach, and identifies directions for further work. [Article copies are available for purchase from InfoSci-on-Demand.com]

INTRODUCTION

This article introduces sociotechnical interaction design (STID), which integrates human-computer interface (HCI) design and the socio-cultural approach to research (Wertsch, 1991). Sociotechnical system (STS) design is interpreted to mean the integration of social and technical components by the application of social science theories to interaction design. STID is a method to express sociocultural ideas in interaction design, and to enhance communication of significant ideas of the past to students of today. This interest of mine was prompted by a retrospective analysis of two interactive systems I have been involved in designing over a number of years, one of which is presented in this article. These systems were inspired by ideas of Pragmatism, a branch of early American social science that began in the late 19th century and is associated with the works of Charles S. Pierce, William James, John Dewey, George Herbert Mead (Rosenthal, Hausman & Anderson, 1999), and their followers like Donald Schön (Schön, 1983; 1987), among others. Pragmatism is applied research and continuous to be relevant to contemporary problems phased by society. It is also interdisciplinary, a perspective on research shared by many scholars today. For instance many of the early contributors were associated with several disciplines like philosophy, psychology, sociology, education, and urban design. Within each discipline and their intersections, they developed far-reaching insights, many of which are relevant to contemporary problems studied in these fields. It is beyond the scope of this article to go into the details of that work here (but I return to one theory later in the article).

The critical reader educated in interaction design might object to my use of theoretical ideas that originated in the pre-web era, and are not directly related to the knowledge-based society we live in today. At present, there are new forms of communication and information-sharing emerging, which extends face-to-face (f2f) interaction, as well as new tools to reflect online behavior. Some of this work will have the effect of rendering communities more transparent than they have been in the past, which may require new theories and models to be made. However, it does not mean that social science has to be reinvented. Human nature is still the main component of social interaction. An implication of this is that many of the significant theories developed by the American Pragmatists are highly relevant today. This is manifest in the application of these thinkers' and their followers' ideas to the problems society is facing today. An example is Dewey and Mead's ideas on education (Barnes, 2002; Schön, 1987).

Pragmatism has implications for practical action, collaboration, learning and design. In particular I claim the ideas contain insights that are useful to interaction designers in HCI, Computer Supported Cooperative Work (CSCW), and Computer Supported Collaborative Learning (CSCL). The claim is put forward as a worked out example in this article.

On the other hand, socio-technical systems (or STS) originated in an effort to study organization design by recognizing the importance of interaction between people and technology in the workplace. STS researchers study the various forms of interrelatedness of social and technical sub-systems. The term STS was coined in the 1960s by Fred Emery and Eric Trist, who were working as consultants at the Tavistock Institute in London. They have evolved the approach over many years, and together with colleagues made important contributions to multidisciplinary studies in organizations, e.g., (Bostrom & Heinen, 1977; Mumford, 2006; Trist, 1981/2004) and participatory design, e.g. (Nygaard, 1986). For example, Bostrom and Heinen identified what conditions caused information systems design of its time to fail and suggested to reframe the conditions in terms of STS to create a better fit between the technical and the social sub-systems (Bostrom & Heinen, 1977). STS was also influential (albeit in a different way) on the early work in participatory design (Schuler & Namioka 1993), in particular on Kristen Nygaard and his colleagues in Scandinavia. He contributed to STS by developing a conceptual framework for collaborative design of information systems for developers and users to work together (Nygaard, 1986).

Socio-technical systems are interpreted in the continuation of participatory design and extended to mean the evolutionary creation of web-based collaboration environments with a focus on the interaction between social and technical components (Ye & Fischer, 2007). Furthermore, the interaction between social and technical components is interpreted to mean the application of social science theories to interaction design. In particular how theories from the applied social sciences (American pragmatism) can inform the design of technical tools (Mørch, 2007). Furthermore, this article understands STS as a "design space," bounded by source (theory) domain and target (technical systems) domain, within which artifacts are "transformed" by appropriation and translation. This is reflected in the subtitle of the article. Appropriation is the adoption of ideas from the source domain into the target domain (Dittrich et al., 2005), and translation is the step-by-step work to "move" an object through the space, from the inception of a theoretical idea in the theory domain to a concrete instantiation in the technical domain in the form of a Graphical User Interface (GUI).

Summary. By socio-technical interaction design we mean the appropriation of ideas from the applied social sciences to stimulate and guide (with affordances and constraints) interaction design and to communicate the ideas through interaction with the resulting designs.

The following issues guide the work reported here:

- What support and triggers are needed during the early (creative) phases of design before designers start to think in terms of usability and technical (software) objects? What lessons can be learned from other fields of creative design when it comes to early design work?
- How can we trace the development of abstract objects (theoretical ideas) into concrete (interaction) objects in terms of evolutionary design and user participation?

The rest of the article is organized as follows. It starts by giving a survey of theory-based design in HCI and CSCW. Next, it presents the design process behind an award-winning chair in the Nordic design tradition to provide an example of creative appropriation in the early phases of the design process. This is followed by an example of 'externalized design,' a technique from post-modern architecture, which provides a model for how to incorporate external (non computational) objects into user interfaces. Based on this, a socio-technical framework is developed that breaks the first part of the design process into three stages (selection, appropriation, translation). This framework is applied to the analyses of an interactive system (Janus). The analysis reveals strengths and limitations of the approach. Finally, lessons learned and directions for further work are discussed.

THEORY-BASED DESIGN

Theory-based design (TBD) of interactive systems is a design approach first proposed in HCI, e.g. (Card, Moran & Newell, 1983). The basic idea is that a theory, theoretical idea, conceptual model or a set of related concepts provides the starting point for a design process. What makes this controversial (and challenging) is that the theory should originate in a field outside of computer science, most notably cognitive science (the source of inspiration of early HCI), or the social sciences, which is more common today with the advent of new theoretical frameworks like Activity theory (Kaptelinin & Nardi, 2006). The phrase theory-informed design is sometimes used instead of theory-based design. I do not make a distinction between the two phrases here. The survey below focuses on two seminal contributions in HCI and CSCW: design principles for user interfaces and design process of the Coordinator system.

Design Principles for User Interfaces

The term theory-based design in HCI can be traced to work done at CMU and the University of Colorado in the mid 1980s. Polson and Lewis (Polson & Lewis, 1990) proposed a design based on psychological theories and cognitive models.

The goal was to build a formal theory of exploratory learning that could assist in the design of easy-to-use interfaces. From the theory, they derived a list of design principles they could use to design user interfaces (Lewis, et al., 1990). Four of the seven design principles derived from this theory are:

- Make the repertoire of available actions salient.
- Provide an obvious way to undo actions.
- Offer few alternatives (to prevent wrong moves).
- Model tasks that require as few choices as possible. (Lewis et al., 1990)

The success of these and related design principles have been useful for specific platforms. For example, Apple Computer and IBM created guidelines along these lines for supporting user interfaces within their GUI frameworks. These guidelines tended to be either very general and open-ended like those used in IBM's 1984 Olympic Message System (Gould et al., 1987), or, like the Macintosh Human Interface Guidelines (Apple Computer, 1987), they gave very detailed specifications for how to select (GUI) components, how components should look on the screen, and what behavior they should exhibit in applications. Critics at that time considered these design principles severely limited in scope and a passing fad in terms of impact, favoring consistency over creativity and exploration (Grudin, 1989).

When looking back at the evolution of the field, the design principles movement in HCI gradually turned into research on evaluation criteria. The application of Polson and Lewis' work is a good example of this. Their frequently cited cognitive walkthrough methodology is an evaluation technique rather than a design method, and it was developed on the basis of the above-mentioned theory and corresponding design principles (Lewis et al., 1990). Another influential evaluation technique for user interfaces is heuristic evaluation. This can also be traced to the design principles developed in the late 1980s (Norman, 1988).

Strengths and limitations of design principles to support design of user interfaces are as follows:

- Strength: Design principles work best for specific platforms and GUI frameworks when the action space is large and there are expectations that user interfaces are consistent with respect to given standards and conventions.
- Limitation: The same set of design principles could be derived from multiple sources, each of seemingly legitimate origin, e.g., psychological theories, empirical findings (user needs), and informed guessing based on design experience. The importance of theory to support design was not adequately demonstrated.

Another approach to theory-based design is represented by the design of The Coordinator, a messaging system known for bringing theory-based design to CSCW. It addresses some of the limitations of the design principles approach.

The Coordinator

One challenge (as well as strength) in theory-based design is to connect two separate domains of discourse (theory domain and technical solutions domain) without "mechanically mapping" elements from one domain into the other (Carroll & Kellogg, 1989). The design space should be kept open to encourage multiple paths to solution. The Coordinator system (Winograd, 1987) is arguably the best-known early system in this tradition. It has theoretical roots in speech act theory, which is a theoretical framework for the study of human communication proposed by Searle (Searle, 1975).

Speech acts are operationalized in the Coordinator system in the form of templates (sentence openers) for managing the different stages of communication (generating, transmitting, storing, retrieving, and displaying messages). The user interface supports this by providing menus for selecting what actions the user may take at any point in a conversation. In many ways it resembles email structured according to message types. For example, the menus for responding to requests include the items: acknowledge, promise, counter-offer, decline, and report-completion (Winograd, 1987).

Ordinary email does not support message categorization in the way the Coordinator does. Some critics say that by requiring explicit structuring of a phenomenon that in the outset is subtle (i.e. transition between illocutionary acts), the Coordinator changes the nature of communication (Suchman, 1994). Proponents reply that Searle's conversation structure can instead be found inside the body of text messages (i.e. reveal the conversation structure at a different level of abstraction, for example, separated by punctuation and spacing). An advantage of the Coordinator over ordinary email is that it allows message recipients to view the conversation structure when browsing previous messages. Communication situations relying on visualization of complex conversation can benefit from this approach. However, the upfront cost of breaking a complex conversation into conversation chunks may not be worthwhile when considering all factors, because those who benefit are not those who do the work. Previous studies have shown that such a dilemma is likely to cause a system to fail or gradually be subverted (Ludvigsen & Mørch, 2003).

Strengths and limitations of the "conversation model" approach to design of collaboration systems are as follows:

- Strength: Several successful collaboration systems in CSCW and Computer Supported Collaborative Learning (CSCL) have been designed based on this model, using templates and sentence openers to organize online conversation.
- Limitation: Task-specific collaboration (e.g., student communication in web-based forums) is highly determined by situation-specific constraints. Predefined conversation types might be in the way because they do not (and cannot) take these constraints into account. As a consequence they do not make sense to some students (Ludvigsen & Mørch, 2003).

EXTERNALIZED DESIGN

The rationale for theory-based design (i.e. why TBD is important) has not been emphasized in the past work, and the stages passed through when translating theoretical ideas into concrete designs (theory adaptation) was not identified, discussed, or problematized. Furthermore, situational constraints were not brought into the environment. In the remainder of the article we address these issues by developing a model of theory-based design based on creative practices associated with two design fields that interaction design can be compared with: furniture design and building architecture (Alexander, et al., 1977; Ehn, 1999; Hooper, 1986; Norman, 1988).

Furniture Design

The design process of chairs is characterized by integrating creativity with utility. Utility (usability, usefulness, and domain-specific needs) is as important to furniture designers as it is to interaction designers. For example, a chair that is uncomfortable will not be used, but one that is comfortable will be. More importantly, and as result of the abundance of comfortable chairs in the world, furniture designers have to bring innovation into their designs to succeed in competition with fellow designers. The Nordic designer Olav Eldøy explained the role of creativity as the first and most important step of the following three-step design process (simplified for illustration):

Figure 1. Peel chair (2002). Orange peels falling to the ground inspired this design

Figure 2. Portland Building (1982). Reflections of elements in the local surrounding are embodied in the façade

- Find a recognizable idea that can be expressed in physical form.
- Balance creativity against utility when building prototypes.
- Provide a construction that affords production and export.

All phases were essential in the design of his award winning Peel chair. The inspiration for this chair was orange peels falling to the ground (Figure 1). This turned out to be a realizable idea. The result can be judged by the degree of resemblance between idea and physical form and color. On the other hand, finding a recognizable idea that can be expressed in computational form is not commonly associated with interaction design. However, there is no intrinsic reason why it should not also be applicable here. Another example of the same phenomenon is described in the next section by distinguishing notions of inner and outer language.

Postmodern Architecture

Postmodernism architecture is associated with architects such as Michael Graves (Patton, 2004; Wheeler, 1982). One of the buildings he is known for is the Portland Building in Oregon, USA (Figure 2). This building was one of a few that instantly became an icon for postmodern architecture. It is distinguished from the nearby buildings by external decoration and small cubic windows. The effect of this is a mix of modernism with older styles in an overall avant-garde design. Graves contrasted it with modernist architecture in the following way:

> While any architectural language, to be built, will always exist within the technical realm, it is important to keep the technical expression parallel to an equal and complementary expression of ritual and symbol. It could be argued that the Modern Movement did this; it expressed the symbol of the machine, and therefore practiced cultural symbolism. But in this case, the machine is retroactive, for the machine itself is a utility. So this symbol is not an external allusion, but rather a second, internalized reading. A significant architecture must incorporate both internal and external expressions. The external language, which engages inventions of culture at large, is rooted in a figurative, associational and anthropomorphic attitude. (Wheeler, 1982, p. 11)

The Portland building makes a distinction between external (artistic, symbolic) and internal (technical) expression. The "external language" he refers to consists of reflections of elements in the local surroundings, which are literally embodied in the building's façade. It consists of symbols professionals can relate to (e.g., small cubic windows on a light-colored background makes one think of the Bauhaus, whereas the blue ribbons have an artistic or non-functional association).

The combination of expressions from a non-technical (external) language with the concrete material of the building forms the hallmark of the postmodern approach to architectural design. The two kinds of languages (internal and external) have direct implications for user interface design. A user interface is defined by internal languages (program + design patterns) as well as an external language (interaction design), although the latter is often not thought of as such. However, from the point of view of theory-based design, one can think of this in terms of two domains of discourse: one associated with the technical system and the other with socio-cultural theories. It is the expression of the latter into the former that can be seen as equivalent to the externalized design of buildings.

TRANSLATIONAL APPROACH TO THEORY-BASED DESIGN

In order to adopt externalized design for interactive systems, the following working hypothesis is made. In the same way as nature, site and symbolic association have inspired architects and materialized in the built environment (physical objects); theoretical ideas, concepts, and abstract notions ought to provide the same kind of inspiration for interaction designers (computational objects). This claim is based on the following differences between computational and physical objects:

- Computational objects like software components are abstract compared to physical objects like chairs (Kramer, 2007). For example software components are defined in terms of program code in addition to being

interactive objects on a computer screen.
- Theoretical ideas and conceptual models have been important to the success of many innovative user interfaces (see Section on TBD).

A socio-technical conceptual framework is presented below. It adopts the "architectural model" presented above and was further inspired by the retrospective analysis Carroll and Kellogg (1989) performed to identify the "myriad of claims and their interrelations" embodied in the Training Wheels and HyperCard interfaces to determine how the claims were given coherence by being codified in software. The authors used the term psychological claim to refer to elements in the "source domain," which in our work is replaced by theoretical idea. A socio-technical approach puts more emphasis on cultural tools (Wertsch, 1991) and conceptual artifacts (Bereiter, 2002) than on cognitive artifacts (Carroll, 1991; Norman, 1988). In spite of this, cognitive artifacts have been important in understanding the design of interactive systems, and re-conceptualizing them in terms of cultural artifacts will bring a social dimension to that line of work.

The following stages define gradual translation and serve as intermediate abstractions for talking about the early (creative design) stages of interaction design:

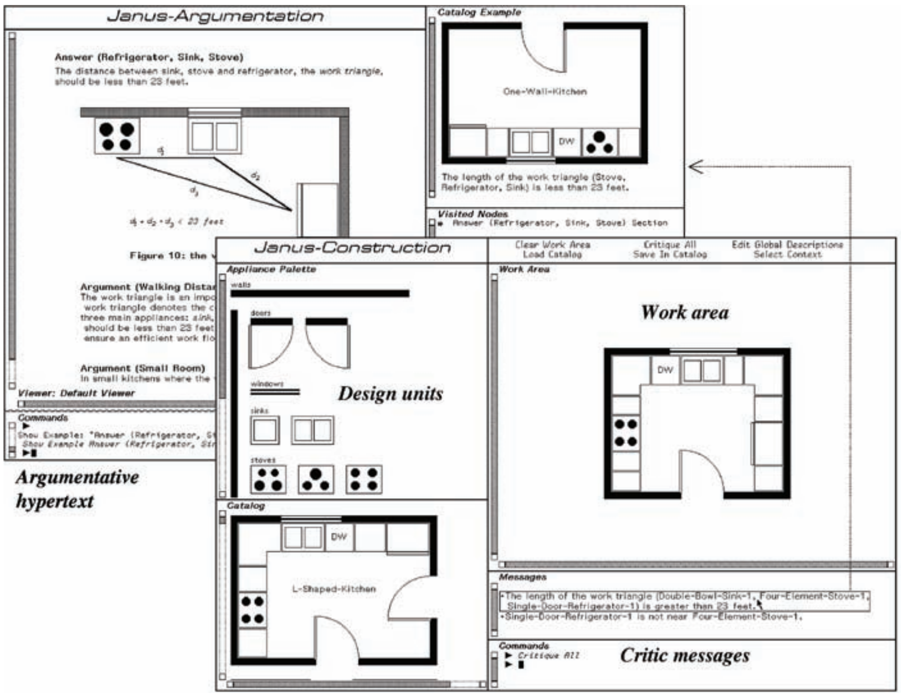
- **Selection:** Any source of inspiration one wishes to explore for the purpose of realization into physical (computational) form. A criterion for selection is to be able to communicate the idea to others (designers and users). However, there are no intrinsic reasons for prohibiting certain ideas. In the work presented here, selection is associated with theories, chosen from a domain outside computation and cognition (social science).
- **Appropriation:** From a socio-cultural point of view, appropriation has been defined as "the process of taking something that belongs to others and making it one's own" (Wertsch, 1991, p. 53). According to Wertsch the path to appropriation is not always straight and smooth, but sometimes involves tension between what we appropriate and the way we use it within a particular context. Appropriation is the act of breaking down an idea so that it will stand out in a contemporary design context, and restructuring the elements to make a concrete design possible without distorting the conceptual integrity.
- **Translation:** This is arguably the most critical step, as it is the most revealing. It involves turning appropriated material into concrete design. An example is the translation of a conceptual artifact (e.g., key words or tags) into a physical or computational artifact (e.g., GUI objects). There are multiple ways of accomplishing this, some better than others. To avoid 'Kitsch design' (poor translation, misunderstanding of original idea), evaluation criteria for assessing the quality of a translated idea are necessary.

In the remainder of this article this conceptual framework is applied to analyze the theory adaptation stages of the design process of a software application in order to illustrate the translational approach with a concrete example.

RETROSPECTIVE ANALYSIS

The system presented below has developed over a number of years and have been written about in the literature, but it has not been profiled in terms of sociotechnical interaction design. The theoretical idea that inspired Janus was reflection-in-action (Schön, 1983).

Figure 3. Janus provides computer support for action and reflection with "back talk" triggered by critic messages



Reflection-In-Action and Janus

The Janus system (Fischer, McCall & Morch, 1989; Fischer et al., 1991; McCall, Fischer & Morch, 1990) is a design environment for kitchen design. It was inspired by Donald Schön's concept of reflection-in-action (Schön, 1983). The end result was the integration of two sub-systems (for construction and argumentation support) with a design critiquing system.

Selection. Reflection-in-action (Schön, 1983; 1987) can be described as "thinking on our feet." Schön has examined this largely unarticulated, improvisational process in a study of practitioners in a variety of professional domains to identify how they explore design spaces and "communicate" with the domain materials for inspiration. It involves looking to our experiences, connecting with our feelings, and attending to our working theories. It entails building new understandings in the present, and based on these understandings to inform our actions in new situations. From this perspective, the knowledge inherent in practice is to be understood as artful doing. In Schön's own words:

In a good process of design, this conversation with the situation is reflective. In answer to the situation's back talk, the designer reflects-in-action on the construction of the problem, the strategies of action, or the model of the phenomena, which have been implicit in his moves. (1983, p. 79)

Appropriation. Schön was primarily interested in developing a descriptive account of design activities, illustrating and explaining what designers do, identifying the importance of human collaboration in this process, and arguing for educational changes on this basis (Schön, 1987). Therefore, his ideas do not lend themselves to operationalization in an interactive system design. His concepts must be further interpreted and broken down into manageable chunks before they can be experimented with in terms of computer support.

We considered "action" and "reflection" as the basic activities of a reflective practitioner and to form the basic components of computer support for reflection-in-action. For reflection support to be part of reflection-in-action, however, it needs to be brought to the designers' attention during the "action present," and to provide answers to the situation's "back talk." In this respect, Schön's notions of "action present" and "back talk," intimately connected to reflection-in-action, have been interpreted to mean automated feedback from the work area the designer is interacting with immediately after an operation on a design has occurred. This is analogous to how a human design critic stands behind the shoulder of a student in a design studio and gives feedback on work in progress.

Translation. Janus consists of two separate interfaces, one supporting action (construction) and the other supporting reflection (argumentation), as seen in Figure 3. During construction, designers select "design units" from the palette and place them into the "work area." The critiquing component links construction and argumentation. Critics provide automated feedback, "critique messages," as shown in the lower right part of Figure 3 (Janus Construction), and they operationalize Schön's notion of "back talk." The "back talk" of the situation depicted in the right screen image in Figure 3 tells the designer that the 'work triangle' is greater than 23 feet. This may trigger reflection on how to incorporate a design recommendation into the design currently under development. The left screen image of the Figure shows the argumentation interface. It is an early hypertext system based on the IBIS design methodology (McCall, 1991). It is structured as issues, answers, and arguments, and represents the design rationale behind kitchen planning principles, and in this case shows a discussion of the various pros and cons of the work-triangle concept.

Table 1 summarizes the appropriation and translation of the theoretical idea reflection-in-action (Schön, 1983) into a concrete interaction design (Janus interface).

Strengths and limitations of the translational (sociotechnical) approach to interaction design are as follows:

- Strength: Identifies theory appropriation as the first stage of the lifecycle of an interactive system before conventional design-time (usability, technical) and use-time (empirical evaluation) activities begin. This is a stage where "amateur computer scientists" such as end-user developers in a user organization can participate. It requires knowledge of two domains of discourse (theory domain and technical systems domain). It does not preclude or disturb any of the conventional approaches to interactive systems design such as user requirements, prototyping, and user testing.
- Limitation: There are examples of externalized design of buildings that have been criticized for incorporating external expressions that are not considered successful design elements, ranging from surface cosmetics with little impact on design to Kitsch (poor translation, misunderstanding of original

Table 1. Translation table for Janus: a three-staged process

Stage	Janus
Selection (motivating idea)	Reflection-in-action (Schön, 1983)
Appropriation (defining the design context)	Action, reflection, action-present, back-talk
Translation (interaction objects; user interface configuration)	Work area, design units, critic messages, argumentative hypertext (see Fig. 3)

idea), which for theory-informed interaction designs might mean unrecognizable ideas and little impact on design. Successful results require belief in the approach, developing several examples, and proficiency in two domains of discourse, all of which are demanding.

GENERAL DISCUSSION AND DIRECTIONS FOR FURTHER WORK

The issues raised in the beginning of this article were:

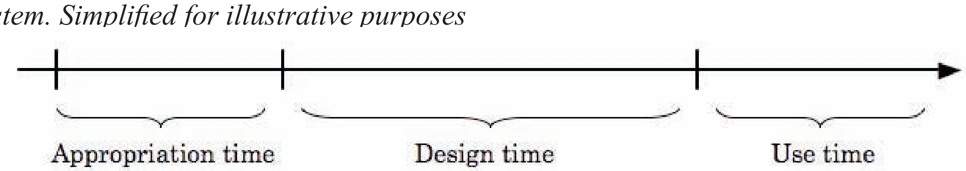
- What support and triggers are needed during the early (creative) phases of design before designers start to think in terms of usability and technical (software) objects? What lessons can be learned from other fields of creative design when it comes to early design work?
- How can we trace the development of abstract objects (theoretical ideas) into concrete (interaction) objects in terms of evolutionary design and user participation?

Related to the first part of the first question is the open issue as to what extent should there be selection criteria for choosing theory/idea to be appropriated in the first place. I have not advocated selection criteria in this article, only to strive for the goal of being able to instantiate and communicate personally meaningful ideas to others (designers and users). Another criterion is motivation: To select an idea that you believe is important to understand and put into a concrete form (other than writing) for others to learn about. A third criterion is quality of outcome. What are the measures and metrics that can help to assure the end product is of a certain quality, and if any of these can be associated with a selected theory domain. The notion of critiquing system can be useful here. Critics can be associated with theoretical perspectives of various source domains and can provide feedback on the application of the theoretical ideas to a technical systems domain.

When it comes to the second part of the first question I have taken inspiration from and made extensive use of examples from design of chairs and buildings, in particular the post-modern movements that made a distinction between external and internal languages of design. The main lessons to be drawn from this is a process that starts with an act of creation ("find a recognizable idea that can be expressed in physical form", "reflections of elements in the local surrounding") that is not commonly associated with interaction design, and which can be explained by the stage "appropriation time", in order to distinguish it from the more established lifecycle stages "design time" and "use time" (when lifecycle is grouped into two: design activity and use activity). This relationship is displayed in Figure 4.

Furthermore, a claim was made by analogy that theoretical ideas relate to interaction design in the same was as nature, building site and symbolic association relate to post-modern architecture (as illustrated by the designs in Figures 1 & 2). The rationale for this claim is that the internal building blocks of the two domains of creative designs differ: computational objects are the material

Figure 4. "Appropriation time" as the first stage in the design process of a theoretically inspired interactive system. Simplified for illustrative purposes



of interaction design, whereas physical objects are the material of chairs and buildings, and the former is more abstract than the latter. This claim and rationale remains is currently a hypothesis that needs to be further developed and tested in subsequent work.

Related to the second question (evolutionary design), I have explored the integration of two kinds of artifacts that belong in disparate worlds. In terms of the philosopher Karl Popper, they are World 3 (conceptual artifacts, ideas) and World 1 (physical and computational artifacts). I have shown how one can move from World 3 to World 1, expressing the abstract ideas of the former world in the material of the latter. This should be thought of as a form of externalization (Kaptelinin & Nardi, 2006). Another of our long-term goals is to understand the transition from World 1 (external expressions) to World 2 (mental representations), which can provide a model for internalization and learning. Whether or not there is a connection from the work presented here (W3 → W1) toward that end (W1→ W2) is an open issue for further research.

When the second question is addressed from the point of view of user participation, the approach proposed can be compared with related (socio-technical) approaches in HCI and participatory design (PD), including contextual design (Holtzblatt, 2001) and user participation in system development (Nygaard, 1986). Whereas many researchers in HCI have taken inspiration from methods originating in the social science in order to improve the design (usability and usefulness) of interactive systems they have had varying degree of success when it comes to integrating technical and social components. Many times the process will stop halfway and not be able to reach to software engineering without starting the process all over, or it has a too ambitious goal at the outset regarding the expectations of user participation. For example, Holtzblatt (Holtzblatt, 2001) makes use of a range of techniques to involve users in the design process. These techniques have many features in common with PD techniques (paper prototyping, informal work models, story boards, diagrams, mock-ups, use cases, etc.). On the other hand, it is difficult to trace the influence of these techniques when analyzing the final results, and often the design process of PD ends with diagrams and conceptual models, but uncompleted systems. Nygaard's (1986) approach to integrate PD and system development attempted to create a comprehensive organization-inspired model of object-oriented systems together with end users. That puts high demands on voluntary user participation. In this work I have a much less ambitious goal because I do not address the entire system, only the user interface, since it is the component that is most intimately involved with end users. The long-term goal of our approach is to make the GUI resemble and be traceable (as an account) back to a set of theoretical ideas associated with a non-technical source domain (social science is the domain explored here). Whether or not this has been achieved in the current work is up to the users (and readers) to judge. As a final note it should be mentioned that I do not imply that other components of an interactive system (beyond the user interface) should be excluded from the sociotechnical approach to design. For examples many researchers in HCI, CSCW, and CSCL consider use contexts and user activities as key to understanding what should be designed. On the other end, software engineers are often more concerned with the internal components of a system. To the extent these components (external and internal) define links to the human computer interface component (i.e. can be made accessible to end users while interacting with a system) they may also benefit from theory informed design according to the approach proposed in this article.

Open issues for further investigation include:

- The translational approach and the design principles approach have many similarities. For example, educational technology developers have treated a concept like "scaffolding" as a design principle in instructional design, which has evolved from a theory in educational psychology. Does that mean that the translational approach should provide intermediate stages in the form of design principles as a normative adaptation of an idea rather than starting directly with the original idea (e.g., reflection in action)?

- Complex ideas like reflection-in-action offer affordances and constraints for design (as well as motivation), and the analyses show that the final design of Janus (user interface components, configuration and functionality) could be traced back to the idea of reflection-in-action. Can similar or better results be achieved if other developers were asked to do the same exercise, i.e. starting with the same basic idea and express it in different interaction designs? My tentative answer is that these designs will be variations of a common theme already established.
- To retrospectively analyze other interactive systems and concrete designs to identify how they display elements and configuration that can be traced back to ideas originating in domains outside of interaction design.
- To appropriate theoretical ideas in the design of interactive systems and other types of concrete artifacts in order to find out what (if any) difference it makes to usability, utility, and educational value. Will it increase or decrease usability and/or utility of the systems? Will it be able to communicate the underlying ideas to new users?

ACKNOWLEDGMENT

The author thanks Gerhard Fischer and Raymond McCall at University of Colorado, Boulder who contributed to the design of Janus and suggested Donald Schön's concept of reflection-in-action as inspiration. Colleagues and students at InterMedia, University of Oslo provided constructive feedback on previous versions of this article. The writing of the article has been supported financially by the Knowledge Practices Laboratory (KP-Lab) project, European Information Society Technologies (IST) 6th framework program, contract no. 27490.

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This work was previously published in International Journal of Sociotechnology and Knowledge Development, Vol. 1, Issue 2, edited by E. Coakes, pp. 8-22, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 2.8
The 'Social Experience Factory' and the Fabrics of Collaboration in Virtual Communities of Practice

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ABSTRACT

This chapter proposes and discusses the "social" experience factory (SEF). The SEF provides a general model and architecture supporting information-based product assembly by cross-organization communities of practice using interactive toolkits and practice-specific technologies. In terms of engineering ground, the SEF builds on two prevalent research tracks, namely experience-based and reuse-oriented proposals for the management of virtual assets and automated software assembly as conceived and facilitated by recent advances on software factories. Our account of the SEF focuses on functions facilitating electronic squads (i.e., cross-organization virtual community management) and workflows (i.e., practice management) which collectively define the scope of collaboration using the SEF. Further technical details on operational aspects of the SEF as deployed in the tourism sector to facilitate vacation package assembly are presented in Chapter XXI in this volume.

DOI: 10.4018/978-1-60566-340-1.ch006

INTRODUCTION

Over the years, increasingly mature ICT infrastructures and novel software platforms and tools either general purpose or domain-specific, have established new grounds for augmenting human intellect across a variety of application domains and engineering disciplines. Amongst the primary beneficiaries are enterprises which face new opportunities for innovation, through novel means of production and customer-relationship management models. This is particularly evident in information-based industries whose products are non-material (intangible) and knowledge is central to gaining competitive advantage. In such domains, new product development is progressively dependent upon the capability to manage virtual (knowledge-based) assets through inter- or intra-organizational virtual partnerships.

In this chapter our objective is to describe a technical framework for appropriating the benefits of virtual networking to assemble new information-based products and services from shared virtual assets. We refer to this framework as the 'social' experience factory (SEF) to highlight three characteristic properties. Firstly, the 'social' qualification is derived from the SEF's orientation to provide support for the articulation of shared practices devised to establish a social protocol of cooperation between (otherwise autonomous) members of communities of practice. We are interested in communities of practice formed by representative knowledge workers engaged in virtual partnerships whose mission is to build and support a 'collective' information-based product. In this context, product assembly is conceived of as a *social practice* framed in designated workflows as much as in *social interaction*—considered as informal exchanges—concerning expression of opinion, commenting, reflecting upon and critiquing aspects of the product being developed – expressed electronically through dedicated tools.

Secondly, the primitive knowledge-based assets of the SEF are in the form of codified *experience* stored and manipulated in shared and reusable repositories (or data stores). These experiences include software product specifications (typically encoded as XML product families), visual domain-specific vocabularies for visualizing the product and its evolution, as well as reusable components for executing statements of the visual vocabulary.

Thirdly, the production process is highly automated, implying a *factory* setup whereby final products are assembled as instances of a corresponding product line/family. To this effect dedicated software plug-ins are needed to undertake the required transformation of an abstract model into a concrete offering matching the requirements and expectations of the intended customer base.

In the remaining of the chapter we provide insights to the theoretical roots and rationale of the SEF as well as its functional and structural underpinnings as established in the context of recent research and development work. We also review on-going efforts to provide supporting software tools for enacting a variety of software engineering processes within a deployed SEF, thus establishing an effective operational model for collaboration in cross-organization communities of practice.

THEORETICAL LINKS AND STATE OF PRACTICE

The SEF in its basic form constitutes a reference model for a mature virtual enterprise in which new product development is the collaborative outcome of virtual partnerships operating as communities of practice. The qualification 'mature' to the virtual enterprise is used to designate the SEF's commitment towards continuous improvement of engineering practices to achieve high quality through mass customization and adaptations. In terms of theoretical ground, the SEF links with recent works on virtual organizations and cross-organization communities of practice. As for its engineering base, the SEF builds upon recent developments on software product assembly and in particular the notion of software factories so as to attain the goal of mass customization through adaptation. In the following we provide a brief review of relevant recent works in these research fields emphasizing how the SEF expands some of the prevalent conceptions.

Virtual Partnerships and Cross-Organization Communities of Practice

In a recent article Ripeanu et al. (2008) define virtual organizations as '… flexible networks of independent, globally distributed entities (individuals or institutions) that share knowledge and resources and work toward a common goal…'.

Typically, the set of shared resources may range from computing power and storage to elements as diverse as data sets, analysis tools, and instruments. There are various connotations and operational models for virtual organizations (for a review see Travica, 2005), including the virtual corporation (Davidow and Malone, 1992), the virtual alliance (Strader et al., 1998), virtual teams (Lipnack and Stamps, 1997; Powell et al., 2004), as well as a variety of studies reflecting upon alternative structures, behaviours and capability for innovation (Jarvenpaa et al., 1998; Vartiainen et al., 2001; Lethbridge et al., 2001; Dustdar & Gall, 2003).

Moreover, recent works indicate both the promises and the challenges confronting enterprises seeking to attain inter-organizational virtual networking in a variety of industries. Representative examples include software development (Scacchi et al., 2006), business travel management (Sigala, 2007; Cardoso and Lange, 2007; Stockdale and Borovicka, 2006), the ship construction industry (Kern and Kersten, 2007), global inter-firm product development (Jin and Hong, 2007), the automobile industry (Schultz and Pucher, 2003; Wenger et al. 2002), etc. The common theme in all these efforts is the intention to appropriate the benefits of novel organizational and technical infrastructures to integrate virtual resources so as to fabricate the required degree and intensity of collaborative practice. To this effect, a variety of methods have emerged with some being explicitly focused on and targeted to capitalizing upon new technologies for knowledge creation during new product development. In a recent study, Hoegl and Schulze (2005) provide convincing evidence of the value of 14 such methods as experienced by 94 new product development projects. The authors admit that a criterion for selecting and studying candidate methods was that they should be well known and widely used (p. 264). As a result, some recent developments such as software factories (Greenfield and Short, 2004), community-based innovation (Fuller et al., 2006) and user toolkits for innovation (von Hippel, 2001; von Hippel and Katz, 2002; Franke and Piller, 2004) were not explicitly addressed.

Our current effort links with virtual organizations established to promote multi-sector collaborations and end user involvement for new product development. A multi-sector collaboration is a partnership formed by representatives of at least two sectors (non-profit, private, and public organizations and community members) to solve problems that impact the whole virtual enterprise. In cases that collaborations are sought for to facilitate new product development, end users' involvement is known to provide a source for incremental innovation (von Hippel, 1988). Recently, the literature on the management of innovation has proposed concepts such as toolkits for user innovation and design (Thomke and von Hippel, 2002; von Hippel, 2001), user design (Dahan and Hauser, 2002) and community-based innovation (Fuller et al., 2006), providing convincing evidence of the value resulting from setting up and maintaining inter-organizational partnerships as virtual communities involving end users, engaging in the practice of new product development. The idea is that creative users manipulate a domain-specific toolkit to devise virtual prototypes of new products which can then be appropriated by the manufacturing partners. This type of set-up is characterized by sense of community amongst the members which is maintained by the members' improved capacity to exercise control and influence the development of a product with high anticipated added value. In turn, this added value motivates both the end users' contributions as well as the member's commitment of resources towards realizing a common goal.

For the purposes of the SEF, the notion of a user toolkit (von Hippel, 2001) is generalized to the concept of practice-specific toolkit, used by members of a virtual community for engaging in the practice the community is about. This makes explicit the link between the SEF and the concept of virtual communities of practice (Wenger, 1998;

Wenger and Snyder, 2000) and in particular the type fostering cross-organization partnerships formed as cross-sector coalitions to attain a specific mission. Cross-organization virtual communities of practice, although less studied and understood, do exist in engineering domains such as open source software development (Scacchi et al., 2006) and scientific practice communities (Foster and Kesselman, 1998). Despite this, the vast majority of empirical works report virtual communities of practice setup and operated in single organizations either public or private (Juriado and Gustafsson, 2007). The more demanding problem of community formation across organizational boundaries – either through inter-organizational partnerships or external communities of practices – is seldom addressed (Dewhurst and Cegarra Navarro, 2004). The complexity of this challenge in terms of organizational and technological set up is explored in a recent study by Kern and Kersten (2007) where the authors investigate technologies for Internet-based inter-organizational product development and identify the problems involved in designing the partnership interaction.

Genres of Supporting Tools

General-Purpose Community Management Tools

The tools supporting cross-organization virtual communities of practice fall into different genres, with the vast majority aimed to fostering the social construction of knowledge (Erickson and Kellogg, 2001). Examples include virtual prototyping suites (Franke & Piller, 2004), tools for idea exploration (Erickson et al., 1999), tools for organizational memory management (Ackerman, 1998; Ackerman and Palen, 1996; Hackbarth and Grover, 1999), collaboratories (Olson and Olson, 2000), Grids (Foster and Kesselman, 1998), as well as tools for information sharing such as electronic mailing lists, or listservs, MOOs, Blogs, Wikis, etc. Typically, tools such as the above almost exclusively focus on managing what organisations know (Davenport and Prusak 2000), rather than what organizations should know (Lueg, 2003). Although the latter is widely acknowledged as a potential source of innovation and a drive for improvement, managing what an organization needs to (but does not yet) know remains a challenge and turns out to be a difficult undertaking. Market research indicates that companies do invest on monitoring on-line discussions aiming to find out what is being said about a company and its products using tools such as eWatch, CyberAlert and IntelliSeek. Moreover, there is also evidence indicating that companies are often not prepared to deal with potential criticism expressed in these forums (Lueg, 2001; MacInnes, 2006). Whatever the case, however, the key question is how such findings are translated into new knowledge and experience.

Another common characteristic of the vast majority of tools, which limits their uptake in the context of cross-organization virtual communities of practice, relates to the type, range and scope of the practice elements supported. Establishing a common ground on what constitutes practice in a virtual community of practice is far from trivial. In general, practices emerge from accumulated wisdom or rules of thumb. Shared practices represent the collective wisdom or repertoire of resources accepted and used widely by practitioners of a domain of discourse towards a goal (Wenger, 1998). In their recent analysis of information infrastructures for distributed collective practices, Turner et al. (2006) offer two alternative interpretations of what may be accounted as practice. The first frames distributed collective practicing in the context of the social interactions taking place between members of a virtual team or a community of practice. The authors' conclusion is that this view on practicing suggests that '… designing infrastructures for supporting on-going collective practices lies in better understanding the dynamics of interacting at a distance – not in the sense of being physically distant as opposed to being co-located in close proximity, but distance in the sense of being emotionally challenged by the position taken by another and requiring breathing room in order to be able to continue to perform independently in a capable manner (p. 105)…'. Nevertheless, this is not the only valid view upon practicing. An alternative is to frame collective practices in shared processes, the artifacts and the tools used for manipulating the artifacts. Turner et al. (2006) acknowledge this view upon practicing and declare that it is more challenging but also less studied in the literature. Indeed our reading of the relevant literature reveals that very few of the efforts reported claim convincingly that the systems studied provide a 'place' for engaging in the practice the community is about.

In the case of the SEF, such an encompassing interpretation of practice is more relevant as it allows distinguishing between organization-specific practices and community-oriented (or social) practices. The former type includes 'local' practices employed and used by an organization to plan and execute own business activities. These practices are grounded on the organization's context of work and may be embedded in dedicated technological tools (i.e., enterprise databases, intranet) and local procedures. The second type, namely community-oriented (or social) practices represent the accepted medium (i.e., processes, tools and artifacts) through which different organizations joining the virtual partnership engage in the practice the community is about. This type of practicing is shared and constitutes the 'social' protocol for participating in the virtual space of the community of practice. de Souza and Preece (2004) refer to these practices collectively as sociability implying the means through which members participate and contribute in the virtual community.

Software Factories as Practice-Specific Toolkits

In contrast to community management which is served by a variety of tools, practice-specific toolkits are rare and less studied. For information-based products, an emerging virtuality which holds the potential to catalyze the development of powerful domain-specific practice toolkits is the notion of a software factory (Cusumano, 1989; Fernstrom et al., 1992; Aaen et al., 1997). In the software engineering literature, software factories are known for quite some time now and there have been various proposals. We are primarily interested in proposals which address the factory support environment (i.e., the computerized support components of a software factory), rather than its institutional character, as well as proposals for factory setups supporting communicating and enacting software engineering activities. In this context, the literature describes various proposals with the most prominent focusing on software assembly lines (Greenfield and Short, 2004) and software process improvement (Basili, et al., 1993).

Software assembly lines concentrate of establishing patterns, frameworks and models and integrating them into software schemas and domain-specific design languages so as to build software form components. Generally speaking, a software factory of this type is installed to extend an organization's development environment, adding guidance-related tools and resources. For example, a software factory might include design patterns, reusable code and solution templates that make it easier to start a new application. Furthermore, it might provide wizards and design guidance throughout the entire development cycle. The basic premise of a software factory is that architects customize the various code recipes that are available with a software factory and then they can redeploy the customized software factory to development teams. This gives architects a practical mechanism for distributing their own guidance to developers.

In contrast, Basili introduced the notion of the experience factory as a pathway towards software process improvement relying heavily upon reuse and deployment of previous codified experiences (Basili, et al., 1993). The experience factory denotes an institutional setup intended to support development teams to appropriate the benefits of empirical evidence and previous project experience. Even for small organizations, large amounts of information can be built up over the years comprising expertise, project data, lessons learned, quality models, etc. For such information to be usable, it needs to be modelled, structured, generalized, and stored in a reusable form in order to allow the effective retrieval of relevant artefacts (Cubranic et al., 2004). A continuous build-up of knowledge requires a suitable organizational structure and appropriate tools. Basili introduced the notion of the experience factory (Basili, 1993) as an institutional concept comprising three distinct components, namely the software development organization, the experience organization and a support organization separate from the other two components. The task of the support organization is to carefully package, document and certify (where applicable) software artefacts. In the original formulation of the experience factory, Basili did not prescribe a particular role for technology or the type of tools needed to support the operation of an experience factory. However, in subsequent publications several examples of codified and packaged experiences have been described as well as the ingredients of the underlying technological set-up (Basili et al., 2001; Seaman et al., 2003).

The SEF and the Management of Collective Practices

In light of the above, the present work aims to contribute to the debate regarding the engineering ground and the type of tools needed to facilitate cross-organization virtual communities and management of collaborative community practices in information-based industries. A key theme in this context is what constitutes 'practice' in a cross-organization virtual community of practice and how such practices can be technologically mediated, shared and capitalized upon to foster new high quality information-based products and services. Our understanding of the efforts reported in the relevant literature is that they characterize virtual communities of practice through constructs which represent valid connotations for online communities of interest or action, rather than virtual communities of practice. The underlying difference is that in virtual communities of practice, the elements of 'practice' are embodied as much (if not more) into shared processes, tools and artifacts, as into social interaction and information sharing. Consequently, interpersonal interaction in the form of feedback, among the members is necessary but not sufficient. Feedthrough becomes equally important (if not more critical) and amounts to shared responsibility and exercising influence on the work of peers. In this view, the systems needed to form, maintain and sustain the virtual community of practice should provide a 'place' for engaging in the practice the community is about.

In our recent work, we are experimenting with a model for knowledge and experience management, which is motivated by Basili's experience factory (Basili, 1993), although it fosters an alternative perspective with regards to both the building components (constituents) and the activities being undertaken. We refer to this model as the 'social' experience factory (SEF) and it aims to address a number of specific objectives briefly summarised below.

The SEF's Objectives and the Products Assembled within its Scope

The SEF seeks to provide the basic model for appropriating the benefits of virtual networking in information-based industries whose products are non-material (intangible) and knowledge is central to gaining competitive advantage. To this effect, it aims to setup and operate a 'virtual' software factory tuned to managing and reusing shared assets, tools and domain-specific software components. This requires an orientation towards implementing assembly lines rather than programming-intensive production lines. Consequently, our primary objective is to describe a domain-independent archetype of a virtual organisation in which domain-specific elements and practices are realised by dedicated tools (such as domain-specific design languages, model building components, visual manifestation of artefacts and sound XML-based protocols) to assemble information-based products.

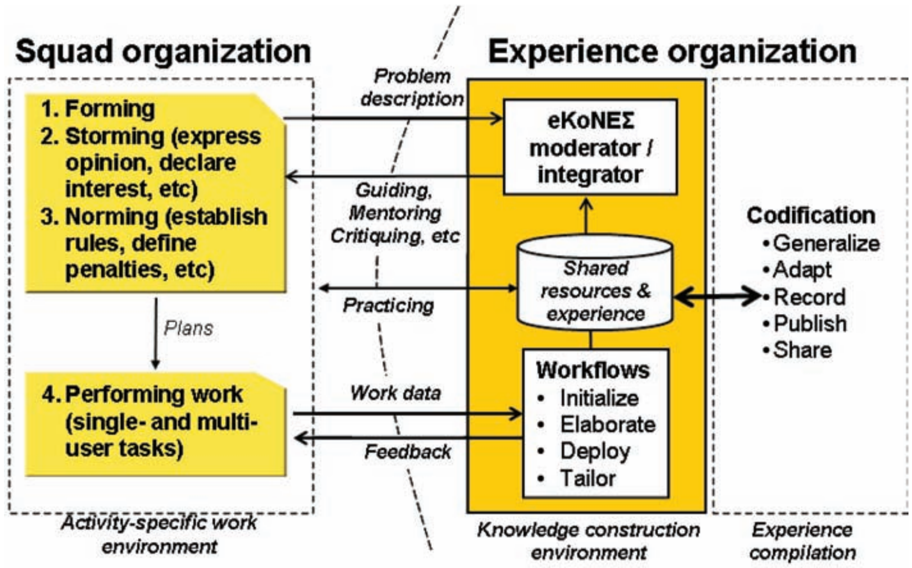
Products assembled within the scope of the SEF have designated characteristics. First of all, they are intangible, information-based artefacts i.e., the end user does not actually experience the end product at the time of purchase, while purchasing behaviour is determined by the information available. Secondly, they are user- or circumstance-driven in the sense that the rationale for building the product is either induced by customers or found in purely circumstantial factors such as foreseen or unforeseen events taking place in the wider social environment of the virtual enterprise – hence the need for adaptation and mass customization for such products to meet varying requirements and preferences. Thirdly, they are fabricated (or assembled) in a moderated fashion by virtual teams using a flexible assembly line (i.e., practice-specific toolkit) and a product family specification. Fourthly, such products have a 'local' character (i.e., they are regionally bound and can be assembled and offered by locals), and short life cycles. Finally, these products cannot be effectively and efficiently developed by anyone member of the virtual partnership alone. Instead, they require collective contribution which makes them orthogonal to other products and services offered by members of the virtual partnership. Consequently, assembling and packaging such services (on-demand) amounts to articulating distributed collective practices so as to yield added-value for all parties concerned including the end user. As these products are the result of collaboration between members in a virtual partnership, they are owned by the coalition for as long as the product / service is offered. To realize these objectives the SEF is organized in distinct and separate constituents, which can be considered from a functional and structural view. We will review first the functional archetype of the SEF and in a subsequent section we will discuss the structural view which relates to the SEF's assembly line.

The SEF's Functional View: Constituents and Archetype

The functional archetype of the SEF, which is depicted in Figure 1, shares common ground with Basili's Experience Factory, although it is distinctively different in terms of organization and processes. As shown, it is structured around two distinct and separate constituents, namely the squad organization and the experience organization. The rationale for this separation of functions is to be found in the type, range and scope of tasks allocated to each constituent. Specifically, the SEF implements an activity-specific work environment referred to as 'squad organisation' and a separate knowledge construction and experience compilation organization referred to as the 'experience organization'. Parallels are to be drawn between the software development organization and the experience organization in the original formulation of the experience factory and our notions of squad and experience organizations respectively. However, the processes being executed by the two constituents are different from those in Basili's experience factory.

The squad organization encapsulates the distinct lifecycle stages followed by collaborating teams / virtual partnerships as they attain joint goals. On the other hand, the experience

Figure 1. Archetype of the 'social' experience factory



organisation encapsulates two sub-components the knowledge construction environment and the experience codification. A virtual partnership or squad is formed across the two constituents and comprises members from different sectors of the industry and at least one moderator from the experience organization. The virtual and cross-organization nature of such partnerships necessitates that community practices are encapsulated into computer-mediated tools and workflows to allow incremental and collaborative construction of artefacts. Thus, a normative objective of the SEF is to provide the grounds for a platform enabling rich collaborative interactions between members of virtual groups.

The Squad Organization and Lifecycle

Squads are cross-neighborhood coalitions (virtual teams) tasked to attain common goals by aggregating and negotiating primitive resources (i.e., neighbourhood assets). Neighbourhoods are virtual communities with topical/thematic interest, a collective memory and cultural vocabulary. For instance, neighbourhoods in the tourism sector include transport, accommodation, cultural heritage communities, etc. Each neighbourhood sets up own rules of engagement which determine participation and acceptable social behaviour within the neighbourhood. As these neighbourhoods exist virtually, rules are embedded into processes covering registration and access rights, acceptance of new members, rules for acceptable behaviour, security, privacy, freedom of speech/act and moderation.

Squads are formed to carry out a designated mission, thus they are mission-specific. The mission may vary depending on the domain of application (i.e., tourism, learning or construction). The SEF is functionally organised in such a way so as to support the social interactions taking place between collaborating group members. In this context, social interactions imply exchanges taking place between group members and being dependent on the group's lifecycle stage and level of stability. Such exchanges differ as the group progresses from formation, to storming (i.e., getting to know each other), norming (i.e., resolving conflicts and reaching agreement) and performing towards the common goal (Tuckman, 1965).

The second reason for the 'social' qualification (of the SEF) is that the above distinct stages in the group's lifecycle are explicitly supported (by dedicated tools) and characterize the design of the SEF. In other words, the SEF assumes that group work entails attainment of distinct goals during the forming, storming, norming and performing stages. Throughout these stages, an experience function / organization compiles experiences by monitoring, analyzing and consolidating persistent outcomes of a group's collaborative exchanges. In the following we provide a detailed account of the squad organization function of the SEF as currently supported in the eKoNEΣ pilot in the area of tourism.

Once formed, squads follow distinct stages to reach their ultimate target (see Figure 1). Initial formation is determined by the mission's requirements (or primitive services required) and the assets of neighbourhood members as declared during electronic registration to neighbourhoods. Each squad comprises one moderator and several participants joining forces to address a problem (i.e., develop a vacation package). The moderator designates the type of input required and establishes a pace of working. In due time, a squad may change in form and structure depending on contextual and circumstantial factors (i.e., a member may be temporarily unavailable or unwilling to commit further resources). This means that at any time, a member can opt out from a squad only through an explicit request for withdrawal. Nevertheless, dynamic formation seldom ensures stabilization and effective performance. Instead, empirical evidence suggests that group stabilization is strongly correlated with the group's ability to effectively move from the initial forming and storming stages into norming and performing. In other words, the group's level of stabilization increases as the group progressively moves from forming (i.e., trying out activities, expression of opinions), to storming (i.e., resolving conflicts) and into norming (i.e., enfolding group coherence, setting group objectives) and performing (i.e., carrying out activities towards the group's mission). The SEF provides explicit tools for moderators to manage squads as they move from formation to performance. These tools are transparent to squad members and utilize data posted / exchanged through the SEF's shared collaborative message board.

The Experience Organization

The experience management organization of the SEF is broadly defined in terms of three sub-constituents namely a distinct role (i.e., moderators), a collection of domain-specific workflows and the persistent experience data store. As indicated in Figure 1 these constitute components of the knowledge construction environment which mediates and interacts both with the squad operational settings (i.e., activity-specific work environment) and the experience compilation component. The important issue to be highlighted is that in contrast to the squad organisation, which is flexible and independent of organisational model, the experience organization assumes a centralized institutional setting with designated roles and functions.

At the core of the SEF's experience management organization is a domain-specific ontology, which serves as the main knowledge and experience-modelling repository. In the context of our current work, we are using Protégé (http://protege.stanford.edu/) to build the ontology for the pilot application domains where the SEF is deployed. The design philosophy of the ontology is as follows. Member organizations are registered in neighbourhoods. Each neighbourhood maintains its own social policies and rules of engagement. Neighbourhoods are specialized into sub-classes depicting structure of the neighbourhood and custom member offerings. Shared resources deposited by members are of two types namely primitiveServices and packages. A primitiveService is a neighbourhood specific activity (i.e., accommodation). Packages are built by assembling instances of primitiveServices and are negotiated by squads.

They represent resources, which do not pre-exist but rather are compiled by members to facilitate an articulated demand. However, the process of assembling them and negotiating their details is distinct and totally different than conventional practices. Specifically, an instance of Package is derived from the archetype of a package family, in a similar fashion as a product inherits properties of a product line. Thus assembling a package involves incremental tailoring of properties of a family of packages. Each package is owned by the squad contributing to the package. Moreover, all deliberations made by squad members leading to the package are persistent and can be traced.

The moderating role is responsible for (a) organizing, leading, mentoring and facilitating the group's virtual activities (b) extracting information from, updating and mining the shared experience data store and (c) codifying successful practices and experience by generalizing, adapting, recording, publishing and sharing artefacts. The moderator is mandatory and there can be no squad without at least one moderator. This role involves active engagement in a range of social interactions and knowledge-based tasks. Social interaction entails monitoring, guiding, facilitating, mentoring and critiquing squads as they move from formation to performing. On the other hand, the knowledge-based tasks involve manipulation of the 'soft' components of the experience organization (i.e., visual models, templates, evidence, etc). Accordingly, the moderator's work may be seen as a complex undertaking with a dual responsibility. The first responsibility is acting as a competence centre or an experience broker mediating between the virtual assets of the community of practice and the active squads. In this capacity the moderator offers advice on problem solving strategy, tools, and best practices, based on existing experiences. The second responsibility of the moderator is acting as a silent critic to mine the data generated by a squad as it works to accomplish its set targets and to codify these data in the form of persistent new knowledge. These responsibilities are further detailed in the next section where operational details of the SEF are described.

The second important constituent in the experience organization is the domain-specific component in the knowledge construction environment, which designates the distinct workflow stages (i.e., initiation, elaboration, deployment and tailoring) characterising the fidelity of the artefacts produced (see Figure 1). The initiation workflow is the responsibility of the moderator and aims to define the squad's mission. The mission is typically a product specification derived from a corresponding product family. Each product family includes mandatory fields to be defined in the initiation workflow (i.e., assignment of a name, indication of resources required such as type of neighbourhood resources and duration). In effect, this task amounts to creating a new instance under the abstract product family. This instance will incrementally be transformed to a concrete offering. Once the instance of the product family is defined a corresponding squad is initially formed as a coalition of all members offering the resources required by the product.

The elaboration workflow requires a stable squad. A squad is stable if for every neighbourhood resource declared in the initiation phase there is at least one, ideally more, committed members. During elaboration, and prior to expressing commitment or withdrawal, squad members seek to populate the designated product with all possible or alternative offerings. Their contributions may range from requests for clarifications to designation of specific parameters of the product, such as pricing of services, discount policies, temporal constraints of a service and other product-specific details. These exchanges are persistent and result in updates in the product's model or the introduction of pending issues requiring agreement. In case of conflicts between the squad members or unresolved issues, the moderator launches a virtual meeting in the form of a synchronous session. This is an innovative component of the current version of the software as it supports typical groupware functions (i.e., object sharing, floor control) as well as role-based access to and various collaborative practices over the shared objects. Notably, throughout such exchanges the object of collaboration (i.e., a graphical version of the product) remains fully synchronized, using a powerful object replication model. At the end of the elaboration phase, a new product has been populated including a variety of possible options to be selected by end users.

In the deployment stage the product has been agreed and becomes an active resource through the portal available for review and refinement. This entails selection and authoring of one or more template layouts so as to facilitate the product's multi-platform presentation (e.g., desktop using Java or HTML, PDA or a cellular phone). In case an existing template layout does not suffice, then a new one can be created and stored as a reusable component in the experience data store. A dedicated software component undertakes to provide the container for deployed products and to allow exploration by users. Moreover, through an asynchronous notification mechanism, all end users who have registered their interest in the product are informed and prompted to consider making a personalized reservation.

Personalization / tailoring is the stage where end users (i.e., prospective customers) are exposed to the product and adapt it so as to reflect own preferences. Product adaptation entails making choices from the variety of alternatives encapsulated in the deployed product, thus specifying a customised instance within a product family. For instance, users may select a particular feature from the range supported. Since the product is fully populated, end users can access it through a variety of devices including desktop computers, mobile devices or other network attachable terminals using the suitable templates. It is also worth mentioning that during tailoring users can engage in a variety of social interactions commonly found in on-line communities. For instance, prospective buyers of a product are presented with the feedback provided by persons who have already bought a similar product in the past. Also during tailoring, customers are presented with information on patterns of tailoring which have emerged. Finally, customers are also encouraged to provide ratings and write reviews for services offered and products obtained.

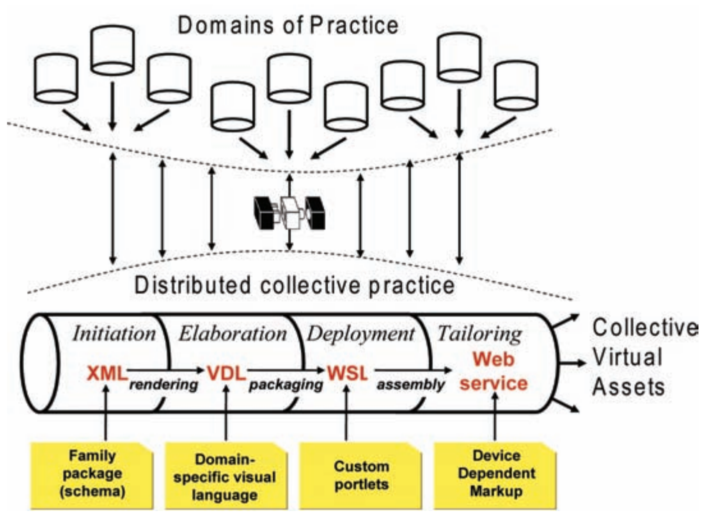
The SEF's Structural View: The Assembly Line

Having described the primitive constituents of the SEF, we now turn to some operational details and in particular the issue of assembling products initiated, elaborated and deployed using the SEF. Our aim is to provide a general description of an assembly line which makes use of concepts such as domain-specific design languages and software factories to automatically compile an information-based product. Such an assembly line has been fully implemented for building vacation packages in the context of the eKoNEΣ project (see Chapter XXI for further details). We will not repeat such details here. Instead, we will try to sketch the engineering ground supporting the SEF's operation.

A structural view for the workflow component in the SEF's experience organization is depicted in Figure 2 highlighting the four workflows which collectively establish the process through which virtual assets are manipulated as distributed collective practice as well as the basic technologies involved. These technologies are embedded into an interoperable software suite which provides the operational context of the SEF. It is worth noticing that this assembly line is located within the experience organization of the SEF to convey that it is transparent to the members of the community of practice. In other words, the community of practice through dedicated tools feeds these workflows without the members' knowing of the involved stages.

Attempting to further characterize the ingredients of such an assembly line we can derive the

Figure 2. Overview of the assembly line

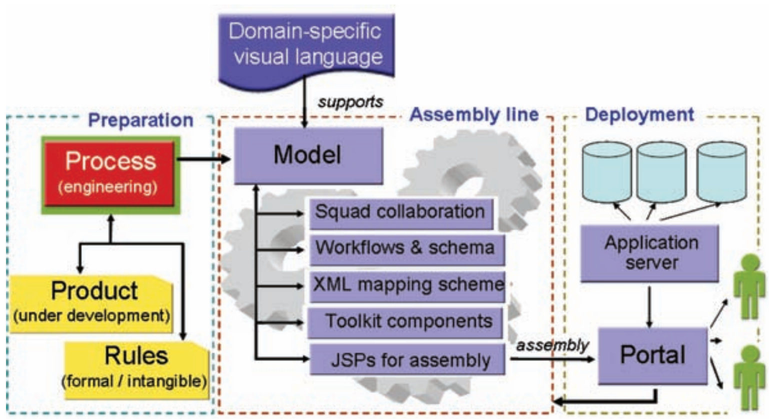


software schema specification which is needed to facilitate interoperability across workflows and enactment of distributed collective practices. This is shown in Figure 3 which bundles the key elements identified in Figure 2 into a concise software schema specification. As shown, the assembly line intertwines with two logical constituents annotated as the preparation and deployment. The preparation constituent is responsible for determining process-related aspects involved in the assembly of a particular type of artefact. On the other hand, the deployment constituent delivers the results of the assembly line to the wider environment of the community. For the purposes of the present work, we will assume that this amounts to deploying assembled artefacts in a portlet context of a community portal.

The assembly line operates on a domain-specific product line specification which characterizes products assembled within the scope of the assembly line. This model is populated by different types of tools devised to facilitate squad collaboration and workflow management so as to derive an instance of a product under a product line specification (or a product family). These tools include general purpose collaboration software (i.e., collaborative message boards, virtual meeting tools, synchronous communication, etc) and practice-specific toolkits supporting the designated distributed collective practice. The practice-specific toolkit provides the community medium through which electronic squads contribute to the development of new products and services within the scope of the assembly line. As the basic user roles in an electronic squad are two, namely the moderator and the squad member, the practice-specific toolkit encapsulates both these roles and offers appropriate functionality in each case.

The key idea behind the above conceptual foundation is that the product is assembled in its entirety from XML. This is illustrated in Figure 4 which describes a relevant extract of a vacation package family and the corresponding XML segments. Both these constitute elements of pre-packaged experience codified in the SEF prior to the initiation of a squad. For purposes of simplicity we have intentionally omitted details of the package family description which are not needed for the present discussion. As shown, the package is considered as a hierarchical structure comprising activities taking place within a day. Such containment hierarchies can be extended to depict alternative application domains. Activities represent instances of neighbourhood services and

Figure 3. Components of the assembly line



can be interrelated. Currently, four activity operators can be used to designate activity relationships, namely *overlap* for activities belonging to different neighbourhoods and having partial temporal execution, *sequence* for serial activities following one after the other, *parallel* for activities belonging to different neighbourhoods and having exactly the same duration and start/end points, *containment* for activities belonging to the same neighbourhood and having partial temporal overlap.

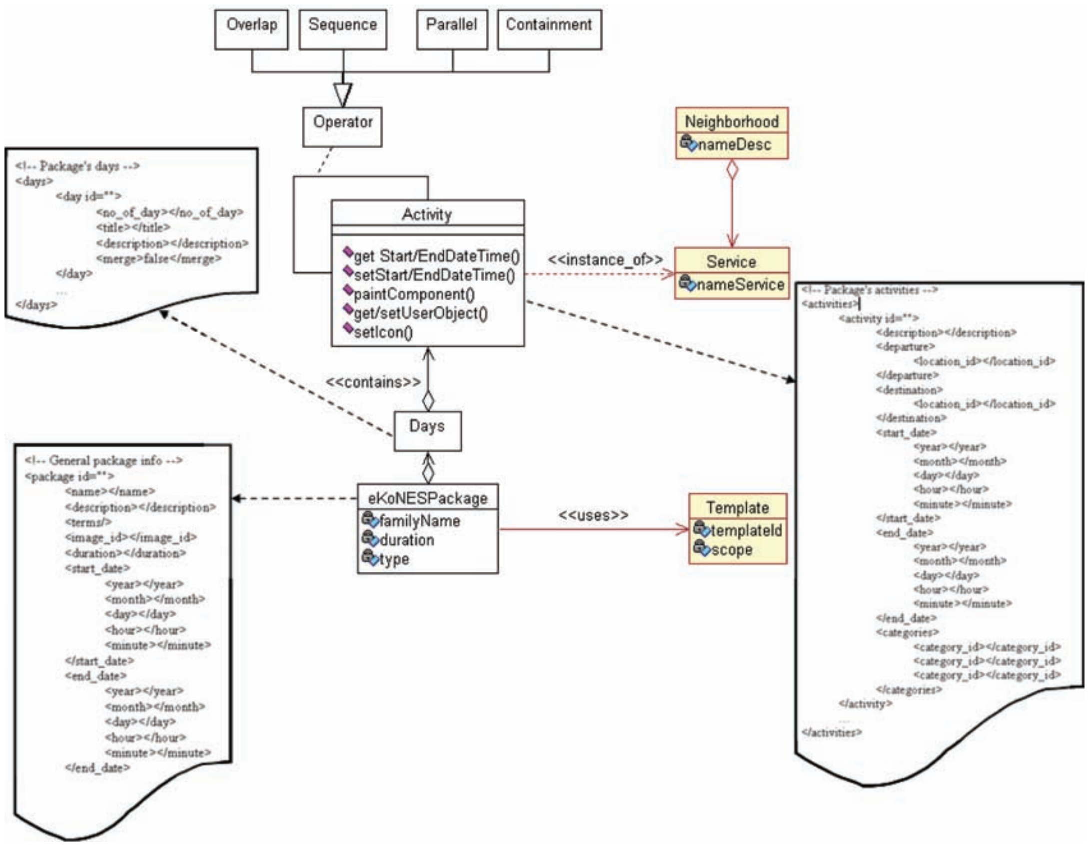
The result of such an assembly line is a concrete product manifested as a collective outcome available for review and manipulation. For our vacation package example, this signals an automatic update of a custom container which undertakes to assemble the components of the new package automatically and publish it either as device-dependent mark-up or in any other form deemed suitable. In all cases, the assembled package includes clear indication of the tailoring that the user can undertake to reflect a customer's detailed requirements and preferences.

DISCUSSION: SEF AND THE DESIGN OF TOOLS FOR VCOP

The SEF promotes a knowledge management model which is built around one generic and one domain-specific component. The generic component is the squad organization, comprising distinct stages in the lifecycle of social groups, while the experience organization is by intention domain-specific. Nevertheless, there are elements and components of the experience organization which may easily be reused, extended and applied to other domains. One issue deliberately not addressed in our discussion so far relates to the technological foundations and engineering base of the SEF. Although our current perspective and thinking on this is documented elsewhere (see Akoumianakis et al., 2007; Akoumianakis et al., 2008; Chapter XXI in this volume), we chose not to make explicit link with the concept of the SEF, as it may be supported through different means and tools. Therefore, in this section, our intention is to provide a critical discussion of the implications raised by the SEF on software tools for virtual communities of practice. Expressed in a different way, our aim is to highlight the SEF's requirements as related to software platforms for managing distributed collective practices (Turner et al., 2006)

Over the years a wide range of technologies have emerged to facilitate collaborative tasks and social interactions in community settings. Bos et al. (2007) provide a classification highlighting tools for ontology engineering (Cragin and Shankar,

Figure 4. Class model of a package family



2006), scientific data repositories and collaboratories (Chin and Lansing, 2004), organizational memories (Ackerman and Halverson, 2004), digital libraries (van House, 2003), community networks (Schuler, 1996; Kavanaugh et al., 2005), recommendation systems (Reichling et al., 2007), etc. Despite the plethora of tools very few efforts have studied the integration of such tools in unified architectures (or information infrastructures) for managing distributed collective practices (Turner et al., 2006). This is not surprising as such a task is both complex and demanding, while several research issues need resolution before a consolidated information infrastructure for distributed collective practices can be conceived. Our work offers insight to this as the SEF constitutes one approach to building technologies for practice. Specifically, we consider that software platforms for communities of practice, such as the SEF, require two separate but interoperable software components, one devoted to community management (i.e., discovering, building and maintaining community) and one devoted to the management of the practice the community is about. From these two, it is the practice management component which is of interest to the current discussion, as it is less studied and understood. To gain some insight, it is perhaps useful to briefly consider what practice is and how off-line practice is influenced and intertwined with on-line practice in different application domains.

On-Line vs. Off-Line Practices

Although it is far from straight forward to define the term 'practice', we will adopt the view that practices represent the collective wisdom, rules of thumb and common ground (i.e., processes, tools and artefacts) characterizing a community, whether professional such as accounting, medicine, landscape engineering, etc., or otherwise. In our account of the term, we also consider that in cross-organizational virtual communities of practice, practice is manifested as on-line or off-line practice, with the two frequently being strongly intertwined. On-line practices are computer-mediated and subsume technology for their enactment, processing and transmission elements of practice. The literature offers a variety of empirical evidence regarding the type of on-line practices prevailing across different application domains such as free and open source software projects (Scacchi, 2005; Scacchi et al., 2006), new product development (von Hippel and Katz, 2002, Franke and Shah, 2001, Franke and Piller, 2004), the automobile and airspace industries (Schultz et al. 2003; Wenger et al. 2002), etc.

In some of these examples practice is solely bound and bundled in the social interactions taking place between the members of the community. It is this social interaction which influences and determines intertwining on-line and off-line practice. In such cases, on-line practice is manifested through the design of tools for engaging in social interactions. Nevertheless, there are application domains, in which practice may be framed in the process, tools and artefacts being produced as well as in social interactions. The implication is that tools for social interaction do not suffice, but instead, practice-specific toolkits are needed for the members of the community to engage in the designated practice. These more involved situations require special components (such as domain-specific visual languages, workflow engines, assembly lines, virtual prototyping toolkits, custom groupware, 'socially' designed user interfaces, community data mining) for manifesting practices, as well as models for codifying knowledge and experience. We use the term new virtuality (Winograd, 1996) to designate the new context offered by these tools for manifesting on-line practice. Thus, new virtualities result in variations in practice codification, enactment and processing, and frequently in totally new (and innovative) practices. Framing practice in this way has implications on the communityware infrastructure. Specifically, mere support for social interaction does not suffice, while the design of the communityware is much more demanding and sensitive to a range of issues. Some of them are elaborated below.

Community Workflows vs. Workflow Engines

Typically, practice domains such as architecture, engineering and software design, are distinctly characterized by workflows, visual languages, domain-specific vocabularies and social semiotics. Even within the same domain of practice some of these tools may evolve and change. For instance, in software design object-orientation brought about a totally different design language (methodology, guidelines, visual languages, etc) than the more traditional structured systems analysis. In tourism, Semantic-Web technologies have begun to change both the traditional workflows and models of cooperation and work; for example dynamic package technologies (Cardoso and Lange, 2007) have changed the way in which tourist packages are compiled, marketed and traded. Similarly, scientific digital libraries have totally altered the practice of preparing, submitting, processing and publishing scientific works. In all these cases, the difference is brought about from the digital medium and the new virtuality being established by software mediating the institution of the underlying practices. Moreover, in all these cases, the computer-mediated environment encapsulates different workflows, practice vocabularies and artefacts. We can therefore conclude that *'infrastructures for cultivated virtual communities of practice should be designed so as to support designated* *workflows encapsulating the community's shared wisdom of practice'*.

Such workflows should prescribe how the community reaches collective outcomes and how distributed collective practices are instituted. In other words, they should depict stages in an evolutionary continuum of joint activities resulting in a collective outcome. For instance, Figure 5 depicts possible workflows through which a vacation package is assembled from a vacation package family. As shown, each stage involves several actions on behalf of the vacation package development team (squad), with some of them being manifested through on-line practices (agreed and shared by all) and others being off-line (local, individualistic or custom) practice. The collective outcome, namely an assembled vacation package, is constituted by the entirety of on-line and off-line practices, which means that the team accomplishes its mission only if the vacation package is deployed and tailored so as to become a concrete offering available to potential customers. This example emphasizes two key points:

- Supporting community workflows amounts to designing to facilitate an effective intertwining between on-line and off-line practices, and
- The social role of practitioners who are embedded in an institution of on-line (shared and agreed) and off-line (relatively autonomous) practices.

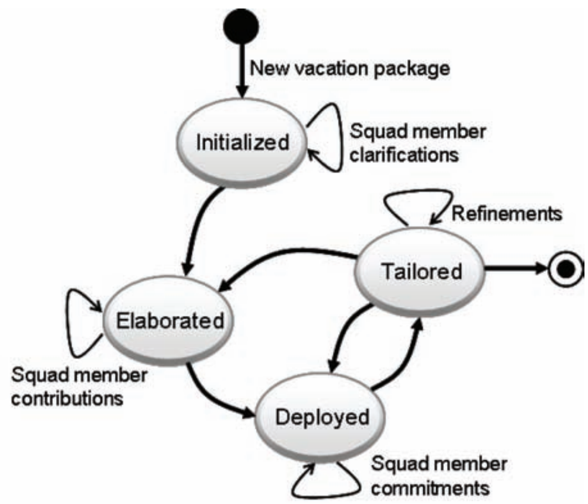
Distributed Collective Practice Toolkits vs. Groupware

The next relevant issue relates to the practice vocabulary articulated in community workflows and how this vocabulary is structured, manifested and processed so as to support distributed collective practices. Traditionally, groupware technologies have emphasized the technical aspects of asynchronous and synchronous collaboration focusing on casual interaction systems such as *instant messengers* (Nardi et al., 2000) where participants carry out communications-oriented tasks, *virtual worlds*, including MUDs, chat rooms, on-line games (Bartle, 2004) where people meet other inhabitants of the virtual world, participate in joint activities and manipulate visual artefacts that comprise the virtual world, *media spaces* (Mackay, 1999) where physical offices and public spaces are linked through networks of audio and video, thus allowing members to easily see who is around and what they are doing. More recent efforts make use of screen sharing technology (Kimberly et al., 2006) to address the limited support for activity and artefact awareness of conventional groupware systems.

One major issue which stands out very promptly in all these efforts, and which is vital for collaboration in communities of practice, relates to the type, range and scope of the artefacts of collaboration, as these constitute elements of the practice-oriented vocabulary. The vast majority of existing works concentrate on conventional artefacts such as documents, communication transcripts and media (i.e. video, audio, images), assuming implicitly that practice is bundled to the social interactions taking place between community members. However, as already pointed out, this is only one view of what practice is about. The alternative view is to frame practice as an institution of processes, tools and artefacts. This view, though less popular in the literature, is the most challenging and useful in the context of communities of practice.

The SEF, as presented so far, supports the latter view. Specifically, it is claimed that designing collaborative practices entails (a) defining the core elements of a suitable practice-specific design language, typically codified as graphical models or notations, integrity constraints, guidelines, and operations on models, and (b) devising mechanisms for computer-mediated collaborative manipulation and execution of valid statements (or artefacts) of this language. Collectively, the design language and its execution environment constitute the *toolkit*

Figure 5. Stages in a vacation package assembly



for managing distributed collective practices. As enactment and reconstruction of collaborative practice is the sole objective of such a toolkit issues such sharing, mutual awareness (conceived of as comprising social awareness, action awareness, workspace awareness and situation awareness), coordinative tasks, asynchronous and synchronous session management, etc., should lie at the core of its design.

Social Community Mining vs. Data Management

Social community mining refers to the process of exploiting the community's knowledge, discovering patterns, codifying reusable experiences and improving practice in a community of practice. There are two issues of particular interest in the context of our current work. The first is extracting patterns and codifying reusable experience. The second relates to applying data mining to discover social networks and 'hidden' or emergent communities. To some extent the two issues are interrelated in the sense that identification of a 'hidden' or emergent community will inevitably result in the consolidation of new patterns and work experiences. However, for the purposes of this discussion, we will address them separately since they constitute subject matters of distinct research communities.

Identifying 'hidden' communities reveals periodic or permanent clusters or cliques formed dynamically as a result of exchanges between members of a social network. For instance, consider the scenario where a community of practice is formed by representatives of a regional tourism industry to assemble vacation packages comprising accommodation, transportation, food and beverage, etc. In such a situation two types of cliques may occur. The first may be a repeatedly recurring clustering between members from different neighbourhoods. For instance, elderly may be consistently choosing bed & breakfast accommodation, public transportation, and two meals from food and beverage while business travelers may favor luxury hotel accommodation, private transportation and no food and beverage. Being able to discover such tendencies (i.e., 'hidden' communities designated or implied by choice of neighbourhood members) or recurring patterns in purchasing behaviours is useful for targeting marketing strategies and building profile-based vacation packages. The second type of clique may designate cross-neighbourhood coalitions (i.e., specific members of a neighborhood that tend to be associated with specific members of another neighborhood). For instance taverns near by a historical site may be more popular than taverns farther away. In this case, the clique amounts to a community within the community with possible negative implications. Indeed, there may be effects such as community desegregation (i.e., establishment of new neighbourhoods), which in turn, may damage the community's stability, coherence and members' trust.

The second relevant application of social mining is for extracting patterns and codifying them as reusable experience. This is a knowledge management and experience building activity aiming to increase the competencies and the capacity for differentiation of a virtual organization. In the context of virtual communities of practice in tourism, such experience building is critical for sustaining an acceptable level of stability between the community members. Moreover, it turns out that it is the presence or absence and periodic refinement and endorsement of community participation policies and rules, which determine both structural and behavioural aspects of the community. To build, maintain and assure endorsement of such rules requires experience and access to community's memoir of interactions. A typical example is the negotiation between customers and providers of a vacation package. Frequently, providers of the same type of service, such as accommodation, in a vacation package including accommodation, transport and visit to local cultural heritage, develop antagonistic behaviours manifested as discounts or last minute offers. Such behaviours may damage the community's stability leading to providers opting out, internal clustering of members, etc. To avoid such negative implications, the community should impose rules of participation and acceptable behaviour. These rules may govern registration and access, acceptance of new members, rules of acceptable behaviour, security, privacy and freedom of speech/act. Moreover, they should be extracted by intelligently manipulating persistent data reflecting each member's behaviour, and negotiated and agreed upon before coming to effect. It turns out, therefore, that moderating such communities is not only about managing access to shared collaborative resources but more importantly a knowledge-based and experience-building task.

SUMMARY AND CONCLUSION

In this chapter, an attempt was made to describe the notion of a social experience factory and how it is substantiated in the context of virtual communities of practice. Our treatment was rather general and abstract. However, the reader may find further details of the SEF and how it was deployed in a pilot application in the tourism sector in Chapter XXI in this volume. The SEF, as presented here, provides a conceptual model and an engineering method for tightly coupling social activities performed in the course of team formation, storming, norming and performing with collaborative workflows such as initiation, elaboration, deployment and tailoring of information-based products.

The SEF has now been used in the area of tourism, which is the main pilot application in which the concept is being validated, but also in other engineering domains through small-scale case studies. These case studies serve a two-fold purpose in the context of the present work. Firstly, they contribute to the verification of the basic operational model of the SEF as described in Figure 1, both in terms of squad lifecycle stages and package development workflows. Secondly, they unfold commonalities which can be generalized across application domains, abstracted to form reusable components and codified to become shared experience through the SEF.

The main contributions of the SEF to the literature on virtual communities of practice can be summarized as follows. First of all, the SEF provides a frame of reference and a guide for building software tools to support knowledge-based virtual communities of practice in their efforts to construct information-based products by assembling components and reusing experience. As such, it is not only concerned with computer-mediated communication, but instead, it seeks to provide a place for engaging in the practice the community is about. Secondly, the SEF emphasizes the social aspects of collaborative practicing, in the sense that it links explicitly practice-related outcomes to evolutionary stages of a virtual team's lifecycle. In other words, the outcome of a virtual team is intertwined with the team's level of stability. Thus, a mission is complete only when the team engages in certain performative practices of a designated workflow. Thirdly, the SEF adopts a model-based approach to establish the fabrics for collaboration. This approach integrates several technological tools to allow role-based access to shared artefacts, adaptable interactive manifestation of domain-specific objects and model editing. Finally, the SEF implements a factory-oriented model for assembling resources into new packages. Such packages are information-based services assembled from components rather than constructed from scratch. Moreover, they represent added value both for the end users (prospective customers) and the coalition members (participating organizations), since no single member of the latter could offer the package cost effectively.

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KEY TERMS

Codified Practice: Elements of a practice embedded in processes, tools and artifacts.

Distributed Collective Practice: Activities executed by electronic squads and relating to the enactment of virtual practices leading to the achievement of a collaborative mission / task.

Electronic Squad: A moderated cross-organization / neighborhood coalition (virtual community of practice) tasked to attain a common mission by aggregating and negotiating primitive resources (i.e., neighborhood assets).

Social Experience Factory: A software engineering setup aimed to provide the computer-mediated environment for managing moderated electronic squads in their engagement in distributed collective practices.

This work was previously published in Virtual Community Practices and Social Interactive Media: Technology Lifecycle and Workflow Analysis, edited by D. Akoumianakis, pp. 101-124, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.9
Information Systems Development:
Understanding User Participation as a Social Network

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ABSTRACT

Conventional wisdom has it that user participation in information systems development (ISD) is essential for systems success. Though the significance of user participation to systems success has been much discussed in the literature, results from empirical studies are inconsistent and suggest, that perhaps new avenues need to be explored. One approach may be viewing user participation as a social network that is, looking at the emergence of social structures and their technological expressions during the user participation process. In this chapter, a framework is presented that organizes user participation approaches that emerge from the different worldviews existing within organizations. This user participation approach (UPA) framework is used as the structure for the systematic arrangement of user participation approaches into a fourfold taxonomy based on extrinsic information attributed to them in the literature. In addition, a categorical analysis and social network analysis (SNA) are used to map and visualize the relationships between analyst and users, thus providing a conceptual and visual representation of the relational structures.

DOI: 10.4018/978-1-60566-344-9.ch005

INTRODUCTION

A critical factor in successful information systems (IS) development is generally assumed to be user participation. Interestingly enough, empirical studies have been unable to conclusively link user participation to systems success. Indeed, attempts to organize and synthesize past empirical studies on user participation have resulted in conflicting results (Cavaye, 1995; Hwang & Thorn, 1999; Olson & Ives, 1981). This may not be totally surprising, due to the dynamic nature of organizations (Doherty & King, 2005) and the inability to capture many of the *everyday* social interactions that occur as users participate. Everyday user participation may or may not be public and therefore has been difficult to assess in the past.

However, in today's world, online communication is becoming an increasingly important part of how users participate in information systems development (ISD). Project participants go online to look for information, keep in touch with co-workers and other professional contacts, conduct business, talk about the project, track progress, discuss new developments, and look for answers to problems. Most of these interactions leave behind records of some sort of social interaction: exchanged email messages, discussion forums, instant messaging (IM) logs, newsgroup postings, blog entries, wikis, etc. Hidden in these growing archives of interactions are useful social patterns that, if more easily recognized and understood, could greatly improve the outcome of an ISD project. This chapter looks at how social interaction may be visualized and how such representations may help organizations understand the mediated environments they inhabit, the worldviews they exhibit, and the relationships of these factors to information systems outcome or success. Indeed, information visualization offers a method of observing the unobservable (Shneiderman, 1998).

The Internet has produced a new way to identify "social networks". Indeed, these networks support social interaction and user participation on an unprecedented scale. Social networks are changing the user participation context, as millions of people around the world come together in online public spaces and exchange ideas, ask questions, and comment on daily life events. Indeed, individuals and organizations are *evolving* in their interactions as they recognize and learn to appreciate how they can stay in touch by e-mail or in online discussion forums with hundreds of people all over the globe. These social networks, which may be public or private, are about collaboration and empowerment for individuals, organizations, and societies (Shneiderman, 2002). They leave behind copious evidence of the evolving social networks and the *revolutionary* ways users are participating. Yet, this evidence is largely undefined and thus so far has been unusable in the context of ISD user participation research. The objective of the current research is to provide a framework that will facilitate visualizing the cues and patterns that are present in social networks, in order to help users, analysts, managers, and other stakeholders participating in ISD, better understand the worldviews they exhibit and their relationship to systems outcomes.

In a sense, we undertake making the intangible aspects of user participation in ISD tangible. In doing so, an issue to contemplate is whether the process of "how users participate" is evolutionary, or are we experiencing a *revolution* with respect to "how users participate?" Disclosing the worldviews and patterns of "how users participate" may help illuminate these issues and others about user participation in ISD. Indeed, it may be a step towards conclusively showing a link between user participation and system success.

This chapter is organized as follows. After providing and discussing some basic terminology, we present and extend the *user participation approach (UPA)* framework (Mattia and Weistroffer, 2008) and justify its use as a means to better understand user participation as a social network. Based on a survey of the literature, we provide and summarize a categorization of user participation approaches using the UPA framework. The chapter concludes with a discussion on how the proposed framework can be better understood as a social network.

THE USER PARTICIPATION APPROACH FRAMEWORK

Basically, this research involves extracting, analyzing, and categorizing information retrieved from available data. The concept of organizing data for better comprehension is not new, and indeed, has an extensive history in the user participation literature (Cavaye, 1995; Hwang & Thorn, 1999; Olson & Ives, 1981; Ware, 2000). What is different in our research is the *what*, *how*, and *why* in organizing, analyzing, and understanding user participation during ISD, viewed as a social network.

Definitions of Terms

User participation has been discussed in the literature from many theoretical perspectives, but attempts at organizing and synthesizing the literature have proven difficult. First, to properly organize the user participation process in ISD we must define several ambiguous terms. Barki and Hartwick (1989) suggest that the term *user participation* should be used "when referring to the set of operations and activities in the systems development process that users participate in", and the term *user involvement* "should be used to refer to a subjective psychological state which influences user perceptions of the system."

Development-related activities performed by users during ISD include activities that may pertain to either the management of the ISD project or to the analysis, design, and implementation of the system itself (Cavaye, 1995). Therefore, participation reflects what specific behaviors are performed, how many of these behaviors are performed, and how often they are performed. These behaviors can be measured by asking users to indicate the extent to which they have participated in specific assignments, activities, and tasks (Hartwick & Barki, 2001).

Due to the diverse use of the terms user participation and user involvement, the term *user engagement* has emerged, referring to either user participation or user involvement or both (Hwang & Thorn, 1999). In addition, recent research also looks at *user attitudes* as a separate term and defines it as affective or evaluative judgment (e.g., good or bad) towards an object or behavior (Barki & Hartwick, 1989). Simply said, it is a psychological state that reflects the user's feelings about IS. This is important because recent research has suggested that user participation, user involvement, and user attitude exert different impacts on system outcomes. Indeed, a circular relationship is suggested (Lin & Shao, 2000), because when user's perform participatory activities, they can help users get more involved, which may improve the user's attitude and make them feel more satisfied with the IS.

A *social network* is defined in this research as a social structure consisting of nodes (which are generally individuals or organizations) that are tied by one or more specific worldviews. Consequentially, persistent data to be investigated and visualized need to be collected from different social networks. Thus, these collections of data deal with user participants and with the spaces and the people they encounter during ISD. Rather than visualizing information systems as a technological phenomenon, we are visualizing the social fabric of the user participation process: the relationship between the roles of analysts and users. User roles in this research are sub-classified as user (in the narrow sense), stakeholder, and manager. This role distinctness is necessary to more accurately model the attributes and relationships of the worldview in which the user role exists. Thus the role of a user (in the wider sense) is flexible; it may range in its definition as solely using the system, to designing and managing the user participation process. We are visualizing the ordinary activities of analyst and users participating in ISD and their worldviews that have an impact on these activities. In so doing, we are not limiting this research to one kind of environment, but instead, explore a variety of online spaces and social networks. Every ISD project is fundamentally different from every other, dealing with different social networks, and online architectures. This approach allows us to explore how social networks may affect distinct user and organizational worldviews, synchronous and asynchronous user participant environments, conversation-based and artifact-based ISD communities. Consequently, this research shows how a user's worldview and social networks can impact user participation in ISD and the resulting system outcomes.

The Proposed Framework

Typically in academic research, a research question is first identified, and then ways are investigated to explore and answer this question. In contrast, creators of social networks often begin with, first, the purpose they are interested in pursuing and, second, the raw dimensions present in the data. To these two parameters, the work presented here adds a third one: empirical findings from information systems research and a variety of social science research – ranging from sociology and psychology to communication research. Whenever possible, the choice of which dimensions to visualize in this research has been guided by the theories and empirical results from these fields. Communication research in particular, can be of great value to designers of social networks because they highlight the kinds of cues users of online spaces utilize as they interact. These studies spell out some of the inner workings of social processes such as online impression formation and the impact that different cues have on interpersonal communications processes (Carroll, 2002). Furthermore, this research explores social network analysis as one analytic approach to better understand user participation.

Adapted from Cavaye (1995) and Mattia and Weistroffer (2008), Figure 1 depicts the various dimensions that have been used in previous user participation research, but extends the model by synthesizing numerous other ideas put forward in the literature, including the four paradigms of information systems development proposed by Hirschheim and Klein (1989). This user participation approach (UPA) framework is designed to present a more complete visualization of a complex phenomenon that is frequently marked by gradual changes through a series of states. In addition, this extension will help organize existing research findings and continue the cumulative research tradition on user participation.

Burrell and Morgan (Burrell & Morgan, 1979) use epistemological assumptions (how you obtain knowledge) and ontological assumptions (your social and technical worldview) to yield two dimensions: a subjectivist-objectivist dimension and an order-conflict dimension. The subjectivist position seeks to understand the basis of human life by exploring the depths of the subjective experience of individuals.

The main concern is with understanding the way in which an individual creates, modifies, and interprets the world. The objectivist position applies models and methods resulting from the natural sciences to the study of human affairs. The objectivist thinks of the social world as being the same as the natural world (Burrell & Morgan, 1979). The conflict-order dimension is described as where an order or integrationist worldview emphasizes a social world characterized by order, stability, integration, consensus, and functional coordination. The conflict or coercion worldview emphasizes change, conflict, disintegration, and coercion (Burrell & Morgan, 1979). The dimensions are offered as a theoretical schema for analyzing organizational theory.

Following Burrell and Morgan (1979), Hirschheim and Klein (1989) map the dimensions onto one another to yield the four paradigms of information systems development. These four paradigms are sets of assumptions about ISD which reflect different worldviews about the physical and social world (Hirschheim & Klein, 1989; Hirschheim, Klein, & Lyytinen, 1995). Different worldviews tend to be reflected in different theories. Indeed, all approaches are located in a frame of reference (worldview) of one kind or another. Iivari, Hirschheim and Klein (2001) extended this line of research by supplying a four-tiered framework for classifying and understanding ISD approaches and methodologies that have been proposed in the literature. The UPA framework proposed in this chapter is a frame of reference for the user participation process in ISD. This provides a comprehensive schema for analysis of user participation outcomes (issues and problems) within ISD and in particular, the user participation domain.

The UPA framework recognizes contingencies, which refer to the variables that enable or inhibit user participation. Intervening mechanisms are included to illustrate that the system outcome may have variables that moderate the user participation effect (Cavaye, 1995). It is important to recognize these, so that the user participation process is viewed in the context of the larger picture.

Categorical Analysis of the User Participation Process

A categorical analysis of the user participation process is used to analyze the UPAs in the context of *information system development approaches (ISDA)*. First, we classify and map the list of user participation items into different process model elements. In a similar manner we characterize the ISDAs. Finally, heuristics are used to investigate how the approaches translate into manager, analyst, stakeholder, and user actions. In this study, this analysis technique helps clarify the story that the UPA tells us. In addition, we use the UPA framework and social network analysis to infer from the whole ISD structure to the user participation part; from organizational structure to individual user participant; from behavior to worldview. Consequentially, this allows us to study whole social networks, all the ties containing specific relations in the defined user participation population, and the personal social networks of user participants and the ties that specific users have, such as their *individual communities*.

A categorical analysis of the user participation process produces four generalized categories. Each category consists of typical classes of behavior that follow from the assumptions of a particular worldview. The worldviews that the ISDAs are derived from are archetypes that represent highly simplified but paramount conceptions.

Elements of the Categorical Analysis:

- The definition of the UPA indicates the overarching concept explicitly defined in the approach.
- The definition of the ISDA indicates the worldview concept explicitly defined in the approach.
- The *management rationale* indicates which justifications are provided for the use of the approach and specific goals that managers should pursue.
- Social *relationships* exemplify the established leadership in the user participation process.
- An *episode* is a set of participatory activities.
- Users, managers, stakeholders, and analysts form social networks that have encounters. It is important to note that encounters mark the beginning and end of an episode, i.e. they separate episodes.
- The heuristics indicate how the participatory activities and the UPA are related. The four main view elements are organization, practice, requirements, and functionality.

The worldviews are arranged in groups (categorized) according to the relationship identified in the UPA framework. Therefore, the categorical analysis provides us with a cognitive map (Table 1) that conceptualizes the attributes, whereby nodes (actors) or individuals can be distinguished.

Social Network Analysis of the User Participation Process

The general form of this analysis views the user participation process as a social network that emerges from the UPA chosen. Actors (nodes) participate in social systems; therefore social network analysis is used to make the relation-

Table 1.

User Participation Approach (UPA) Taxonomy		
Worldview	**I. The analyst as the user participation leader**	**II. The analyst as a facilitator**
UPA:	User participation as a rational process in a social network.	User participation as a sense making process in a social network.
Worldview:	Functionalism (objective-order) focuses mostly on technical change.	Social relativism (subjective-order) focuses on social interaction.
ISDA:	Typically these approaches to ISD share a number of common features that drive interpretations and actions. Examples: Structured, information modeling, decision support system, socio-technical design, object-oriented.	Interactionist, soft systems methodology, professional work practice.
Management rationale:	The ideal of profit maximization.	None are apparent. As the social worldview is continuously changing, no particular, rationale can be provided to 'explain' the user participation state.
Social Network:	Management, the analyst and users.	Users and the analyst.
Social Relationships:	Analyst-led.	Equivocation.
Episode's Guiding Principles:	Information systems are developed to support rational, organizational operation and effective and efficient project management.	Information systems development creates new meaning.
Heuristic:	This UPA is technical in nature and significantly focused on the requirements element. Functionality, practice, and organizational elements follow in its analyst-led, technical to social focus. Significant emphasis on design and requirements model a worldview that turns a system into a useful tool for management to achieve its goals.	Interrogative activities that enable debate. This UPA focuses on social interaction and thus, is significantly focused on the functionality element. Through interaction, objectives emerge and become legitimate by continuously developing or adding functionality to the information system. The technical communicator role, with its increased emphasis on listening to users and advocating their needs and desires, also can be used to increase and enhance communication during the user participation process and reduce the pain of these changes.
Worldview	**III. The user as the user participation manager in a social network.**	**IV. The analyst and stakeholders as partners in a social network.**
UPA:	User participation as a process of empowerment.	User participation as an equal opportunity process.
Worldview:	Radical structuralism (objective-conflict) focuses on radical change.	Neohumanism (subjective-conflict) focuses on social change.
ISDA:	Participation supports democracy at work and quality of work. Example: Trade unionist.	Models communicative action in organizations. Example: Speech act-based.
Management rationale:	The ideal of an evolution from capitalist market economy to a collectively planned and managed economy. This evolution empowers users to meet their own needs.	The ideal of emancipation. Information systems should lead to freedom from all unwarranted constraints and compulsions (e.g., distorted communication) toward a state of well-being for all.
Social Network:	Management and the analyst.	Stakeholders and the analyst.
Social Relationships:	User-led.	Joint system development.
Episode's Guiding Principles:	Information systems are developed to support managerial control because management is the user.	Information systems are developed to remove distorting influences and other barriers.
Heuristic:	This UPA focuses on radical changes that allow users to meet their own needs (User-friendly ISD tools) thus, is significantly focused on the practice element. Craftsmanship and productivity are thought to improve when the users' daily practices are enhanced.	This UPA is social in nature and significantly focused on the organizational element. Practice, functionality, and the requirements elements follow in its social to technical focus. Significant emphasis on organizational design and adaptation should lead to an ideal environment for joint system development.

ships between actors explicit. The theoretical and methodological focus of social network analysis is identifying, measuring, and testing hypotheses about the structural forms and relations among actors, making this type of analysis well suited for use with the UPA framework, in contrast to factor research which has an individualistic and variable-centric focus (Knoke & Yang, 2008) (see Figure 1). Basic units of analysis are relations (ties). Other measures of social network structure include range, density, centrality, groups, and positions (for a review, see (Wasserman & Faust, 1994)).

As a point of departure we offer the following research question: *What enables certain groups of users participating in ISD to contribute to system success?* A traditional approach to this question has been to focus on the analysts and their ability to manage the process of user participation. This is because analysts have traditionally played a pivotal role in designing and coordinating collective actions. This traditional (objective) leader-centered worldview has provided valuable insights into the relationship between leadership and group performance. Today, user led approaches exist that are also consistent with an objective, leader-centered worldview. All of these objective, leader-centered worldviews assume that there is only one leader in a group, and view leadership as an exclusively top-down process between one leader and the other users (Figure 2).

A newer, more subjective approach to managing the user participation process is to have multiple leaders. This approach has proven effective because groups often have more than one leader. Even when there is a formally assigned analyst or user as the group leader, other, informal, leaders may emerge. Users often choose informal leaders of their own, leaders who are separate from the analyst designated as leader by the organization. The subjective, multiple-leader worldviews assume that there is a need for more than one leader in a group. These worldviews view leadership as an emergent process between multiple leaders and the other users (Figure 3).

Basic units of analysis here are relations (ties) measured by visualizing formal social structures of the type “reports to”.

Figure 1. User participation approach (UPA) framework

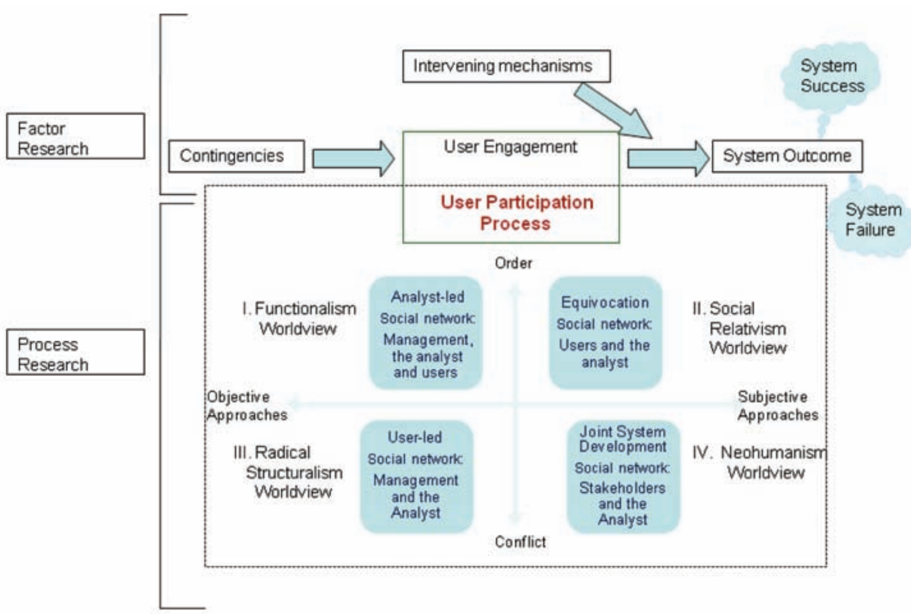


Figure 2. Objective, leader-centered social network

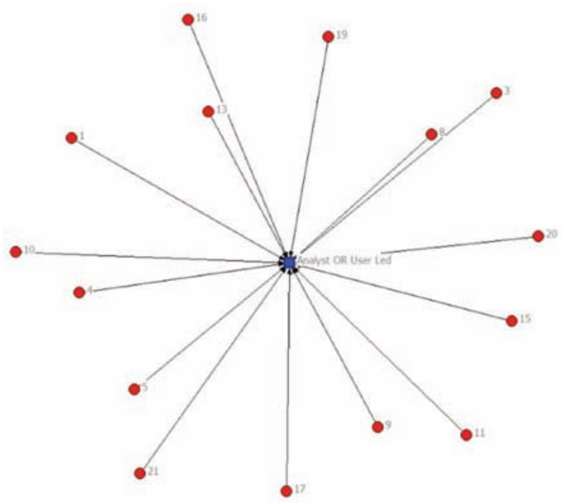
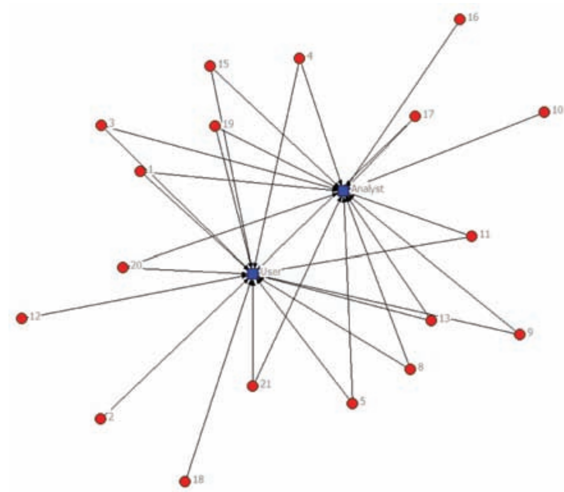


Figure 3. Subjective, emergent-leader social network



The purpose of this section was to give a brief explanation and a corresponding visualization of the social relations indentified in the categorical analysis. We have briefly outlined how social network analysis can enhance the research agenda set forth in the UPA framework. User Participation during ISD until now has remained mostly untouched by social network analysis. In all four worldviews of the UPA framework, we argue that the network perspective combined with the categorical analysis has the potential to supply a cross-level analysis, generally incorporating more macro-level constructs (such as management rationale) into micro-level research (such as user participation leadership). As we continue to analyze user participation during ISD using the UPA framework, we expect social network analysis to supply many more interesting explanations about the user participation process.

CONCLUSION

The research-in-progress reported in this chapter is focused on organizing and analyzing user participation by viewing it as a social network. Though people are quite adept in participating in social networks in new and ever-more detailed and persistent ways, they often lack the ability to see the relationship in intelligible, useful, and business oriented ways. And yet, it is clear that the use of social networks can be an important source of information about the people that create them and the worldviews they exhibit. Worldviews play a critical role in determining the way problems are solved, organizations are run, and the degree to which individuals succeed in achieving their goals. Existing social networks supply persistent datasets on how users participate, and a social network analysis may present the cues and patterns that allow us to better understand the relationship of user participation in ISD to systems outcomes. In addition, visual representations of social networks help us understand the dataset and convey the results of the analysis. Social network analysis tools can change the layout, colors, size and many other elements of the social network representation. Indeed, a picture can say a thousand words.

The refinement of the categorical analysis on user participation leads to a more organized taxonomy and therefore a more useful understanding of a user's worldview and the user participation approaches most congruent to the worldview identified. The next logical step is to analyze the social networks and the ties that bind them as a source of persistent data on user participation. This will open new avenues of making tangible what is now obscured and intangible. In addition, social networks should be investigated as a new (evolutionary or revolutionary) approach that managers, analysts, users, and stakeholders can utilize in accordance with the appropriate worldview that they exhibit. As simple as this approach may sound, it is a clear departure from how user participation in ISD has traditionally occurred. Most user participation during ISD is disconnected from the organizational and individual worldviews and the social networks available to the participants. By categorizing user participation approaches according to validated aspects of each worldview and exploring social network structures, this research expands our knowledge of how visualizations of the user participation social network can be used and what impact these UPAs have on systems outcome.

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This work was previously published in Systems Analysis and Design for Advanced Modeling Methods: Best Practices, edited by A. Bajaj and S. Wrycza, pp. 58-67, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.10
A Framework for Integrating the Social Web Environment in Pattern Engineering

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ABSTRACT

In the last decade, patterns have emerged as a notable problem-solving approach in various disciplines. This paper aims to address the communication requirements of the elements of pattern engineering (namely, actors, activities, and artifacts) in general and the pattern realization process in particular. To that regard, a theoretical framework using the Social Web as the medium is proposed and its implications are explored. The prospects of using the Social Web are analyzed by means of practical scenarios and concrete examples. The concerns of using the Social Web related to cost to actors, decentralization and distribution of control, and semiotic quality of representations of patterns are highlighted. The directions for future research including the use of patterns for Social Web applications, and the potential of the confluence of the Social Web and the Semantic Web for communicating the elements of pattern engineering, are briefly explored. [Article copies are available for purchase from InfoSci-on-Demand.com]

INTRODUCTION

The reliance on the knowledge garnered from past experience and expertise is important for any creative endeavor. A pattern is one such type of conceptually reusable knowledge (Buschmann, Henney, & Schmidt, 2007b). From their origins in urban planning and architecture in the 1970s (Alexander, Ishikawa, & Silverstein, 1977; Alexander, 1979), followed by object-oriented software design in the late 1980s and the early 1990s (Gamma et al., 1995), patterns have found applications in various domains of interest (Rising, 2000; Henninger & Corrêa, 2007). For novices, patterns are means of guidance; for experts, they are means of reference. The use of patterns has, for example, enabled the construction of high-quality distributed software architectures (Buschmann, Henney, & Schmidt, 2007a), electronic commerce applications (Kamthan & Pai, 2008), mobile interaction design (Ballard, 2007), secure systems software (Schumacher et al., 2006), use case models (Kamthan, 2009), and Web Applications (Kamthan, 2008), to name a few.

The human-centric nature of patterns has been known for some time (Coplien, 1996; Schumacher et al., 2006). For its broad acceptance and use, the knowledge in form of patterns needs to be explicably communicated to its actors.

The Social Web, or as it is more commonly referred to by the pseudonym Web 2.0 (O'Reilly, 2005; White, 2007), is the perceived evolution of the Web in a direction that is driven by 'collective intelligence' (Engelbart, 1995), realized by information technology, and characterized by user participation, openness, and network effects. The purpose of this paper is to assess the viability of the Social Web environment in serving as an ecosystem for many-to-many asynchronous and synchronous communication of the elements of pattern engineering in general and the pattern realization process in particular. For the sake of this paper, the Social Web *environment* includes Social Web technologies, applications based on those technologies, and tools for managing both.

The rest of the paper is organized as follows. The background and related work necessary for the discussion that follows is first outlined. This is followed by introduction of a theoretical framework for communicating the elements of pattern engineering via the Social Web (namely, SW4PE) that includes identifying and classifying actors of patterns, a model for the pattern realization process, and communication requirements for pattern engineering. Then, a detailed analysis of the prospects and concerns of using the Social Web for communicating the elements of pattern engineering along different dimensions is carried out. In particular, the role of 'collective intelligence' and of the technologies/applications underlying the Social Web including blogs, folksonomy, mashups, microformats, podcasting, social bookmarking, social networking, and Wikis, is highlighted. Next, challenges and directions for future research are outlined. Finally, concluding remarks are given.

BACKGROUND AND RELATED WORK

This section presents a synopsis of terminology specific to patterns and a perspective of related work. In particular, limitations of the current media towards communicating the elements of pattern engineering are highlighted.

A Terminological Overview of the Pattern Space

There is currently no standard or a reference model for terminology related to patterns. Therefore, for the definition of the members in the *pattern space*, this section relies on selected publications (Appleton, 1997; Meszaros & Doble, 1998; Buschmann, Henney, & Schmidt, 2007b) that can be considered as authoritative.

A *pattern* is defined as an empirically proven solution to a recurring problem that occurs in a particular context. There are several possible views of a pattern. From a structural viewpoint, a pattern is typically described using an ordered list of elements that are labeled as (pattern) name, author, context, problem, forces, solution, examples, and related patterns. At times, the labels may vary across community, and other (optional) elements, such as those related to *metadata*, may be included to enrich the description.

The name element of a pattern is an evocative, often a noun-phrase, metaphor reflecting the nature of the solution; the author element gives the identity of the pattern author(s); the context element provides the situation or pre-conditions within which the problem occurs; the forces element provides the constraints that are resolved to arrive at a solution; the solution element provides an abstract, general, and reusable solution to the problem and is shown to work in practice via an examples element; and the related patterns element outlines any other pattern(s) to which a pattern is related to in some way. It is this structure that makes patterns more practical in their applicability compared to other expert bodies of knowledge such as principles, guidelines (Wesson & Cowley, 2003), and heuristics.

A pattern is usually referred to by its name. In this paper, the name of a pattern is listed in uppercase in order to distinguish it from the surrounding text.

There are other members in the pattern space closely related to a pattern. An *anti-pattern* is a pattern that suggests a 'negative' solution to a given problem, and occurs when the context of the problem is not understood or the underlying forces are not optimally balanced. A *patlet* is a 'simplified' description of a pattern, providing only a short statement of the problem and solution, and does not include other elements. A *pattern thumbnail* is similar to a patlet except that it is usually accompanied with a picture of the solution. The purpose of both patlet and a pattern thumbnail is to briefly introduce a pattern (without engaging in details) so that a pattern reader can make an informed decision whether or not to read any further. This can be particularly significant when there is a large collection of patterns to select from.

It is rarely the case that a pattern exists in isolation. Indeed, a pattern is often intimately related to other patterns in many different ways. A *pattern language* is a network of patterns that are intimately related to each other by a common goal and collectively solves a larger problem than that possible by any individual pattern. The collection of patterns in a pattern language when taken together forms a 'vocabulary' that can be used by the actors for communication.

A sequential reading through the text of a lengthy pattern language may not be sufficient to gain an overall picture that is necessary for its understanding and subsequent use. A compact graphical representation can be useful in such a case. For a given pattern language, a *pattern language map* is a visual presentation of patterns and their relationships.

A *pattern management system* (PMS) is an interactive software system with responsibilities that include archiving a selected collection of patterns that could evolve (added, deleted, or modified), facilitating the discovery of those patterns via navigation or searching, and rendering those patterns on a user agent. For example, a PMS could be based on a client-server environment of the Web (Kamthan, 2008).

A *pattern realization process* (PRP) is a collection of activities and their interrelationships for specifying a pattern. The activities themselves can either be individual or social.

Finally, *pattern engineering* (PE) is a systematic and disciplined approach to the definition, subsequent use and maintenance, and interface to humans, machines, and other entities of knowledge of a member of the pattern space within the given constraints of available resources. A PRP is a part of PE.

Medium for Communicating the Elements of Pattern Engineering and the Human/Social Factors

Every means of communication requires a medium. From 1970s to about mid-1990s, patterns were essentially restricted to print medium like commercial-only books or event proceedings. According to an empirical study (Henninger & Corrêa, 2007), the print medium continues to dominate as a major channel for publishing patterns.

However, a print medium provides limited opportunities for communication. In particular, it enables only a one-to-many communication paradigm; there is no interaction; information in modalities like animation, audio, video, or three-dimensional graphics can not be communicated; there is notion of presentation, not of representation; a reuse can only be realized through citation or duplication; entities (such as books) are essentially isolated from each other; it is not possible to provide multiple views of the same information (for example, change the level of magnification) or, on-demand, present information at different levels of abstraction; and there is no support for hypertext.

In the past decade or so, the electronic (digital) medium, particularly the distributed environment of the Internet and the Web, has proved to be a useful vehicle for communicating elements of PE in different sensory modalities. The use of electronic mail (e-mail) and Internet Relay Chat (IRC) services, both of which predate the Web, has conventionally been made for communicating asynchronously and synchronously, respectively. As indicated by surveys (Deng, Kemp, & Todd, 2005; Henninger & Corrêa, 2007), mailing lists and newsgroups dedicated to patterns have spawned and various domain-specific portals/repositories for patterns, usually equipped with navigation and search mechanisms, have been established.

However, mailing lists and newsgroups provide limited capabilities for organizing patterns (Manolescu et al., 2007). Furthermore, a conventional repository is limited by one or more of the following issues: it tends to be prescriptive; it still only enables a one-to-many communication paradigm; it usually only provides an author-view of patterns where the role of a reader is that of a mere observer, not a contributor; and, in general, any human or social relationships in PE are not always made explicit. This is prohibitive to the advancement of patterns and could potentially undermine their significance.

To alleviate some of these issues, human and social aspects of the PRP and subsequent deployment, in addition to technical considerations, is necessary. There have been some partial efforts in that direction such as the use of Wikis (Weiss & Birukou, 2007) but an in-depth analysis has not been carried out. This lends one of the motivations for this paper.

A FRAMEWORK FOR COMMUNICATING THE ELEMENTS OF PATTERN ENGINEERING USING THE SOCIAL WEB ENVIRONMENT

This section posits SW4PE, a framework for communicating the elements of PE via the Social Web illustrated in Figure 1. In the forthcoming sections, the actors of patterns are identified and classified, the details of the PRP are specified, the actor-specific requirements for communicating the elements of PE are outlined and, based on these, the prospects/concerns of integrating the Social Web technologies/applications in PE in general and PRP in particular are discussed in detail.

A Model for Actors of Patterns

According to the CLEAR TARGET AUDIENCE pattern (Meszaros & Doble, 1998) and the CONSISTENT “WHO” pattern (Harrison, 2003), the external entities to which a pattern is being communicated need to be recognized. An *actor* is a person who has interest in a pattern for some purpose. Based upon their *roles*, the possible actors of patterns can be identified and classified as follows:

- **Producer:** *Pattern Author* (responsible for authoring a pattern), *Pattern Shepherd* (responsible for inspection and feedback on a pattern), *Pattern Writers’ Workshop Participant* (responsible for inspection and feedback on a pattern), *Pattern Engineer* (responsible for providing means for representation and presentation of a pattern), and *Pattern Administrator* (responsible for maintenance and management of patterns).

- **Consumer:** *Pattern Reader* (target for perceiving a pattern) and *Pattern User* (target for using a pattern).

The actor classification scheme has a few properties. In it, the actors are not necessarily mutually exclusive. For example, there is a generalization-specialization relationship between a pattern reader and a pattern shepherd and the same between a pattern reader and a pattern user; however, the converse in both cases is not necessarily the case. The same person can also take upon different roles, and the same role can be taken upon by different persons. For example, a person casually reading a pattern plays the role of a pattern reader but given the write permission can (at least in part) play the role of a pattern administrator. The Social Web has made the boundaries among actors increasingly fuzzy as a professional pattern consumer can become a voluntary pattern co-producer, or a pattern 'prosumer' (Shuen, 2008).

Remarks

The actor classification scheme can be granularized further if needed. For example, a pattern reader and a pattern user could both be categorized further into *novice* and *expert*, or into *putative*, *potential*, or *future*. Also, pattern user could be labeled as a secondary actor, while all other actors as primary actors.

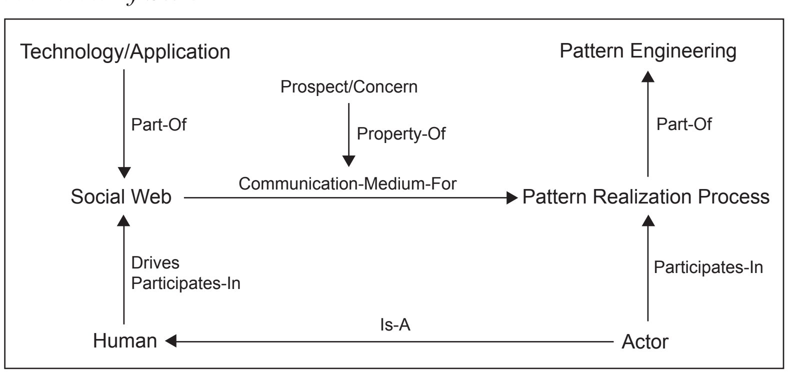
The actor classification scheme can also be extended. For example, a pattern reader could be generalized to a pattern percipient. A means of creating a taxonomy of actors for a general software system is available (Alexander, 2005), the discussion of which is beyond the scope of this paper.

A Model for a Human-Centric and Evolutionary Pattern Realization Process

The PRP is an actor-centric, iterative, and incremental process, the resulting product of which is a pattern. A *workflow* of PRP is a high level organization unit that consists of one or more activities. As shown in Figure 2, there are a number of workflows in PRP, including (1) *planning*, (2) *developing*, (3) *representing and presenting*, (4) *inspecting and revising*, (5) *publishing*, and (6) *maintaining*. These are prefixed by (0) *internalizing knowledge and assessing viability*, which is a prerequisite to the workflows that follow.

[0]. Internalizing Knowledge and Assessing Viability

Figure 1. A high-level view of SW4PE



The two recommended approaches for acquiring internal knowledge are *individual* and *sociological*. In an individual approach, there is a single pattern author who relies on personal experiences *and* extrospections (observations) based on others' experiences; in a sociological approach, there are multiple pattern authors relying on each other's experiences.

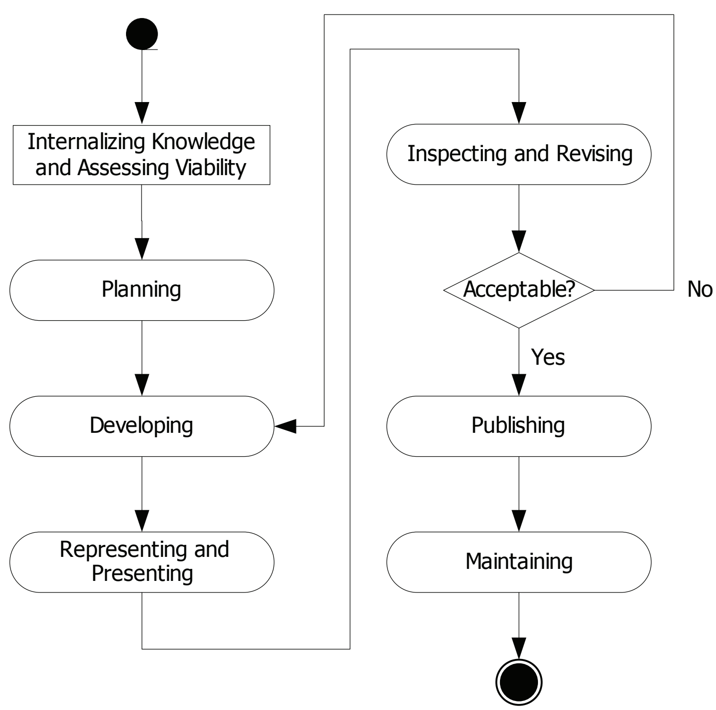
For the sake of discussion, consider the individual approach. It is assumed in this paper that practice involves action (doing). The practice over a period of time by a person of repeatedly solving a problem in some domain leads to experiences. Among other factors, the ensemble of the experiences themselves and of the retrospective after each experience (and perhaps extrospections based on others' experiences), lead to insight. The experiences also lead to acquirement of skill. It is then insight *and* skill together that form expertise. The a posteriori, situated, and experiential knowledge internalized by the person is either implicit or tacit. The person may voluntarily decide to share the implicit knowledge with others. For that, the implicit knowledge needs to be externalized (articulated) to explicit knowledge. At that point, the person takes upon the role of a (potential) pattern author.

Based on the expertise and research of existing pattern base, the pattern author determines the viability of proposing a 'new' pattern (also known as the *proto-pattern*) to the pattern community at-large (including target pattern readers and potential pattern users). As part of this workflow, the pattern author also checks for the existence of patterns that may be similar or variants of the one being proposed. This workflow concludes with a favorable decision to proceed with the definition of a proto-pattern.

[1]. Planning

In order for the PRP to be productive, the definition of the proto-pattern requires appropriate planning by the pattern author(s). The planning

Figure 2. The sequence of workflows in a pattern realization process



needs to include an assessment of the availability of resources including time, effort, expert body of knowledge, and tools. In case of multiple pattern authors, schedules for meetings also need to be decided upon.

There is a cost factor associated with the PRP. In particular, if the pattern author seeks a 'formal' analysis of the proto-pattern, there is cost involved in traveling to the Pattern Languages of Programming (PLoP) 'family' of conferences. There can perhaps also be ancillary cost related to publishing and administering the proto-pattern. The exceptions to this are the voluntary time and effort of the pattern authors and pattern shepherds.

There are a few non-commercial resources at the pattern author's disposal to assist in the PRP. These include expert bodies of knowledge like guidelines (Buschmann, Henney, & Schmidt, 2007b) and patterns (Meszaros & Doble, 1998; Harrison, 2003) for describing patterns, and patterns for shepherding (Harrison, 2000) and Writers' Workshops (Coplien, 2000). There are also tools for representing and presenting the patterns, the discussion of which is delegated to later sections.

[2]. Developing

For the purpose of referencing, the pattern author assigns an evocative name to the proto-pattern. From an analysis of the given information, the pattern author then abstracts the problem and, guided by previous personal experiences and extrospections based on others' experiences from [0], explicitly places the problem in a specific context that reflects the scope of the problem.

Next, a general and (conceptually) reusable solution for the problem needs to be devised. This is achieved via abstraction of instances of the solution from personal experiences and extrospections based on others' experiences from [1]. The solution describes both the process *and* the thing (created by the process). The purpose of the process aspect of the solution is pedagogy. It is likely that the problem has more than one solution, and that each solution has its own advantages and disadvantages. The 'best' solution is chosen based on an optimal balance (or equilibrium) of forces (constraints), which are usually the desirable quality attributes of the solution (Lea, 1994). From an examination of previous work, it appears that the means of achieving this balance are not given.

Since even the best solution is not absolute, the pattern author examines the implications (consequences) of applying the solution. The consequences could include forces that are not entirely resolved as well as new forces that may arise. This may lead to the need for other pattern(s), which is the inception of a pattern language.

The solution proposed by the proto-pattern must be generative (Lea, 1994), that is, it must be demonstrably proven to work. Therefore, based on the 'rule of three' (Meszaros & Doble, 1998), the pattern author elicits three solution instances or examples that best demonstrate the feasibility of the proposed solution. The examples could possibly be from earlier personal experiences and extrospections based on others' experiences from [0]. However, since the proto-pattern is based on empirical knowledge, it is prone to subjectivity. Therefore, to lend some degree of objectivity, these examples should not exclusively be internal, that is, they should not be all from the pattern author's personal experiences. In other words, there must be at least one external example.

Finally, the proto-pattern is placed in its social context. To do that, related patterns (if any) along with their relationships to the proto-pattern are listed.

[3]. Representing and Presenting

In order to become explicit, the information in [2] needs a suitable means of representation. A representation can subsequently be presented in one or more ways, in one or more sensory modalities, to make it perceptible to an actor.

In this workflow, the pattern author selects one of the available means for representing and presenting the proto-pattern (that are made possible by a pattern engineer), keeping the needs of the readership (Meszaros & Doble, 1998; Harrison, 2003) into consideration. The possible means for representing and presenting a proto-pattern can vary across the spectrum of formality (informal, semi-formal, formal), modes (text, graphics), open/closed technology, and so on.

For example, proto-patterns (and even an entire proto-pattern language) may be represented (Kamthan & Pai, 2006a) in the Extensible Markup Language (XML) and, depending on the target device, subsequently presented in one of the profiles of the Extensible HyperText Markup Language (XHTML) that is targeted for the Web or in the Portable Document Format (PDF) that is targeted for printing. This marks the end of the first iteration of the PRP.

[4]. Inspecting and Revising

The proto-pattern may go through an informal inspection (a non-anonymous, highly recommended but optional, review process) to evaluate the characteristics of the proto-pattern.

The prime example of inspection includes submission of the proto-pattern to one of the members of the PLoP 'family' of conferences, which leads to shepherding (which is one-on-one mentoring of the author by another person, namely the pattern shepherd, who is familiar with the underlying domain and is experienced in describing patterns) followed by participation in a Writers' Workshop (which is a face-to-face structured peer review process involving domain experts). The inspection may lead to a few iterations of the proto-pattern and thereby a re-visitation of [2] and [3]. At the end of the inspection, the proto-pattern may reach the candidacy of a pattern.

The pattern author, individually or otherwise as a result of the inspection, may associate a rating reflecting the confidence or maturity level of the pattern. Before publication, the pattern author may also optionally include metadata information related to configuration management, copyright/licensing, and so on, in the description of the pattern.

[5]. Publishing

Up until now, the pattern is limited to internal consumption. In order for the pattern to reach a broader community (beyond the pattern author(s), pattern shepherd, and participants of the Writers' Workshop), it needs to be published in a public environment.

The pattern is published in some (usually print and/or electronic) medium that is deemed reachable to the patterns community. The Web in general and the Social Web in particular is one candidate medium for publication of patterns. For example, a Web Application for patterns could be developed in a systematic manner (Kamthan, 2008) that archives and serves desirable patterns.

[6]. Maintaining

If needed, a pattern administrator carries out corrective and/or adaptive maintenance of pattern(s) on a timely basis. Furthermore, these pattern(s) may also be integrated (into a larger collection) and organized (classified and indexed) in some way. This concludes the conventional PRP from the viewpoint of the pattern producers.

A pattern, once published, does not get 'retired' or 'terminated' (in the sense of hardware or software systems). However, for various reasons, it may lose support and go out of use.

Remarks

A few remarks concerning PRP are in order. From the description of PRP, it is evident that PRP is non-linear and its workflows are not necessarily mutually exclusive. PRP also relies on human creativity and can not be completely automated. In some ways, PRP is similar to agile software development methodologies and open source software development processes but it is not as rigorous or formal. There has traditionally been modest involvement (if any) of the pattern consumers in PRP. This changes significantly by the introduction of the Social Web as a medium in the PRP.

A multidisciplinary, interdisciplinary, and participatory methodology called Identification-Development-Refinement (IDR) for realizing interaction design patterns has been proposed previously (Winters & Mor, 2008). However, IDR does not precisely identify actors or provide details of their involvement, rejects shepherding, and its steps are subsumed by that of PRP.

Actor-Specific Requirements for Communicating the Elements of Pattern Engineering

This section lists computing environment-, domain-, and technology-independent requirements for communicating the elements of PE driven by the needs of the actors. These informally collated requirements are identified by the prefix [PE-CR-n], n = 1, 2, 3, 4, and stated as follows:

- **[PE-CR-1]** It should be possible for a pattern author to readily describe a proto-pattern; it should also be straightforward for a pattern shepherd to readily inspect and provide feedback on it (in proximity as well as remotely). In general, a pattern author and a pattern shepherd should be able to collaborate and share a proto-pattern.
- **[PE-CR-2]** It should be possible for a pattern engineer to provide a means to represent and present proto-patterns.
- **[PE-CR-3]** It should be possible for a pattern administrator to manage (including store, retrieve, process (manipulate, transform), modify, and delete) a collection of patterns with minimal effort.
- **[PE-CR-4]** It should be relatively easy for a pattern reader (and a potential pattern user) to be able to locate, read, and understand a pattern and, with appropriate permissions, be able to distribute the pattern. It should be possible for a pattern reader to contact the pattern author and the pattern administrator.

These requirements serve as a guide for the rest of the paper. The use of qualitative terms in the statements [PE-CR-1] – [PE-CR-4] is intentional: their quantification is possible but is beyond the scope of this paper. In the following, symbols [+PE-CR-n] and [–PE-CR-n], n = 1, 2, 3, 4, are used to respectively denote strong and weak conformance to the corresponding requirement.

Communicating Patterns using the Social Web Environment

The Social Web has recently emerged as a perceived extension of the current Web that fosters ‘collective intelligence’ (Engelbart, 1995) and further decentralization. The notion of the apparent ‘humanization’ and ‘socialization’ of the Web is not new and dates back to the early days of the Web. Indeed, amazon.com and eBay are classical exemplars of consumer participation that introduced product review/recommendation and feedback, respectively. The notion of decentralization also has its predecessor in file sharing via Peer-to-Peer (P2P) computing.

However, it appears that there are three primary factors that have brought the vision of the Social Web to a mainstream realization: (1) it enables a many-to-many communication paradigm; (2) the maturation of the underlying technological infrastructure and the availability of its implementations as open source, and (3) the awareness, followed by immense interest and large-scale participation, by the public in general.

This paper advocates retaining the advantages that the Web offers towards communicating the elements of PE and assessing the viability of the Social Web in extending those advantages. The Social Web provides the medium in which human-to-machine-to-human communication takes place to realize human-to-human communication.

Scope of SW4PE: Open Problems in Patterns—Beyond Information Technology and the Web

There are certain impediments that the actors currently face in their dealings with patterns. In the future, it is theoretically possible that some of the issues, like the existence of a meta-index of repositories (Manolescu et al., 2007) or means for more precise search/retrieval might be addressed and even get resolved by technological means within the realm of the Web and its extensions.

Still, there are other pressing issues, like existence of a coordinating body for patterns, standardization of terminology related to pattern engineering body of knowledge (PEBOK), standardization of representations of patterns, or making all patterns as open/freely available content, that are obstacles to pervasiveness of patterns. These issues naturally constrain SW4PE, and are likely to remain beyond the scope of the Web and its foreseeable extensions.

AN ASSESSMENT OF THE PROSPECTS AND CONCERNS FOR COMMUNICATING THE ELEMENTS OF PATTERN ENGINEERING USING THE SOCIAL WEB ENVIRONMENT

In this section, based on the background set forth in the previous sections, the prospects as well as the concerns in deploying the Social Web are each assessed along certain dimensions.

Prospects for Communicating the Elements of Pattern Engineering via the Social Web

There are certain aspects of patterns that make them a natural fit within the environment of Social Web. In this section, the potential of the Social Web for communicating the elements of PE is explored along the lines of [PE-CR-1] – [PE-CR-4] and, to that regard, specific examples are provided.

Collaborating and Sharing

There is need for collaboration and sharing during the different workflows of the PRP. A pattern reflects *shared* understanding of a domain, and can be viewed as a shared resource or 'commons' (Hess & Ostrom, 2007). In the PRP, the transition of a proto-pattern to the status of a pattern inevitably involves collaboration during shepherding and during Writers' Workshops. Also, a pattern author needs to be cognizant and be sensitive to pattern readers' concerns. The Social Web lends various opportunities for collaboration and sharing, which we consider next.

Collaborative Researching

The Web has become an indispensable source for researching for information, and the same holds for elicitation of domain knowledge (such as elicitation of pattern instances) during the PRP. There are Social Web applications like Google Notebook and Microsoft OneNote that allow one to attach notes to and clip text, graphics, and links during researching. These 'notebooks' can be saved, and can subsequently be used for collaboration and sharing with others. Furthermore, the 'notebooks' in Google Notebook can be exported to Google Docs.

Social Scheduling

A face-to-face meeting, whether it is for sociological approach to elicitation of domain knowledge or for Writers' Workshop, requires scheduling. A schedule that is agreeable to all, particularly as the number of persons involved increases, can become difficult to manage. The use of Social Web applications that facilitate calendar sharing (such as the Google Calendar) can reduce some of the tedium involved in scheduling a meeting agenda.

Brainstorming

Brainstorming is implicit to various activities in the PRP. For example, in a sociological approach to elicitation of domain knowledge, the authors often engage in brainstorming (for collectively organizing their thoughts and recall, for collaborative decision making, and so on). The same idea applies to the dynamics of shepherding.

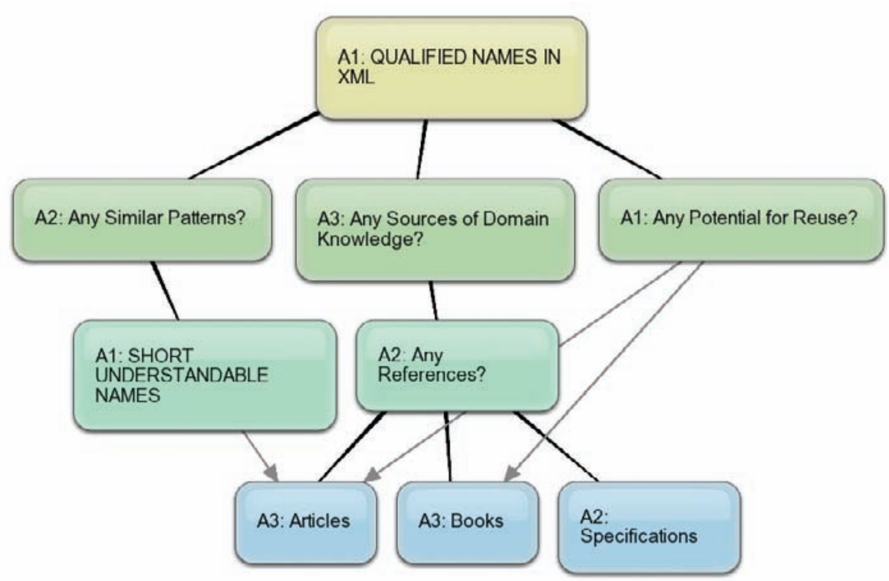
One way to brainstorm is through visualization, and mind mapping is a graphically-oriented approach to realize it. A mind map is a graph where nodes represent sub-ideas (or sub-goals or sub-tasks) at different levels of granularity and vertices represent 'semantic' relationships, all of which are arranged radially around a central idea (or goal or task, respectively). The pattern authors can share these mind maps over the Web and, depending on the permissions, read and/or edit others' maps.

Figure 3 illustrates a snapshot in time (work in progress) of a mind map using the bubbl.us tool (http://www.bubbl.us/). In it, three authors, namely A1, A2, and A3 are in a brainstorming session on the viability of a proposed pattern. The 'bubbles' reflect respective inputs by pattern authors.

Collaborative Authoring

The Social Web presents a suitable environment for collaborative authoring of patterns using various means including Google Docs and Wiki. The concept of Wiki (Leuf & Cunningham, 2001) was invented in the mid-1990s as a group communication utility. It allowed open editing of information

Figure 3. An example of a partial mind map reflecting a brainstorming session on the viability of the 'new' QUALIFIED NAMES IN XML pattern

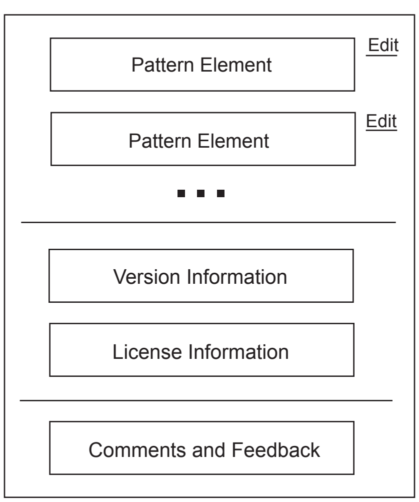


(like patterns) as well as the organization of the contributions and, with various enhancements, continues to serve well in that vein (Weiss & Birukou, 2007). A properly administered Wiki assists pattern authors, pattern shepherds, and pattern readers. Indeed, barring certain reservations, a Wiki environment enables a person to play the dual role of a pattern reader and a pattern administrator.

There are several, opens source flavors of Wiki available today addressing different target groups and organizational needs. Most flavors of Wiki, including MediaWiki and TinyWiki, can be easily acquired, installed, and administered under commonly-deployed computing platforms (Ebersbach, Glaser, & Heigl, 2006). For example, Asynchronous JavaScript and XML (AJAX) Patterns (http://ajaxpatterns.org/) and Perl Design Patterns (http://perldesignpatterns.com/) are collections of patterns based on MediaWiki and TinyWiki, respectively.

Figure 4 presents a simplified view of the description of a pattern within the Wiki environment. The mandatory elements of a pattern can be presented where they can be progressively disclosed (Lieberman, 2007) and edited; the details of history of the document can be automatically highlighted through version information; licensing terms can be made explicit; and pattern reader's feedback can be solicited and included. The figure could, for example, be extended by the addition of a block for the table of contents (in case the document is lengthy).

Figure 4. A glimpse into an abstract, partial view of the description of a pattern within the Wiki environment



It is not absolutely necessary (although it may be relatively easier) to deploy Social Web technologies/applications for realizing collaboration. The conventional technologies/applications that have found success on the Web such as the Personal Hypertext Preprocessor (PHP) can be used to achieve similar effect as a Wiki. For example, a collection of patterns for 'living spaces' (http://architypes.net/patterns.php) is built from collaboration between architects, interior designers, and photographers.

Syndication

Every so often pattern consumers need to keep track of several resources on patterns, including announcements of new patterns or modifications of the existing ones, availability of relevant books or podcasts, and so on. However, individually and somewhat arbitrarily visiting each Web Site of interest can be inconvenient and time consuming. The subscription to periodically refreshable news feeds helps ameliorate this issue.

Syndication is a type of metadata implemented in form of channels that point to relevant resources on a topic that the pattern readers can subscribe to. There are a variety of syndication technologies of which Really Simply Syndication (RSS) and Atom are beginning to find broad support in conventional user agents and news feed readers.

For example, the following RSS markup fragment represents news for a specific day from a single channel:

```
<?xml version="1.0" encoding="UTF-8"?>
<rss version="2.0">
  <channel>
     <title>Pedagogical Patterns Channel</
     title>
    <link>http://www.pattern.ca/</link>
    <description>
     This is a channel for news on patterns
     related to teaching and learning
       in the classroom.
    </description>
    <item>
       <title>News for January 15, 2008</
     title>
   <link>http://www.pattern.ca/2008/01/15/</
     link>
       <description>
        The interview of the author of the
     recently published book titled
       Patterns in the Classroom is avail-
     able as a podcast ...
       </description>
    </item>
  </channel>
</rss>
```

It could, for instance, be stored in a file named `PedagogicalPatterns.rss` and linked from a place that pattern readers could readily discover.

Social Bookmarking

Bookmarking has traditionally been one of the most common ways of remembering the resources of interest visited while browsing on the Web. However, these bookmarks reside on the user's computer and are not accessible by other devices (and therefore are not shareable).

Social bookmarking enables management (for example, storage, organization, search, and sharing) of booksmarks residing remotely at third-party services. By unifying their knowledge base, social bookmarking can help pattern authors and pattern shepherds communicate more effectively during the PRP. By expending modest effort, it can also help pattern consumers share links to resources (including desirable patterns) amid themselves. The notion of social bookmarking was pioneered by itlist.com in the mid-1990s and brought into mainstream around 2003 by del.icio.us. Since then other social bookmarking services like Google Bookmarks have spawned.

Organizing and Social Networking

It was claimed more than a decade ago that "finding patterns is much easier than describing them" (Gamma et al., 1995). On the Web, one could locate a pattern one of the following three ways: (1) directly using the (known) address where a pattern resides, (2) by navigating to the address, or (3) by searching through a collection. However, the rapid growth (Henninger & Corrêa, 2007) of the number of patterns and pattern languages has made the task of locating desirable patterns increasingly challenging for the pattern readers. Still, by participating in the Social Web, the pattern consumers can help one another (and indirectly help the pattern producers) in somewhat easing the task of locating desirable patterns, and folksonomy is one way to do that.

Folksonomy

A suitable organization of patterns is critical for locating desirable patterns. However, the search for a suitable organizing scheme for locating desirable patterns continues to remain a persistent and elusive problem (Hafiz, Adamczyk, & Johnson, 2007).

A crucial aspect of organization is classification. There is no universal scheme for classifying patterns: a pattern placed in one category by its author(s) can reappear as belonging to a different category in a different pattern language by another set of author(s). For example, the MODEL-VIEW-CONTROLLER (MVC) pattern (Buschmann, Henney, & Schmidt, 2007a) can be classified in multiple different ways, including categories that are not envisioned by its original author(s) but are considered relevant by its pattern readers and pattern users. This 'post-publication' faceted classification of a pattern is possible by social annotation, specifically via the notion of folksonomy or social tagging (Smith, 2008).

Folksonomy enables pattern readers to associate with a resource words or phrases that they deem meaningful, relevant, and significant in describing the resource. By doing so, there is an implicit assumption that other (new) pattern readers will share and benefit from this understanding of the resource.

Folksonomy can be realized in several different ways. For instance, the semantics of the XHTML documents can be extended using certain mechanisms within the `div`, `span`, and `class` elements, and `id` and `rel` attributes. Microformats (Allsopp, 2007) are an effort to standardize the conventions for using these extension mechanisms. In XHTML, the attribute-value pair `rel="tag"` can be used to indicate that the resource that has been linked-to acts as a tag for the current context. For example, to tag an XHTML document describing the MVC pattern with 'Distributed Computing,' markup such as `<a href="http://path/to/MVC/" rel="tag">Distributed Computing</a>` could be used.

A collection of tags can lead to the formation of a tag cloud. (There are some resemblances between a tag cloud and the classical Web concepts of image map and site map.) A tag cloud is set of related tags with associated weights that represent frequency of use of each tag. The tags within a tag cloud are usually ordered lexicographically and the frequency of use of each tag is illustrated by visual cues such as distinct font color and size. It is preferable to use a style sheet language such as the Cascading Style Sheets (CSS) for associating presentation semantics with tags.

The 'human element' of the Social Web—as personified by mutual collaboration among the actors in locating desirable patterns through navigation—can be realized in the following manner: by proper organization of tags and representation of weights in a tag cloud, pattern administrators and pattern engineers can help the pattern readers, and by a careful selection of tags, pattern readers can help each other.

Figure 5 shows a tag cloud for the MVC pattern. It can be noted that the tags are not all of the same type: while some are about things, others are about people. For example, Modularity is a software engineering principle; POSA is the acronym for Patterns for Software Architecture; and Trygve Reenskaug is the person who is ascribed for first introducing MVC, and the tag could, for instance, link to a resource that acknowledges this.

The above idea can be extended to tagging a pattern language map that is dynamically-generated and expressed in a vector graphical language such as the Scalable Vector Graphics (SVG).

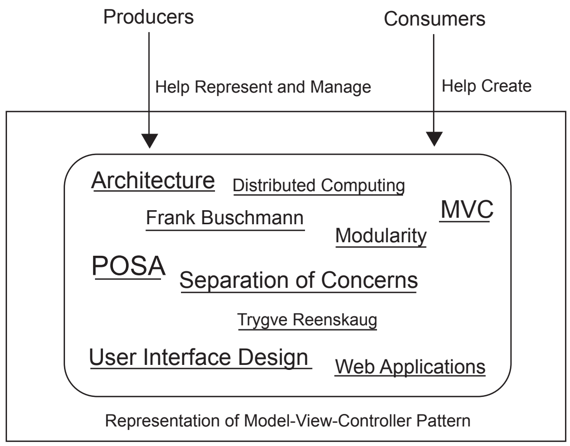
Social Networking

There are plenty of opportunities for social networking (Freeman, 2004) during and after the PRP. A variety of different types of social relationships can exist among the actors including pattern author-to-pattern author, pattern author-to-pattern shepherd, and pattern reader-to-pattern reader that can be made explicit.

The XHTML Friends Network (XFN) is a specification for explicitly indicating social networking relationships using `rel` attribute values in XHTML on blogroll links. For example, XFN values can be added to the `rel` attribute by a pattern author to indicate that John Smith is the shepherd, is a colleague, and is someone the author has met, using the following markup:

```
<ul>
  <li>
    <a href="http://john.smith.ca/"
        rel="colleague met shepherd">John
     Smith</a>
  </li>
</ul>
```

Figure 5. A tag cloud embedded in the abstract representation of the MODEL-VIEW-CONTROLLER pattern



The social networking relationships expressed in XFN could be exploited by programs like bloggers, search engines, or spiders.

Publishing

The authors of patterns and pattern languages publish their work at the end of the process. In doing so, there are several issues involved. The representation and presentation of a published pattern can often be heterogeneous in nature, involving the use of different modes of information (text, graphics, source code, and so on). For instance, the solution of a pattern, particularly that is structurally-oriented, is usually accompanied with a picture illustrating the solution in an abstract manner or of its instances (examples). Any publishing also needs to take into account that some information can be reused and repeated at multiple places, and it needs to evolve independently for an effective maintenance. For example, the picture in a solution may also be a part of a pattern thumbnail. It is also possible that the author may not have complete technical control or legal rights to physically include some of the desirable information but nevertheless still needs to point to it. From a Social Web viewpoint, these considerations, if appropriately carried out, are suitable for a mashup.

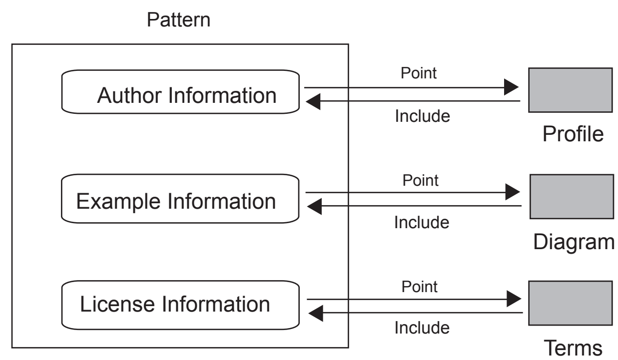
Mashups

A mashup aggregates and reuses information from multiple sources. This is accomplished via some means such as a transclusion (Nelson, 1982), which is an on-demand inclusion of one resource into another via hyperlinking and/or a programmatic mechanism like an Enterprise Mashup Service (EMS), which is a Web Service based on the Service-Oriented Architecture (SOA). It then presents information in a federated manner that is transparent to a pattern reader.

Figure 6 illustrates an abstract construction of a pattern mashup in which author information, picture of an example, and licensing terms are 'transcluded' from external sources.

Both pattern authors and pattern readers (using, say, iGoogle) can benefit from mashups. For example, the description of a user interface pattern could reside on one server and, after receiving appropriate permissions, 'transclude' a picture depicting a solution instance from another server (like that of Flickr). As another example, the author can indicate that the pattern is licensed under the Creative Commons 3.0 Attribution Required License by including the markup `<a href="http://creativecommons.org/licenses/by/3.0/" rel="license">CC by 3.0</a>` in an XHTML document.

Figure 6. A pattern mashup that points to and includes three different external sources



Deliberating, Educating, and Outreaching

It is the responsibility of the pattern authors to make a considerate effort to reach their audience of pattern consumers and, in doing so, use any means available to them. Being able to publish is only one aspect of communicating the elements of PE: it is also indirect, passive, and static, where the human side of patterns is less apparent. The Social Web presents an array of possibilities for direct, active, and dynamic means for communicating the elements of PE through a judicious use of media outlets. In particular, blogging and podcasting are asynchronous and synchronous means of communicating, respectively.

Blogging

A blog is an outlet for anybody to publicly express opinion, in writing, on just about any subject. In side bar of a personal blog, a blogger can provide a list of other blogs (or a blogroll).

There are a few benefits of blogging for the actors of patterns. Blogging gives pattern authors to respond to concerns of pattern consumers in an informal environment, inform others of their scholarly activities related to patterns (like relevant presentations at events), or state their current position about the (mis)use of patterns. For example, for the past few years, Grady Booch has been blogging about issues related to the Handbook for Software Architecture (http://www.booch.com/architecture/), which is one of the largest collections of patterns on software architecture. Blogging also gives pattern readers an opportunity to ask questions, and make their agreements and disagreements known in a public forum. For example, the Software Patterns Blog (http://pattern.ijop.org/) has been used by Mohamed Fayad to express concerns regarding current obstacles to learning and selecting patterns.

Podcasting

Podcasting provides an avenue to the pattern community for education and outreach by means of audio and video. For example, YouTube (http://www.youtube.com/results?search_query=Patterns) provides a platform for authors to post their presentations from events or other forms of media supporting patterns for a general audience without having to provide the service themselves. The pattern readers can provide comments on the videos, rate the videos, and add the videos to their list of social bookmarks.

As another example, the Software Engineering Radio (http://www.se-radio.net/) offers podcasts for interviews on software engineering related topics in general (Rech, 2007) and software patterns in particular. These interviews provide an opportunity for the authors to *converse* about patterns: demonstrate the patterns process by answering questions related to their experience in the domain, including successes and failures; draw attention to the history of patterns they elicited; mention the reasoning behind the selection of a means of representation or choice of examples; and so on.

Table 1. A mapping of activities in PE and concepts/activities associated with the Social Web

Pattern Engineering Activity	Social Web Concept/Activity
• Eliciting Pattern Instances	• Collaborative Researching • Brainstorming
• Assessing the Viability of the Pattern	• Brainstorming
• Eliciting Domain Knowledge (Sociological Approach)	• Social Scheduling
• Locating Expert Body of Knowledge for Authoring a Pattern	• Folksonomy • Social Bookmarking • Syndication
• Selecting Expert Body of Knowledge for Authoring a Pattern	• Brainstorming
• Participating in Writers' Workshop	• Social Scheduling
• Locating the Means for Representing and Presenting Patterns	• Folksonomy • Social Bookmarking • Syndication
• Selecting the Means for Representing and Presenting Patterns	• Brainstorming
• Authoring a Pattern	• Collaborative Authoring
• Assuring the Quality of a Pattern	• Social Web Application
• Representing and Presenting a Pattern	• Mashup • Microformat
• Publishing a Pattern	• Social Web Application
• Shepherding	• Collaborating • Social Networking
• Evaluating the Quality of a Pattern	• Collaborating
• Locating a Pattern	• Folksonomy • Microformat • Social Bookmarking • Syndication
• Reading and Understanding a Pattern	• Folksonomy
• Selecting a Pattern	• Brainstorming
• Using a Pattern	• Blogging • Podcasting
• Reflecting on the Use of a Pattern	• Blogging • Feedback
• Mentoring a Pattern Author, Pattern Reader, or Pattern User	• Blogging • Podcasting • Responding to Feedback
• Maintaining a Pattern	• Social Web Application
• Interfacing a Pattern with Other Entities of Knowledge and Artifacts	• Social Web Application

Table 1 presents a summary of the key activities in PE and supporting concepts/activities corresponding to the Social Web discussed in this section.

Concerns of Communicating the Elements of Pattern Engineering via the Social Web

The integration of patterns within the Social Web is not absolute and has its share of shortcomings. In this section, the scope and limitations of the Social Web for communicating the elements of PE is examined and in doing so specific examples are provided.

Cost to Actors

The issue of cost impacts all actors. The increase in the number of mature, open source implementations of the technologies underlying the Social Web has contributed to control of development costs and thereby to the reduction of entry barrier for aspiring pattern producers. There is still the non-trivial cost of time and effort in learning, especially due to the fact that there is currently no single provider of these implementations and that the interaction (including the user interface functionality) varies tremendously from one application to another.

However, for pattern consumers, the technological infrastructure of the Social Web remains largely exclusive: for optimal operation, it assumes high-speed Internet connection, state-of-the-art operating systems, and latest user agents with up-to-date capabilities on the client-side. This is not all free-of-cost for personal use. In general, 'Rich Internet Applications' of the Social Web are resource-intensive. For example, the mashups in which aggregation of information takes place on the client-side expect hardware and software capabilities that a pattern consumer may not have. As another example, the Software Engineering Radio podcasts are currently not streamed but are available only as download at file sizes that could be prohibitive to those on low bandwidth.

The issue of hardware and network cost is not perennial. If past statistical trends are any indicators, then it is likely to subside with time. The cost of hardware necessary for creating Social Web applications (like computers with fast processor speeds, and large storage space and memory; digital cameras; audio recorders; and so on) has been on decline in the past few years, and reflect a market trend that is expected to continue. The same applies to cost of Internet service. However, it also needs to be noted that the original vision of the Web is yet to be realized: a large segment of the world population does not (still) have access to the Internet in general (Press, 2004) and the Web in particular.

Decentralization and Distribution of Control

The technologies underlying the Social Web can be disruptive: they require change and, in some cases, radical departure from conventional approaches. For instance, the Social Web is not meant for pattern authors working individually in isolation.

Any form of multi-node interaction over a distributed network where a node could be either a human or a machine (like real-time collaboration among author and shepherd, resource sharing, or mashup) creates an indirection. Its success is based on the assumption that it works like a symphony: *all* the nodes involved are available, are in unison, interaction among them is transparent and timely, and so on. The past experience with the Web has shown that the relationship between the probability of success and the number of nodes is not linear (the former can decrease as the latter increases).

The 'transfer' of even some of the traditional control from server-side to client-side has its side-effects that need to be balanced. For example, the exposure of the PRP to the Social Web may lead to a perception by the pattern readers that a pattern is never 'complete' but in a 'perpetual beta' state, which contradicts the characteristic of 'timelessness' (Alexander, 1979) of a pattern. The transfer of control also faces a classical dilemma. For example, moderating feedback by retaining only complimentary messages from pattern consumers or time-delimiting the feedback could be perceived as bias on part of pattern producers, which is against the spirit of openness of the Social Web. In contrast, it is not automatic that all unfiltered feedback driven by 'citizen journalism' or 'user-generated content' contributes to enriching the description of a pattern, and therefore some degree of moderation is necessary.

In spite of several possible uses, the flexibility of blogs and Wikis comes with a price: they are known for 'noise' (including impertinent information), 'casual' writing (due to the presence of phonetic, 1337 style of writing, and frequent spelling and/or grammatical errors), and 'editing wars' (discussions that have morphed into endless debates that put personal interest before that of a pattern reader). These, however, can be attributed to human usage rather than to inherent limitations of the underlying technology. In any case, this impacts the quality of the description of a pattern, and is not favorable to either a pattern administrator ([–PE-CR-3]) or to a pattern reader ([–PE-CR-4]). A partial solution to this issue could be to (1) separation of the description of a pattern as provided by the pattern author from any annotations (which should be clearly labeled and managed as such), and (2) provision of multiple views of a pattern, including the option to suppress any annotations, to a pattern reader.

Folksonomy (as opposed to taxonomy) is an uncontrolled vocabulary, and the lack of terminological control can have linguistic implications due to synonymy, homonymy, and polysemy. In particular, classical issues associated with the natural language use of acronyms can surface. It is not automatic that all tags that are created by pattern consumers may be relevant to the context. For example, MVC has other known expansions like Marriott Vacation Club, the Missouri Valley Conference, and the Motor Vehicle Commission that are irrelevant to the notion of a pattern as discussed in this paper. Similarly, the tag 'Architecture' in the civil engineering sense is not relevant to the MVC pattern. Therefore, once again, to add long-term value, the tags associated with the description of a pattern need to be monitored and moderated.

Semiotic Quality of Representations of Patterns

The theory of semiotics is the field of study of signs in which the communication itself is viewed as interchange of signs. It is known that a pattern can be viewed as a second-order sign of a semiotic system (Buschmann, Henney, & Schmidt, 2007b). It is possible for a sign to have one or more representations.

From a semiotic viewpoint (Stamper, 1992), the quality of the representation of a pattern (and a member of the pattern space in general) can be viewed on six interrelated levels: physical, empirical, syntactic, semantic, pragmatic, and social. This paper focuses on the last two levels. Then, inspired by conventional quality modeling (Fenton & Pfleeger, 1997) and by [PE-CR-1] – [PE-CR-4], pragmatic and social levels can be decomposed further. The desirable pragmatic and social quality attributes of concern to a pattern producer include comprehensibility, legality, and maintainability, while the desirable pragmatic and social quality attributes of concern to a pattern consumer include accessibility, comprehensibility, credibility, performance, readability, reliability, and usability.

The quality of representations of a growing number of patterns and pattern languages on the Web is a concern. In recent years, various accessibility, performance, reliability, and usability issues with patterns and pattern languages made available on the Web have been reported (Dennis & Snow, 2006; Segerståhl & Jokela, 2006; Manolescu et al., 2007). The evaluations (Deng, Kemp, & Todd, 2005) of certain collections of patterns (Gaffar et al., 2003) lead to questions of the credibility of these collections and for which there are no trivial answers.

The technologies/applications underlying the Social Web do not by themselves contribute towards the improvement of many of the aforementioned quality attributes of representations of patterns. In fact, in some cases they can potentially lead to a detriment. For example, let use consider the case of accessibility and legality. The misuse of microformats by overriding the semantics of XHTML attributes or real-time applications based on AJAX that are exclusively visually-driven, mouse-input-only, can be unfavorable to accessibility (Cooper, 2007). The use of fixed fonts and certain colors can make the tags/tag clouds inaccessible to those with certain forms of visual disability. A similar argument holds for podcasts. XFN graphs can become unreadable as the number of nodes and vertices increase. Furthermore, this situation only gets exacerbated with the use of mobile devices to access the Social Web.

The rise of the Social Web has amplified the classical struggle between liberty and legality. The term 'free' in the notion of 'freely sharing' on the Social Web (analogous to the open source movement) stands for freedom. As the same time, the preservation of rights of the creators of digital work is an ongoing challenge in a distributed environment where laws (if any) can vary across jurisdictions, and patterns are no exception. The use of pattern mashups, similar to its predecessors like 'inclining images,' can be open to legal issues related to copyright infringement, irrespective of nature (intentional or inadvertent) of the motive. The issues related to absence of any clear terms of use, or lack of comprehension of misinterpretation of license by an average pattern reader, are yet to be satisfactorily addressed.

Therefore, if the aim is to reach broad, diverse, and global readership, both the pattern producers and the pattern prosumers need to exercise caution towards adopting new, unproven, techniques and technologies in representations of patterns. In particular, as the boundaries between actor classes fade, quality assurance will need to become a *shared* responsibility. In absence of a supervising authority and relying solely on an honor system, this can be admittedly difficult.

DIRECTIONS FOR FUTURE RESEARCH

It is still early to predict the outcome of the Social Web phenomenon in general and its impact on patterns in particular. The work presented in this paper can be extended in a few different directions that are briefly discussed next.

Social Network Analysis of the Pattern Community

The diversity and visibility of participants in public appearances such as events (conferences, meetings, and workshops) in different countries, postings on blogs, mailing lists, and newsgroups, and so on, indicates that the pattern community is thriving. A social network analysis (SNA) of the pattern community, as it continues to grow and morph into a dedicated social network, would be useful.

In particular, quantitative properties of the resulting graph such as centrality, closeness, clustering coefficient, cohesion, density, eigenvector centrality, and radiality, could be analyzed. This could help reveal certain relevant qualitative aspects of the network such as the relationships between actual actors; frequencies of use of specific patterns and pattern languages by certain actors; publications related to patterns and pattern languages recommended by people; demographical use of patterns; new domains of applicability of patterns; and so on.

Using Patterns for Social Web Applications

As shown in Figure 7, there is an apparent *symbiotic* relationship between patterns and the Social Web, one direction of which is explored by SW4PE in this paper.

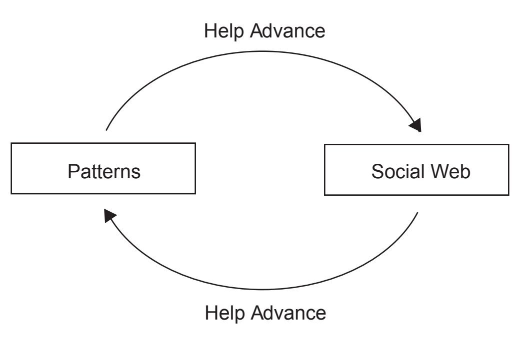
The support for the other direction has been steadily increasing. The User Interface Design Patterns Library (http://ui-patterns.com/) provides, for instance, a TAG pattern and a TAG CLOUD pattern. There are patlets (Decker et al., 2006), patterns, and anti-patterns (Mader, 2008) available for making proper use of Wikis, which in turn could improve the collaboration between patterns authors and pattern readers. There are design patterns for writing new microformats (Allsopp, 2007). There are also patterns available for computer-mediated communication in general (Schümmer & Lukosch, 2007) and for the design of Social Web applications in particular (O'Reilly, 2005) that can assist in the other direction. For example, APPLICATION SHARING, COLLABORATIVE SESSION, SHARED ANNOTATION, SHARED BROWSING, SHARED EDITING, and SHARED FILE REPOSITORY are patterns applicable to the Social Web context. It would be interesting to investigate the impact on the quality of collaboration and the quality of social (groupware) software that make use of these patterns. Finally, the design of Social Web applications typically corresponds to the PUBLISH-SUBSCRIBE architectural pattern.

The Convergence of the Social Web and the Semantic Web: Implications for Patterns

The Semantic Web has recently emerged as another perceived extension of the current Web that adds technological infrastructure for better knowledge representation, interpretation, and reasoning (Hendler, Lassila, & Berners-Lee, 2001). The Social Web efforts and the Semantic Web initiative are not competing but complementing, and need to co-exist. For the sustainability of the architecture of the Web, it is essential that the extensions of the Web evolve harmonically (Shadbolt, Hall, & Berners-Lee, 2006). For a unified view, the Social Web-specific efforts will need to take advantage of formalization (and thereby become more machine-oriented) and the Semantic Web-specific efforts will need to become more human-centric. This can be crucial for a future generation of PMS.

It would therefore be of interest to examine the synergies between the Semantic Web and the Social Web efforts, or as it is more commonly referred to by the pseudonym Web 3.0 (Lassila & Hendler, 2007), from the viewpoint of benefits

Figure 7. The symbiotic relationship between patterns and the Social Web



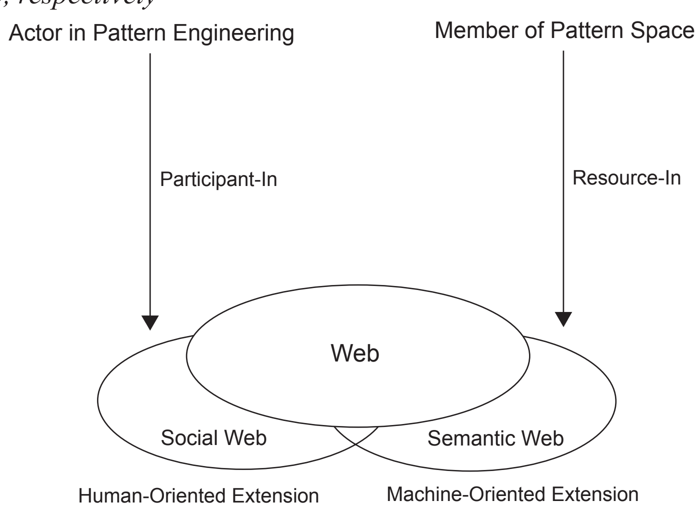
and concerns to patterns. This, as the Figure 8 illustrates, is all the more significant since the actors in PE are participants in the Social Web and the members of the pattern space are resources in the Semantic Web.

Indeed, there are an increasing number of initiatives (Mika, 2007) that belong to the intersection of the Semantic Web and the Social Web, some of which may be relevant to PE. The Friend of a Friend (FOAF) and RELATIONSHIP are both Resource Description Framework (RDF) vocabularies: FOAF is used for expressing metadata about people, and their interests, relationships between them, the things they create, and activities they are involved in; RELATIONSHIP enriches FOAF by extending the types of relationships between people. As an example, the following is a combination of FOAF and RELATIONSHIP markup that represents the Myers-Briggs Type Indicator (MBTI) (Keirsey, 1998) of the shepherd John Smith and the relationship between John Smith and the author Steven Nash:

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF
    xmlns:rdf="http://www.w3.org/1999/02/22-
     rdf-syntax-ns#"
  xmlns:foaf="http://xmlns.com/foaf/0.1/"
 xmlns:rel="http://purl.org/vocab/relation-
    ship/">
  <foaf:Person>
    <foaf:name>John Smith</foaf:name>
     <foaf:mbox rdf:resource="mailto:john.
    smith@john.smith.ca"/>
          <foaf:myersBriggs>ESTJ</
    foaf:myersBriggs>
    <foaf:knows>
      <foaf:Person>
        <foaf:name>Steven Nash</foaf:name>
      </foaf:Person>
    </foaf:knows>
    <rel:mentorOf>
      <foaf:Person>
        <foaf:name>Steven Nash</foaf:name>
      </foaf:Person>
    </rel:mentorOf>
  </foaf:Person>
</rdf:RDF>
```

The limitations of these vocabularies are evident as they do not represent precise relationships among actors of patterns. For example, the `mentorOf` element is only an approximation to a shepherd.

Figure 8. The actors in PE and the members of the pattern space belong to the human and machine extensions of the Web, respectively



The notion of an ontology perhaps forms one of the most important layers in the Semantic Web architecture. A formal representation of a pattern language as an ontology in the Web Ontology Language (OWL) enables better opportunities for organization and inferencing than that is possible by conventional means (Kamthan & Pai, 2006b). For example, an ontological representation of a pattern language allows making the implicit relationships between patterns explicit, which can complement [3] of PRP. However, the focus in this study is on technical rather than on social aspects. The aforementioned means of social collaboration could be useful towards ontology engineering of patterns, which is conducted in a social context (Gruber, 2004) and requires a considerate human effort to reach a consensus. These ontologies could be enriched by more knowledge about the actors. For example, the Semantically-Interlinked Online Communities (SIOC) Project aims to use Semantic Web technologies to connect people using different (Social) Web applications (like e-mail, blog or Wiki). The SIOC Core Ontology Specification explicitly uses RDF, OWL, and FOAF.

The other possibilities for a confluence between the patterns, the Semantic Web, and the Social Web from a research viewpoint are: a pattern language map in SVG could be generated from an OWL ontology and annotated with pattern reader-oriented tags to make it amenable to the tools for the Social Web; the FOAF – XFN and FOAF – hCard microformat connections from the perspective of an ontology of pattern language could be further exploited; the places where an ontology falls short could be compensated by the creation of a microformat for representation of patterns in XHTML; the implications of Semantic Wikis on communication of patterns from an ontological viewpoint could be examined; and so on.

Patterns on the Mobile Social Web

It would perhaps not be an overstatement to suggest that in the last few years the ability to access the Web via a wireless device has been remarkably successful (Stanoevska-Slabeva, 2003). The potential of mobile access to the Social Web has evidently inspired the notion of Mobile Social Web, or more commonly known by the pseudonym Mobile Web 2.0 (Jaokar, 2006; Golding, 2008).

Due to the inherent constraints of both hardware and software (Tarasewich, 2003), it is unlikely that the Mobile Social Web could ever become 'de facto' environment for communicating the elements of PE. However, it could still serve as a means to facilitate collaboration in the PRP, in particular that of patlets, pattern thumbnails, and small pattern language maps, and for syndication. Further exploration of the interplay between patterns and the Mobile Social Web, particularly from the viewpoint of an extension to Figure 7, would be of interest.

Extending the Scope of SW4PE

The arguments presented in this paper accentuating the prospects versus highlighting the concerns of communicating the elements of PE via the Social Web are not exclusive. They could apply to other members of the pattern space as well as to other similar situations. For instance, as the number of anti-patterns grows, assessing the viability of the Social Web in communicating anti-patterns would be worth investigating.

The world of patterns is not secluded from other entities of knowledge. Indeed, software design patterns are related to (in the sense that they are influenced by or influence), for example, aspects, software engineering principles, Application Programming Interfaces (APIs), and software frameworks (Garzas & Piattini, 2005). The Social Web has potential benefits for these other entities of knowledge that are related to patterns and, in doing, so would benefit patterns indirectly. The same applies to the relationships between software patterns and other reusable software artifacts such as those identified in the Zachman Framework for Enterprise Architecture (Zachman, 1987).

There are various knowledge areas in the Guide to the Software Engineering Body of Knowledge (SWEBOK) and the Software Engineering Education Knowledge (SEEK) that require human-to-human communication. Further studies on topics, such as, integrating Social Web technologies/applications in requirements engineering (Macaulay, 1993), collaborative conceptual modeling, or in a socio-constructivist approach to software engineering education in general and in a collaborative approach to open source course projects in particular (Kamthan, 2007), would also be of research interest.

CONCLUSION

The creation and transfer of knowledge that occurs in PE rests strongly on human-to-human communication. This human-orientation needs to be acknowledged explicitly, and the Social Web provides an open and global environment for doing so.

The Social Web opens new vistas for the actors of patterns and indeed for the PRP itself. It celebrates a critical feasibility issue facing the pattern producers—that the number of pattern producers is less than the number of pattern consumers, and due to practical limitations on resources (in terms of time and effort) to dedicate, can not realistically be expected to explicitly document every possible view of patterns—a resolution to which results from the ‘collective intelligence’ of the pattern consumers. This, however, is not free of cost.

It is likely that by appropriate use of technologies/applications, some of the concerns outlined in this paper can at least be avoided if not entirely eliminated. It should, however, be noted that although certain limitations of the Social Web as it pertains to communication of patterns are transient, others are more fundamental.

The potential benefits of the Social Web can outweigh the costs in the long-term if the expectations are realistic and if an effort is made to address the associated concerns. If the past experience with the use of the Internet and the Web is any indicator, the movement has traditionally been towards flexibility, usability, and universality. The success between the interplay of patterns and the Social Web is likely to depend on these invariant values.

In conclusion, the shared benefits of any socialization for the purpose of communication of patterns can only come to fruition with the *shared* sense of accountability and responsibility on part of all actors. This can come only with coordination between pattern producers and pattern consumers. Therefore, an optimistic but cautious use of the Social Web is an imperative.

ACKNOWLEDGMENT

The author would like to thank the reviewers for their feedback and suggestions for improvement.

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This work was previously published in International Journal of Technology and Human Interaction, Vol. 5, Issue 2, edited by B. C. Stahl, pp. 36-62, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 2.11
A Framework Describing the Relationships among Social Technologies and Social Capital Formation in Electronic Entrepreneurial Networking

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ABSTRACT

E-commerce technologies—including online exchanges—focus heavily on transaction support. They are designed primarily to reduce transaction costs between suppliers, producers, distributors, and customers. Entrepreneurs however are not likely to realize the full business potential of e-commerce unless the transaction technologies are simultaneously supported by technology-enabled social learning networks used to stimulate the formation of social capital in its three primary manifestations. Toward that end this article argues that a number of Internet-based social technologies (e.g., email, chat, blogs, wikis, podcasts, etc.) can be used more effectively when it is understood that each technology offers different characteristics in support of the formation of different dimensions of social capital. This article presents a conceptual framework describing the capacities of various social technologies for supporting the formation of social capital. A primary thrust of the article is that alignment of a social technology infrastructure with the social capital requirements in entrepreneurial communities will facilitate the formation of electronic learning networks, enabling more collaborative and therefore more successful entrepreneurial communities.

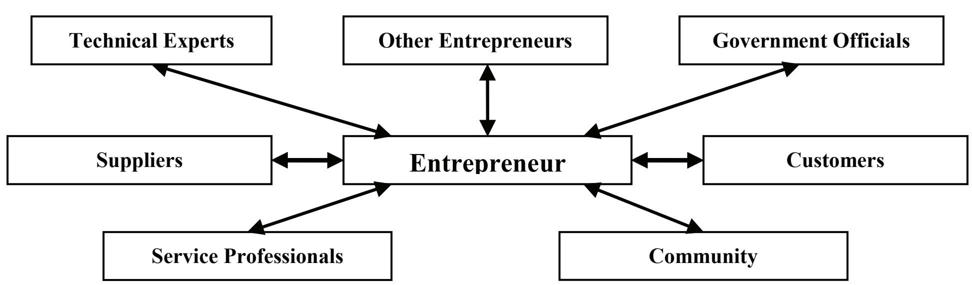
INTRODUCTION

A number of entrepreneurship theorists have suggested that community-based entrepreneurial infrastructures critically influence the development and support of existing, new, and growing small businesses. These infrastructures include: 1) assistance to the owners, 2) physical and monetary resources, 3) information, and 4) knowledge (e.g., Tan, Tan, & Young, 1997; Van de Ven, 1993). Of particular importance in the present study is the development of infrastructures to facilitate information and knowledge acquisition and sharing among entrepreneurs in support of their business objectives (Huysman & Wulf, 2006; Swan, Newell, Scarbrough, & Hislop, 1999). We consider the potential benefits various Internet-based social technologies (such as e-mail, chat/instant messaging, blogs, podcasts, and others) provide to entrepreneurial communities. We are especially interested in the potential role of information technology in facilitating the cogeneration and sharing of tacit knowledge or "know-how" associated with effective utilization of an e-commerce cooperative network. Figure 1 below presents a visual conceptualization of an entrepreneurial information resource environment.

Feedback from recent e-commerce workshops conducted by one of the authors suggests that even among entrepreneurs who currently use some of these technologies in support of business operations, many of them feel the need to learn more about current technologies before adopting them or expanding their use. Understanding the diffusion of information technologies in entrepreneurial communities requires awareness of how the participants come to know about and develop individual as well as shared understandings about these technological opportunities. Research has emphasized the importance of social networks in entrepreneurial development (e.g., Aldrich & Zimmer, 1986). Accordingly, this article takes a social network perspective in discussing technology adoption among participants in an entrepreneurial community.

In fact, the article applies multiple, but related, theoretical perspectives in describing the relationships among social technologies, social capital, and entrepreneurial networks. The framework draws from the following theoretical perspectives: entrepreneurship as a network phenomenon, social capital theory, and small business information systems (SBIS) use. The next section details the theories relied on in generating the framework, with particular attention to the dimensions of social capital. Following that, we describe the network and information requirements associated with each dimension of social capital. We then present the framework describing how the characteristics of various social technologies support each dimension of social capital. In the forth section, the article discusses the implications of the framework as it might be applied in support of social capital formation in an emerging entrepreneurial community. Finally, we conclude

Figure 1. Entrepreneurial information resource environment



with a discussion of issues for future research and conclusions.

BACKGROUND THEORY AND LITERATURE

Entrepreneurship as a Network Phenomenon

The Kauffman Foundation report (2005) notes that much of the entrepreneurship literature has tended to focus on individual attributes and intentions as explanatory factors for entrepreneurial success. The report called for closer attention to entrepreneurship as *organizational experimentation*, defined as "the development and implementation of a novel value-creation and value-capture system" (2005, p. 18). Thus, a network (electronic or otherwise) can be seen as one manifestation of an emergent "entrepreneurial infrastructure" supporting the acquisition and mobilization of resources, particularly new knowledge (Aldrich & Zimmer, 1986; Premaratne, 2002; Tan et al., 1997; Van de Ven, 1993).

Social Capital as a Network Phenomenon

In their study of venture creation, Liao and Welsh (2005) adopt Nahapiet and Ghoshal's (1998) view of social capital, which they define as "the sum of actual and potential resources embedded within, available through, and derived from the networks of relationships possessed by individual entrepreneurs" (2005, p. 348). This article employs Nahapiet and Ghoshal's three dimensions of social capital. Specifically, this article discusses how and why various social technologies support formation of the three types of social capital. The dimensions of social capital are *structural* (the pattern of interactions between actors), *relational* (development of trust and trustfulness), and *cognitive* (development of shared meanings as a basis for cooperation and joint learning).

Small Business Information Systems (SBIS) as a Network Phenomenon

Early research about small business information systems has focused primarily on the adoption of technology as a strategy for improving the internal efficiency of the firm. For example, Bergeron and Raymond (1992) developed a matrix for identifying strategic SBIS opportunities in small businesses, including performance forecasting, electronic data interchange with suppliers, computerized order entry, and marketing database applications, and for supporting such organizational activities as inventory control, receiving, production, accounting, distribution, pricing, and so forth. More recently, however, Levy, Powell, and Yetton (2001) maintain that SBIS have for too long been focused on operational efficiencies and suggest the need for a broader perspective in evaluating the application and success of SBIS. The current article views the value of an e-commerce system as a function of the resulting operating efficiencies in combination with the system's ability to facilitate knowledge acquisition and mobilization via social capital formation.

Communities of Practice as a Network Phenomenon

Steinfield (2004) and Ackerman and Halverson (2004), among others, argue that technology-based knowledge management systems need to incorporate social processes for *embedding* or *contextualizing* information, especially shared tacit/implicit insights about not only *know how*, but also *know who* and *know why*. Huysmann and Wulf (2006) go so far as to argue that electronic networks cannot survive without a corresponding and coexisting social network. Wenger (1998) suggests that members in a *community of practice* learn through participation in that community and that the boundaries of the community are determined by the task(s) the members share in common, the culture, and the history of the community. Members in the community share their understanding and expertise with other members, embedding knowledge in the network for later reuse and reconstruction as a resource in problem solving. Swan et al. (1999) characterize this new approach to knowledge management as a community networking model, envisioning a task-oriented community where knowledge is not so much processed as it is continuously recreated and reconstructed through dynamic, interactive, and social networking activity.

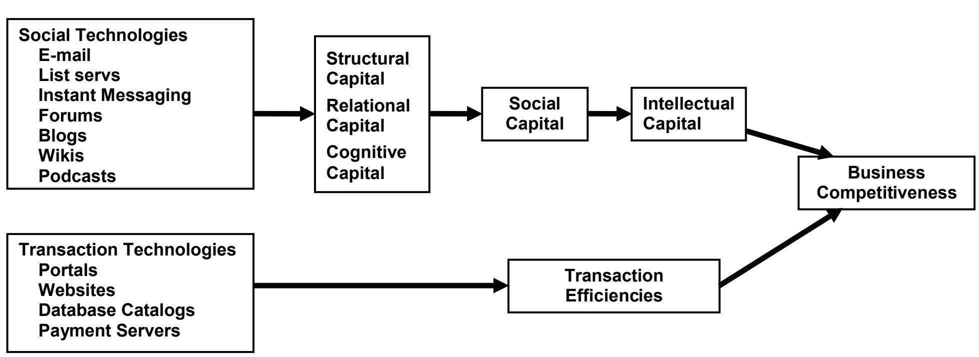
INTEGRATED THEORETICAL FRAMEWORK

The current study describes how characteristics of different social technologies can be seen to support the development of different aspects of social capital, permitting more (or less) effective entrepreneurial learning networks. This article extends the work of De Carolis and Saparito (2006) in arguing that the formation of different elements of social capital within entrepreneurial networks can also contribute to the building of stronger structural and relational ties while leveraging shared knowledge assets, rather than contributing primarily to unrealistic and destructive risk assessments of entrepreneurial opportunities. Such networks suggest the potential for a new business model of internet-based cooperative competition, referred to as coopetition by Brandenburger and Nalebuff (1996). Figure 2 below presents the theoretical model.

Small Business Information Systems (SBIS) Resources

As mentioned earlier, strategic organizational information technology issues have largely been seen from a transaction-based perspective. For example, Bergeron and Raymond (1992) present a matrix of information systems for competitive advantage (ISCAs) which referred to suppliers, competitors, and clients as targets of information used for strategic activities. Similarly, e-commerce has been seen from a transaction perspective. Researchers have described e-commerce business models as business-to-consumer (B2C), business-to-business (B2B), consumer-to-business (C2B), or consumer-to-consumer (C2C). For example, Bailey and Bakos (1997) categorize electronic markets into industrial (B2B) or consumer (B2C). This approach suggests that information management is critical to facilitate transactions between a firm and its buyers and suppliers. The transaction approach draws largely on the transaction cost theory of the firm, developed by organizational economists, such as Williamson (1985), to explain

Figure 2. Relationship among Internet technologies, social capital and business competitiveness



how internalizing market functions can help firms gain competitive cost advantage. E-commerce is used to internalize many types of business functions, including research, purchasing, sales, and distribution, that are often accomplished via intermediaries external to the firm. Focusing on transaction cost reduction, however, overlooks the value of learning from information flows, as well as other critical resources, within a network of associated parties in the business environment, particularly in an emergent, entrepreneurial setting.

A more inclusive view of the business information environment can be helpful in guiding entrepreneurs and other small business managers in implementing their business information strategies. Consider that in larger firms many information resource management functions are internalized. For example, larger firms often have entire departments developing and managing resources such as field and technical expertise (e.g., chemical or environmental advisors), or other business support services (e.g., finance, marketing, etc.). But for smaller businesses, often these resources must be acquired from sources external to the firm. Thus, small business information technology strategies need to find ways to manage and thereby leverage information flows among various external participants, considered as a resource-based (including knowledge) network.

In particular, we call attention to the need for small business information systems to incorporate and enable knowledge management as a dynamic strategic capability, one that may best be developed within an informal social network. Burton-Jones (1999) argues that the knowledge-based strategic benefits of informal small business networks include: (1) integration of tacit knowledge drawn from a variety of internal and external sources as part of an ad hoc problem solving effort; (2) improving the congruence of product-knowledge across the product line by trading surplus knowledge in one product area for new knowledge from network partners to overcome a knowledge deficit in a different area; (3) overcoming uncertainty by learning what it will need to know to remain competitive; (4) addressing timing issues related to overcoming uncertainty; and (5) repairing a "leaky" knowledge asset base by exchanging and mutually protecting shared productive knowledge assets. While the resource network includes the traditional participants, that is, suppliers and customers, it is important to also include in the network other participants in the information environment. For instance, entrepreneurs need to manage interactions and relationships with participants such as professionals offering supporting legal, financial, or other services, government agencies, technical or field experts, fellow entrepreneurs, and even competitors who come to recognize potential mutual benefits of growing markets by sharing product or market information (see again Figure 1). Extending network infrastructure to facilitate information flows among these various parties will significantly expand an entrepreneur's potential resource base, creating those strategic benefits described by Burton-Jones (1999).

The Role of Social Capital in Developing Entrepreneurial Networks

Social capital is required for the formation and mobilization of intellectual capital or knowledge for productive purposes (Nahapiet & Ghoshal, 1998). Social capital develops out of problem-based interactions among participants in a shared cognitive domain or community of practice. The shared problem (e.g., how to acquire and utilize resources needed to generate and sell one's product) triggers a search for ways to manage interdependent relationships between self (the firm) and others (the network). Social capital has the effect of contextualzing (i.e., giving meaning and credence to) resources, and particularly knowledge, within shared network linkages, relationships, and understandings so that these resources can be more effectively mobilized and utilized to achieve complementary objectives. Huysman and Wulf (2006) contrast human capital, which highlights individual ability with social capital, which refers to collective abilities derived from social networks. Social capital typically is expressed in three dimensions: structural, relational, and cognitive (Nahapiet & Ghoshal, 1998). In support of intellectual capital, social capital helps create structural opportunities, a relational motivation to share knowledge, and a cognitive ability to jointly develop and apply shared knowledge to solve problems within a socially embedded context. Social capital is a dynamic asset that will wither and die in the absence of continual social reinvestment by network participants. One result of social capital is that participants see the return value and become committed to developing and sustaining cooperative, nonopportunistic interaction within the community of practice.

Structural capital is the capacity to access and develop information, knowledge, and other resources that are essential to business operations. In practice, structural capital is defined by the patterns of connections or linkages among participants in an entrepreneurial network. These patterns are described by the number (density) and variety (diversity or multiplicity) of connections. Density is a measure of the location and number of ties in a network. Diversity is a measure of the variety of expertise possessed by members of the network. Connections can also be either direct, as in one-to-one exchanges, or indirect, as in broadcast-type interactions. Broadcasting increases density and yields diversity. Granovetter (1973) characterizes "strong ties" as exhibiting more density, being more direct, being low in diversity, and exhibiting high solidarity. In contrast, "weak ties" are more diverse and indirect. Both kinds of ties are important in developing and mobilizing knowledge assets. Strong ties reflect shared insights and commitment to common knowledge; weak ties tend to serve as sources of new information, promoting knowledge acquisition and strategic adaptation.

Where structural capital relates to the patterns of relationships among participants, relational capital is defined more by the affective or emotional quality of the connections themselves. Relational capital concerns the willingness of participants to share information, knowledge, and support based on a converging sense of shared identity (of both self and other) and purpose. As respect and trust increase, the parties will be more likely to share knowledge, especially tacit knowledge.

Finally, cognitive capital is described as those resources that provide shared understandings via mutually accepted representations, interpretations, and systems of meaning among parties to an interaction (Nahapiet & Ghoshal, 1998). In other words, to the extent that people can cognitively connect with each other, they understand the meaning intended by others during communication. Orlikowski and Yates (1994) argue that this sort of sense-making occurs when effective use is made of shared stories, language, and communication regimes. Use of multiple-cue modes of communication can assist in conveying meaning, for instance, when showing a person a photograph of the damage to a plant while describing a plant pathogen. Huysman and Wulf (2006) conclude that media characteristics, for example bandwidth, must be appropriately matched to the communication requirements to support such interaction. When explicit knowledge transfer is required, such as a listing of product prices, an e-mail message or a Web page can suffice. When more complex tacit knowledge needs to be shared, for example when soliciting members' feelings about the trustworthiness of a supplier, more complex forms of interaction (e.g., a telephone conference call) will be more effective.

It is often the case however that none of these three dimensions is sufficient in itself for generating social capital. To gather usable knowledge in one's business network, an entrepreneur must be able to tap into all three forms of social capital.

Structural capital is critical. The entrepreneur must be able to interact easily, and sometimes spontaneously, with people in various areas of expertise: He or she must have a number and variety of network connections. Merely having the opportunity to interact, however, is not sufficient to ensure knowledge sharing and joint learning. One also needs to be able to trust the source of the information before it can be transformed into useful knowledge. Trust allows one to be confident that the provider of the information, and therefore the information itself, is reliable. Trust is the essence of relational capital. Nor is it sufficient to possess just a connection to and trust in the information. It is also critical that both parties to an exchange share similar meanings and understandings about the content as well as the implications for use of the shared information, especially when the interaction is complex, consisting of a series of related and ongoing exchanges. Hence, to generate usable social capital, technology must be designed to support all three aspects of social capital.

Social Technologies in Support of Social Capital Formation

Designing effective infrastructure in support of social capital formation requires matching the characteristics of the social technologies with the network and information requirements inherent in the three forms of social capital. To identify appropriate match-ups, in the next few paragraphs we explain the network/information requirements for each of the forms of capital. The discussion clarifies the relationship of capital requirements to technology characteristics by giving some examples of relevant characteristics for some technologies relative to specific network/information requirements. Following that we present a table that lists a variety of social technologies, the relevant characteristics of each, and its general performance fit for supporting each dimension social capital.

Structural capital relative to a social technology relates to the number of nodes made accessible in a network (density). Also important structurally is the ability of the technology to service connections with participants from varying interest areas (diversity). For instance, list-servs, discussion forums, blogs, and even podcasts tend to coalesce around common topics, and are therefore more homogenous than e-mail, which allows people to target receivers from a variety of interests. Finally, structural capital includes connection directness. Directness refers to whether the information can be directed to an individual or specific group of individuals (as with e-mail and e-mail lists) or if the information is relayed to people indirectly, including people not intentionally targeted by the source. For our purposes, indirectness can include information that is passed along, but we also include situations where information is broadcast, with the sender not knowing who the particular recipients will be.

Relational capital for a social technology relates to how it fosters feelings of trust and shared identity among network participants. Trust is developed through cooperative interactions over time. Thus, the level of *interactivity* supported by a technology will affect the level of trust. Generally, a technology that allows a person to respond to a specific exchange can be said to facilitate interaction more than a technology that allows less responsiveness. Similarly, a technology that permits immediate responses is more interactive than one that tends to delay responses. This notion of interactivity, including responsiveness and delay, as a characteristic of technology is rooted in Media Richness theory (Daft & Lengel, 1986). Accordingly, a technology that permits specific responses and allows for minimal delays between exchanges (e.g., instant messaging) is more interactive than a technology that permits responses but exhibits longer delays (e.g., e-mail), which is in turn more interactive than a technology that permits no response at all (e.g., podcasts). Relational capital also consists of what we term *collectivity*. Nahapiet and Ghoshal (1999) argue that in addition to trust, relational capital also depends on a sense of identity among participants and a sense of belonging to the group, leading to a belief in the benefits brought to its participants. Technologies can be seen in terms of how well they foster group belonging. For example, instant messaging sessions are very limited in the size of the group allowed to participate, while wikis permit participation by very large groups of individuals. We call this characteristic the *collectivity* of the technology.

Cognitive capital consists of the capacity to share multiple languages and vocabularies, or what Nahapiet and Ghoshal (1998) refer to as shared codes. Differing codes may be generated via various modes of communication. For instance, nonverbal communication can be used to enhance the communication of a verbal message. We refer to this characteristic as cue multiplicity, that is, the capacity for a technology to transmit more than one type of communication cue simultaneously. A second component of cognitive capital regards the sharing of narratives (Nahapiet & Ghoshal, 1998). Narratives are stories whose historical context provides meaning to contemporary interactions. In examining technology-related aspects of cognitive capital we appeal to the notion of "personal focus" as posited by the social presence theory (Short, Williams, & Christie, 1976) in conjunction with the speed of responsiveness a technology exhibits, as suggested by the media richness theory (Daft & Lengel, 1986). Richer media carry more types of cues simultaneously, allowing for greater perceived salience by the receiver, a form of personal focus. For example, e-mail allows the sender to target a specific individual while also allowing the attachment of images and graphics. This capacity to convey correspondingly more communication cues results in the potential for a more personally focused and hence more interactive exchange than typically occurs in a blog. The level of contextualization support provided by information technologies has been shown to determine the level of knowledge development in virtual teams (Majchrzak, Malhotra, & John, 2005). Contextualization is provided by offering participants information repositories, identities of contributing members, historical links between contributions, multiplicity of media (e.g., accompanying messages with pictures of the sender), and other sorts of informational enhancements. Thus, the availability of various social technologies can provide different contextualizing opportunities for participants in the network, depending on the participants' needs.

Table 1 illustrates the conceptualization of each technology's capacity to support the formation of social capital. The Internet technologies listed in Table 1 were presented as "conversational technologies" in a discussion by Green and Pearson (2005) of social software and its relationship to the development of strong and weak relational ties.

The forgoing discussion suggests that the physical characteristics of the Internet technologies do not necessarily function as resources in isolation. Rather, they tend to interact, working together to provide different forms of capital. For example, a technology that permits the use of several media (i.e., cue multiplicity) may facilitate shared meanings (cognitive capital), and because of the potential for greater personal focus, can simultaneously facilitate shared trust (relational capital). In other words, technologies and their attendant characteristics work in combination to support various aspects of social capital formation.

It is important to note that, while Table 1 describes specific capacity characteristics exhibited by various social technologies, the reality is that a technology may be appropriated in various ways, some expected and some unexpected. A technology may provide more or less capacity for a specific social capital than described by the current framework, depending on how it is actually used. In practice, the framework should be considered from a contingency perspective. For instance, according to the table, typical one-to-one e-mail

Table 1. The capacities of social technologies for developing social capital

Technology	Dimensions of Social Capital						
	Structural (shared linkages)			Relational (shared trust)		Cognitive (shared meanings)	
	Density	**Diversity**	**Directness**	**Interactivity**	**Collectivity**	**Cue Multiplicity**	**Interaction History**
Email	Low	High	Direct/ Indirect	Med	Low	Med-High	High
List-Servers	Medium	Low	Indirect	Low	Med-High	Medium	Medium
Chat / IM	Low	Low	Direct	Med-High	Low	Med-High	Low
Forums	High	Low-Med	Indirect	Med	High	Med-High	High
Blogs	High	Low-Med	Indirect	Med	High	Med-High	High
Wikis	High	Low	Indirect	Low	High	Low	High
Podcasts	High	Low	Indirect	Low	High	Low	Medium

use exhibits a moderate degree of interactivity and a low degree of collectivity, suggesting that e-mail would normally not be ideal for developing relational trust, which requires high levels of interactivity and collectivity. In some situations, however, e-mail can support greater degrees of interactivity (e.g., when responding immediately to messages received while online) and collectivity (e.g., forwarding messages to a special-interest distribution list). Consequently, in some contexts e-mail can facilitate trust development to some degree. In this respect, Carlson and Zmud (1999) argue that, rather than being fixed in nature, a technology's capacity is really dynamic, and its use can sometimes result in capacity enhancement, what they refer to as *channel expansion*.

In addition to the potential for technologies being used differently in different contexts, it is also possible for a specific characteristic of a technology to result in different outcomes when used in different circumstances. For instance, the model presented here argues a positive relationship between interactivity and trust development: A technology that allows relatively more interactivity (e.g., instant messaging) has the capacity to facilitate trust development more than a less interactive technology. In a highly contentious context, however, more interactivity could allow the exchange of more negative communications. In other words, it is not the technology itself that develops trust; rather it is the way in which the network members use the technology that results in more or less trust being developed.

Aligning Social Technologies to Social Capital Requirements

At this point a brief discussion examining several of the technologies with regard to their capacities for social capital formation might help the reader toward understanding the rationale for the assessments presented in Table 1. *E-mail*: as typically used is one-to-one resulting in low density; allows connections among a variety of participants, rating high in diversity; allows both direct exchanges and, through forwarding, indirect ones; allows pointed responses but with delayed timing, making it moderately interactive; connects one-to-one or small groups making it low in collectivity; allows transmittal of text, images, and even videos resulting in high multiplicity; and finally, by permitting the archiving of exchanges, its historical capacity allows substantial contextualization.

Alternatively, typical discussion *forums*: are very high in number of connections made; generally exhibit low to medium diversity since they tend to coalesce topically, hence consisting of participants with similar interests; are one-to-many exchanges, thus exhibiting a more indirect than direct nature; are medium in interactivity since they allow responses to specific postings but with delayed time frames; their large-group nature makes them high in collectivity; although many forums are text-only, nonetheless the technology rates high in multiplicity since they can be set up to transmit a variety of media including text, images, and videos; are also highly historical in organization.

Finally, *wikis* typically: rate high in density, with the capacity to connect to multitudes; are low in diversity because they tend to attract very specifically-oriented users; are indirect in nature; exhibit medium interactivity since the point of wikis is for the participants to contribute, though the contributions are often evolutionary and not necessarily responsive in nature; can appeal to large groups, so they are high in collectivity; at this point tend to be primarily text-based, so they are low in code multiplicity; generally evolve over time, but earlier contributions can be altered or even expunged, so they are medium in historical capacity.

The three examples presented serve to illustrate how the group of social Internet technologies listed in Table 1 differ among themselves, sometimes slightly, sometimes more noticeably, in their capacities to facilitate social interaction. The potential value of the table is in its use to determine the propriety of a technology to support contingent social-networking requirements.

APPLYING THE FRAMEWORK: SUGGESTIONS FOR SOCIAL CAPITAL FORMATION IN AN ENTREPRENEURIAL ELECTRONIC NETWORK

In this section we present a semicase study of a localized agricultural industry and discuss applying the proposed framework to design a social-technology infrastructure to support the industry participants.

One of the authors recently conducted a series of three e-commerce workshops with a group of tropical flower growers. The workshops were designed to inform participants about the benefits of e-commerce and the essential techniques and procedures used in creating individual Web sites to access alternate distribution channels. Some participants had existing Web sites and were looking for intermediate or advanced marketing and site management lessons. A number of participants did not have Web sites and were looking for information to help get started. By the end of the third workshop, attendees had the knowledge to assess their business needs, evaluate and choose a host, set up a basic commerce site, and undertake basic marketing strategies.

Informal follow-up interviews were conducted recently with several workshop participants. For example, we asked one participant whether he had established a Web site yet and the response was, “No – I haven’t really had the time.” He felt business was satisfactory as it was and was not motivated enough at this point in time to proceed with e-commerce. When asked whether he would be interested in joining an electronic cooperative, he asked what the benefits would be. When informed about potential transaction cost reductions and increased marketing leverage, his response was that he did not think the benefits outweighed the risks. Further probing revealed some interesting concerns. The farmer described several earlier attempts to manage cooperatives in local markets, a couple in other agricultural sectors and one in the fishing industry. In all cases it seems the efforts to form a cooperative failed, sometimes quickly, other times belatedly.

These earlier situations have generated an attitude that, while cooperatives will bring in small and large customers for the participants, eventually the bigger customers will seek one-to-one relationships with a favored member of the cooperative. The belief is that under competitive pressure, the favored member will see sufficient benefits in withdrawing from the cooperative and assuming the relationship with the customer outside the cooperative structure. The essential issue, at least for this farmer, is not lack of perceived benefits in joining a cooperative. Ironically, the concern is that the cooperative will indeed be successful in garnering new business, but peers will seek unfair advantages from the system. In other words, lack of *trust* (or a deficit of relational capital) reduces the perceived value of cooperating with competitors. Thus, to be successful in this particular entrepreneurial community, an electronic cooperative will have to facilitate the development of trust among participants.

In retrospect, during the workshops we might have made a good start toward the formation of a social learning network and trust development within this community of practice by spending more time in helping workshop participants to get to know each other. Moreover, trust development may also require the development of governance safeguards that discourage opportunistic behavior, reinforce norms of cooperation, and gradually erect a structure for collective action (Flanagin, Stohl, & Bimber, 2006). While social technologies are not equivalent to governance mechanisms, they could facilitate a joint search for improved norms and processes of learning-based interactions within a community of practice.

As pointed out earlier, existing online marketplace models are primarily transaction oriented, offering to increase marketing leverage and reduce searching and monitoring transaction costs. But electronic marketplaces have encountered difficulties and have generally failed to exhibit the scale of adoption expected (Tedeschi, 2001). Transaction efficiency, while important, is only one aspect of effective competition. Management of trading and competitive relationships is an equally important, yet neglected dimension in the current generation of electronic marketplaces (Steinfield, 2004). One key to more widespread adoption of electronic marketplaces may lie in the enhancement of their functionality and value by integrating transaction-based e-commerce with social technologies, providing network participants a set of tools for managing relationships and thus developing critical business knowledge.

Entrepreneurial networks can incorporate various social technologies into a virtual cooperative, but which technologies should be emphasized in this situation? Given the lack of trust in this situation, in addition to traditional e-commerce, the cooperative's Web site should also include social technologies designed to facilitate trust-building interaction. To build trust, the network needs to support more interactivity and be collectivity-oriented, factors that directly affect trust. It would also be advisable to include support for code multiplicity and interaction history, less direct but nonetheless important factors in trust development inasmuch as they support the construction of shared meaning. Looking at the framework one can see that the need to support these dynamics suggests providing discussion forums for the farmers: forums are medium in supporting interactivity, high in collectivity, medium-to-high in code multiplicity, and high in historical capacity.

This discussion presented here should be taken only as an example of the application of the framework, not as a solution that can be generalized to all situations. The existence of other issues or objectives should be used to determine other technologies to integrate into a Web site. For example, in a different entrepreneurial community, participants may prefer to acquire technical knowledge rather than build trust, but may not have the time to attend formal classes or workshops. The technical knowledge may be possessed to some degree by the entrepreneurs themselves, and thereby made accessible by forums. But, the network may also find it useful to have field experts generate topic-specific tutorials, and provide them to the members via blogs or podcasts.

One might say, why not just include all social technologies in a network Web site? The answer is that most entrepreneurs are busy with their daily operational requirements and have limited time, skills, and resources available for learning the entire toolbox of social technologies. A member would be more likely to see value in the selection and provision of a few specific and useful tools.

FUTURE RESEARCH

This article describes a theoretical perspective suggesting that modern social technologies may be bundled in configurations designed to support greater degrees of social capital formation. Social technologies like e-mail, list-severs, discussion forums, blogs, podcasts, and so forth have the capacity to support linkages, trust development, and shared meaning among networked entrepreneurs to varying degrees. The article further acknowledges that the appropriate configuration of technologies to support a particular group of entrepreneurs depends on a combination of factors, including the social capital requirements of the group, the situational context, and the ways in which the participants decide to actually use the technologies.

Thus, a concern for future research is the contingent nature of the interaction between technology characteristics and their appropriation. For instance, a contingency perspective suggests that a technology will support greater trust development in some situations, while in other situations the same technology could allow behavior that impedes trust development. It would be helpful to practitioners if studies could be undertaken to determine how particular combinations of social technologies work together in different contexts when appropriated in specific ways.

The model and discussion presented here raise a number of other issues also worth examining in the future. For example, a logical next step for research would be to assess the extent to which trust and other dimensions of social capital exist in specific entrepreneurial networks, like the co-operative network described above. Understanding existing conditions in a network will inform participants in the design and implementation of a technical infrastructure best suited for the formation of social capital, making all network members more competitive.

A complementary line of research would be the exploration of governance processes appropriate to overcoming incentive problems that impede cooperation (Borgen, 2003) and to developing norms of interaction that build trust in networks (Calton & Lad, 1995). Burton-Jones (1999) notes that small business networks tend to be organized on democratic lines, since this arrangement favors the development of higher levels of trust, commitment, information sharing, and cooperation. Krackhardt and Brass (1994) point to the need to consider the role of leadership in developing and sustaining network relationships, particularly by studying patterns of "leader-member exchange" across strong and weak ties. Lipman-Blumen (1996) develops a model of "connective leadership" based on maximizing trust-building interactions and a collaborative search for solutions in shared problem domains. These are all promising lines of research which are beyond the scope of but suggested by the model proposed herein.

The preceding paragraphs describe the technical infrastructure in relation to contextual issues like governance and leadership in the network. Indeed, the article as a whole is concerned with a variety of interacting contextual social dimensions. Considering the model this way illustrates the need to examine a much broader sociotechnical framework, within which the social technology infrastructure discussed here plays an important but partial role.

CONCLUSION

In summary, the article presents an extension of earlier entrepreneurial network research. We develop a theoretical model describing how social capital theory can be used to configure networks of social technologies supporting entrepreneurial communities of practice. We argue that different aspects of social capital are realized to varying degrees by different social technologies. Therefore, embedding these technologies within an online marketplace can create a learning network infrastructure, requisite for knowledge creation and management in entrepreneurial communities.

A well-developed electronic network can increase interconnectedness and information sharing among participants within an entrepreneurial community. Enhancing the network this way reduces the incidence of "structural holes" which allow some participants to leverage strategic positions in the network, extracting rents at the expense of others (Burt, 1992). A social technology-based network provides the opportunity for members to increase "weak-tie" development, generating correspondingly more opportunities for information sharing and knowledge development (Granovetter, 1973). In application, this suggests that entrepreneurial network initiatives, integrated with more commonly accepted e-commerce technologies, will support members in their efforts to share knowledge and perhaps even help overcome industry problems like mistrust, thus improving participants' competitiveness.

There is significant creative potential for promoting organizational learning by mobilizing an integrated social/transaction-based technology model like the one presented in this article. As Friedman's (2005) *flat world* perspective suggests, entrepreneurs should benefit competitively from the creation of and access to a shared space among network participants. Such interaction can bring together multiple perspectives on new information, encourage development of greater congruence in shared meanings, and thereby generate knowledge-based capabilities within the entrepreneurial network to enhance each firm's ability to succeed in the connected global marketplace.

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This work was previously published in the International Journal of e-Collaboration, Vol. 5, Issue 3, edited by J.N.D. Gupta, S.K. Sharma, and J. Hsu, pp. 25-38, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 2.12
Towards Learning 'Self' and Emotional Knowledge in Social and Cultural Human–Agent Interactions

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ABSTRACT

This article presents research towards the development of a virtual learning environment (VLE) inhabited by intelligent virtual agents (IVAs) and modelling a scenario of inter-cultural interactions. The ultimate aim of this VLE is to allow users to reflect upon and learn about intercultural communication and collaboration. Rather than predefining the interactions among the virtual agents and scripting the possible interactions afforded by this environment, we pursue a bottom-up approach whereby inter-cultural communication emerges from interactions with and among autonomous agents and the user(s). The intelligent virtual agents that are inhabiting this environment are expected to be able to broaden their knowledge about the world and other agents, which may be of different cultural backgrounds, through interactions. This work is part of a collaborative effort within a European research project called eCIRCUS. Specifically, this article focuses on our continuing research concerned with emotional knowledge learning in autobiographic social agents.

INTRODUCTION

In addition to the popular utilisation of social agent simulations in areas such as education and academic research, nowadays immersive online virtual worlds allow social agents to be further enhanced through highly frequent interactions with human users. For example, Second Life (Linden Research, 2005), as a well-known and quickly evolving virtual society, has attracted millions of users to experience a new kind of social interaction in a virtual space. Powerful PCs, fast broadband connections and advanced 3D graphics offer users this alternative online reality. Interestingly, users' social activity in such a virtual society involves high levels of cultural and emotional learning, as many real cases demonstrate that are reported by Ananthaswamny (2007). How well can we expect intelligent virtual agents (IVAs) to be able to cope with interactions similar to those that human users experience in a comparable social context?

To answer this question, one of the primary goals from our research project eCIRCUS (2006) "Education through Characters with emotional-Intelligence and Role-playing Capabilities that Understand Social interaction" is to promote intercultural empathy. Cross-cultural conflicts have been the source of violent acts in many countries worldwide, including conflicts involving people who come to live in a different country. This background forms a strong motivation for our goal to develop a virtual learning environment (VLE) that supports intercultural learning and fosters intercultural empathy skills for its users. Through developing an educational role-play game named ORIENT with character-based emergent narrative (Aylett et al, 2005), we aim to establish a fun way to educate boys and girls at the age of thirteen to fourteen years in the UK and Germany. The learning outcomes will be designed specifically for children native to the host countries and will be used by the entire school class.

Not surprisingly, in virtual worlds like Second Life or other popular online games, the large international user population and the freedom given to individuals to openly "live" in the environment introduce a certain level of difficulty in intercultural communication. Naturally most users can handle problems emerging from cultural differences – without much effort they can understand both verbal and non-verbal expressions from other characters, which may be either non-player characters (NPCs) or avatars controlled by other users who may be from different backgrounds[1]. To achieve the same level of social and cultural understanding, IVAs are expected to have an *interdependent* (rather than *independent*) "self" – being more attentive to themselves and sensitive to others[2] (Markus & Kitayama, 1991). Consequently, they need to have the ability to be aware of cultural differences and to learn from others. Therefore, we argue that IVAs will benefit from a type of memory which records events that are meaningful to the agent personally and also allows them to extend their knowledge about others' cultural expressions.

Like human beings, these agents should also respond to a stimulus situation with mediation by cognitive processing at several different stages. As reported by social psychologists (Wyer & Srull, 1989; Kim & Ko, 2007), effects of two factors play an important role in most phases of social and cultural information processing: (a) the affect or emotion that one experiences at the time information is processed and a judgment or decision is made, and (b) the agent's "self"[3]. If we assume that one's own emotional reaction to a stimulus is essentially an aspect of oneself, and emotions can be both cause and effect in relation to one's perceptions, then these two factors are clearly related.

In the psychological literature, two different definitions of emotion are commonly used. According to one tradition emotion is viewed as a set of internal cognitive processes of self-maintenance and self-regulation, e.g. Young defined emotion as an "acute disturbance of the individual as a whole" (Young, 1936, p. 263). Another tradition views emotion as an adaptive and organising response because it can motivate forces and direct activity (Salovey & Mayer, 1990). Both definitions seem to naturally assume that these cognitive processes or responses are universal (e.g. Plutchik, 1994), however, the emotional experience is very much culture-based (Solomon, 1984). The reason is that "emotional meaning is a social rather than an individual achievement – an emergent product of social life" (Lutz, 1988; p. 5). Furthermore, like our thoughts and the language that we use to express them, meaning and regulation of emotion are also shaped by "the interest of cultural cohesion", as pointed out by Bruner[4] (1990, p. 58).

To create the dynamic representation of different meanings of agents' emotions, it is beneficial to use schemas for agents' long-term memory that record significant events (events that are meaningful from the agent's point of view). Since the 1920s, psychologists like Bartlett (1932) have been illustrating that humans appear to deal with complex structural knowledge by using memory schemata – not by storing everything in a 'semantic bin' which works like a warehouse. In computational terms, the memory schema provides us with empty slots to be filled in by recalling meaningful episodic information from our long-term memory. This whole remembering process involves memory reconstructions of one's past experiences and thus produces coherent narratives[5] based on meaningful events which tend to be unforgettable in one's life. Psychologists in recent decades identified this type of episodic long-term memory with personally significant events for individuals as *autobiographic memory* (Conway, 1990).

In light of our interests in agents' cultural and emotional learning using computational autobiographic memory, this article reports our ongoing research into the emergence of agents' knowledge about the "self" and emotion in social simulations. We aim to develop a minimal cognitive agent architecture with essential components for IVAs to perform cultural understanding, to extend emotional knowledge and thus eventually to be able to empathise with other agents or human users. In the rest of the article, we first review psychological literature illustrating cognitive representation of emotion concepts in human long-term memory. Next we discuss research in IVAs using emotional models. Then we introduce autobiographic memory for IVAs and our previous research using autobiographic agents with emotional expressions for narrative storytelling. Following that, we briefly introduce ORIENT (Overcoming Refugee Integration using Empathic Novel Technology) – a software application that is being developed that aims at helping teenagers in emotional and social learning. The next section illustrates several important modules in our agent architecture to support the implementation of agents' personality and emotion, and the integration of autobiographic memory for extendable emotional knowledge for individual agents. Finally, future work is discussed in the concluding section.

BACKGROUND

In this section we introduce some essential ideas that support our study in cultural and emotional learning for IVAs. These ideas are very much interdisciplinary, and they cover mainly the areas including 1) *the presentation of emotion concepts in human long-term memory,* 2) *empathy,* 3) *memory and emotion*, and 4) *computational autobiographic agents*. We will illustrate the interrelations that exist between them.

Representation of Emotion Concepts

Culture not only impacts the language that we use, non-verbal behaviour that we display, our gender roles, etc, but also influences our emotional expressions. Here we specifically focus on agents' emotions because much psychological research has shown that emotion plays a critical role in our memory-encoding, decision-making, interaction with others, and overall, intelligence (Salovey & Mayer, 1990). To create socially "friendly" IVAs, emotion is certainly a critical component to be integrated into the agent architecture. From this perspective, representing concepts of emotions is fundamentally important in agents' memory.

In psychology, the way that humans encode concepts of different emotions has been commonly identified as a type of semantic representation. Emotion concepts, together with other concepts of semantic knowledge, are stored permanently in our long-term memory. Wyer & Srull (1989) suggested that, like concepts of personality, each emotion can be also conceptualised as a central node attaching different configurations as features. They further explained that these features may include verbal labels, representation of overt behaviours, etc. As an example, Figure 1 illustrates their idea about the cognitive representation of the emotion concept of "sad".

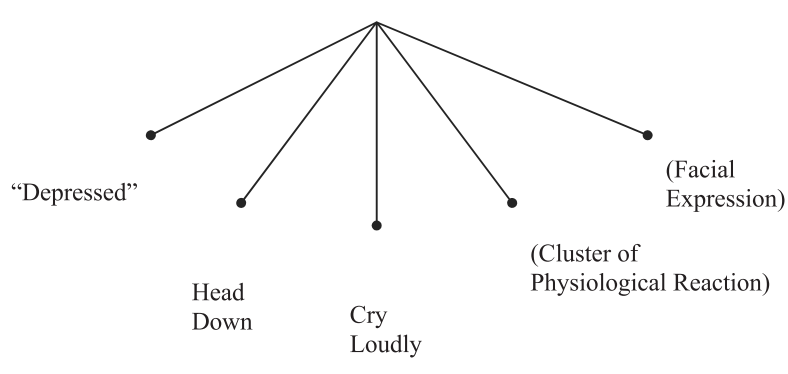
Understandably, features attached to the central node are derived from social learning. They are, however, not only used for expressing the internal emotional state of oneself; more interestingly, in social interactions they are often used directly to interpret others' emotions. Consider the following scenario: A mother who observes her young son slamming the house door or performing another behaviour that she personally labels as "angry" may ask him "Why are you angry?". Therefore, emotion concepts stored in the long-term memory are crucial to daily life because the retrieval of these concepts can often help process observable information in interaction with others and in the process of making a decision of how to react or respond to the situation.

Believable Agents and Modelling Emotion

Research on believable agents in Artificial Intelligence (AI), inspired by work on believable characters in the Arts, has been pioneered by the Oz project under the guidance of Joe Bates. A believable character is "... one that provides the illusion of life, thus permitting the audience suspension." (Bates 1994, p. 122). Work on believable agents in AI has grown significantly, a detailed overview in believable emotional agents can be found in (Loyall, 1997).

Integrating an emotion model into the design of an agent architecture is important for believable interactive virtual agents in applications such as computer games or training software. Marsella and Gratch (2003) utilised appraisal processes from the OCC model (Ortony et al, 1988) for believable characters that perform in various applications. They state that appraisal variables enable agents to characterize the significance of events from the individual's perspective as the interpretation of each event is altered by an

Figure 1. Cognitive representation of the emotion concept "sad"



agent's own beliefs, desires and intentions, and past events. To continue this research direction with computational autobiographic memory, our previous work developed a mechanism that creates *significant experience* for believable virtual characters through OCC appraisal processes (Ho et al. 2007a).

Empathy

In addition to inferring others' internal states, emotion concepts are fundamentally important for the *empathic process*. Empathy refers to "any process where the attended perception of the object's state generates a state in the subject that is more applicable to the object's state or situation than to the subject's own prior state or situation" (Preston & de Waal, 2002, p. 4). Contemporary empathy research agrees on two main aspects of the empathic process, one is cognitive, and the other is affective in nature (Davis, 1996; 2006). Both aspects are clearly relevant to our research. Cognitive empathy focuses on the "intellectual or imaginative apprehension of another's condition or state of mind without actually experiencing that person's feelings" (Hogan, 1967, p. 308), resulting in an understanding of the target's inner state. Affective empathy is described as "a vicarious affective response to another's feeling" (Hoffman, 1977). Therefore, learning emotional expressions from another culture seems to rely on the understanding of internal states of the members of the culture and creating affective evaluative reactions towards them.

Furthermore, there can be two types of development for emotional reactions during the empathic process (Davis, 2006): 1) Through a repeated simultaneous experience of an emotional expression in a target person and an emotion in the observer, 2) through associative processes, which work similarly, but rely more on memory representations of past experiences of the observer; these associations may emerge from visual perception of expressions or situational cues.

Autobiographic Memory and Emotion

Being aware of how high level empathic processes help in increasing the cultural understanding of others, we now study further a rather basic but essential concept of attributing emotion to a specific kind of episodic memory – *autobiographic memory*. In psychology, autobiographic memory has been introduced as memory that contains significant and meaningful personal experiences for a human being (Nelson, 1993). It serves important functions in providing the basis for social interaction, maintenance of a dynamic self-concept as well as the representation of the meaning of concepts (Conway, 1990). Moreover, when memories were plotted in terms of age-at-encoding highly similar life-span memory retrieval curves were observed: the periods of childhood amnesia[6] and the reminiscence bump[7] were the same across cultures – suggesting that there are culturally invariant features of autobiographical memory that yield structurally similar memories across cultures (Conway et al, 2005).

In the literature on human memory, it has been widely acknowledged that events associated with emotional experiences partly constitute highly available memory. Psychologists and cognitive scientists also propose that when experiencing an event with emotional content, a human's cognitive system is more fully engaged in processing that event, in comparison to the processing of events which are not clearly associated with any strong emotional experience. This view can be further elaborated with respect to the frequency of rehearsal (Conway, 1990) – in that highly emotionally intense events are more readily available for retrieval.

Personally significant events which are directly involved in the self memory structure, like first time experiences, can have stronger impacts on humans' lives by creating a pre-existing knowledge structure for other similar events (Conway, 1990). These life events, together with events with emotions, indicate that central knowledge structures relating to the self have been employed in representing autobiographic memory. Nevertheless, studies e.g. from Markus & Kitayama (1991) suggest that emotional processes may differ from the nature of the self-system. They further pointed out that both 1) the predominant eliciting conditions, and 2) the intensity and frequency of emotions expressed and experienced by individuals, vary dramatically according to one's construal of the self.

Computational Autobiographic Agents

Conceptually, an autobiographic agent is an embodied agent which dynamically reconstructs its individual history (autobiography) during its life-time (Dautenhahn, 1996). This individual history helps autobiographic agents to develop individualised social relationships and to communicate with others, which are characteristics of social intelligence. It has been suggested that autobiographic memory for agents may also lead to more appealing and human-like engaging interactions, making the agents more pleasant and acceptable to humans.

Different types of computational memory architectures for Artificial Life autobiographic agents have been developed and experimentally evaluated in our previous research work, e.g. in (Ho et al, 2006). These architectures include memory modules which are commonly acknowledged in psychology: short-term, long-term, and positively and negatively categorised memories. In a series of simulation experiments we showed that agents embedded with these computational autobiographic memories outperform Purely Reactive agents that do not remember past experiences in surviving in both static and dynamic environments.

In the paradigm of developing synthetic agent architectures, we previously proposed that 1) knowledge representations in the computational autobiographic memory can be based on general episodes that agents have experienced and 2) goal structure, emotion, and attention processes support and are influenced by the autobiographic knowledge (Ho & Watson, 2006). Autobiographic knowledge may also support long-term development and learning in synthetic agents as they gain new experience from acting in each new situation.

Our previous research also includes the investigation of how the engagement of users can be increased in an interaction through the inclusion of believable agents with their own emotions and autobiographic memory (Ho et al, 2007a; 2007b). Specifically, in Ho et al. (2007a), we incorporated the psychological view that emotions can arise in response to both internal and external events. More importantly, both types of events have "*a positively or negatively valenced meaning*" (Salovey & Mayer 1990, p. 186) for an individual agent.

More recently our study in Ho et al. (2008) shows that, embedded with communicative autobiographic memory, agents' behaviours can be understood as intentional, narratively structured, and temporally grounded. Furthermore, the communication of experience can be seen to rely on emergent mixed narrative reconstructions combining the experiences of several agents.

Earlier in this article we discussed the semantic representation of emotion concepts and how these concepts can be learnt. Now we define *learning* in this article as more than just acquiring knowledge. Agents use the emotional knowledge to improve their performance – in the sense of achieving believability and performing cultural interactions with other agents and human users. We therefore focus on low level symbolic learning for agents aiming to increase their cultural and emotional knowledge through gaining experiences from interactions with other agents/users and using autobiographic memory.

CULTURAL AND EMOTIONAL LEARNING FOR SOCIAL AGENTS

This section presents the challenge of creating IVAs that are able to extend their emotional knowledge based on cultural interactions with other agents or users. We start with identifying several limitations of existing research in the area. We then introduce the software application ORIENT developed within the eCIRCUS project, the agent architecture and examples of story scenarios in which agents' intercultural learning ability is required for human-agent interactions. Next, we present our agent architecture design and specify the *minimum requirements* for agents embedded with computational autobiographic memory in ORIENT to be able to learn emotional knowledge through social and empathic interactions.

Issues and Challenges

As discussed in the background section, humans represent concepts of emotion in long-term semantic memory. Importantly, these concepts are *not* innate but each individual forms them either from one's own cultural inheritance (i.e. knowledge acquired via folk tales, books or other media etc.) or from past meaningful personal experiences. For this reason, we may not be able to infer others' emotions from purely observable information during the interaction. Instead, backed up by the reviewed psychological literature, we argue that both cultural background knowledge as well as autobiographical experiences of a person or an agent play an important role in recognising and learning others' emotional expressions.

One possible approach is to create a synthetic culture for a group of agents, so that each agent can have the same set of semantic knowledge for emotional expressions that represent their culture – this is our first step in the current implementation of ORIENT, which will be introduced in the next subsection. Unfortunately, when these agents are interacting with users in different circumstances, this set of *static* semantic knowledge is too limited.

Since developing a personality model which is valid across cultures is also essential to our research, we suggest re-interpreting cultural dimensions in terms of personality traits. According to Triandis & Suh (2002), the basic personality traits in the Big Five model (Costa & McCrae, 1992) are the most suitable to incorporate cultural dimensions. They argue that 1) the Big Five model is applicable to a wide variety of cultures, 2) traits are supposedly biologically based and they show the same pattern of developmental change in adulthood, and, most importantly, 3) acculturation effects can be found in the predicted direction. To give an example of point 3: if people live as part of a culture different from their own, then their behaviour and attitudes are likely to change by acclimatising to the lived in culture.

Overall, the Big Five model represents five replicable, broad dimensions of personality: Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to experience. These five dimensions are, however, descriptive concepts that focus on illustrating how human behaviour can be traced back to psychological variables and their interplay. Therefore, they still need to be explicated in low-level structures and processes for our implementation.

With the consideration of the developmental stages that a person may pass through, the transition includes social and psychological changes. Hence, one shall undergo a time of important changes, which can be a cause of conflict, and a positive development of personality or a clearer sense of psychological identity (Piaget, 1952). Computationally capturing these changes from all agent interactions requires a careful design specification of episodic memory that allows agents to remember those significant events. Therefore, in addition to the underlying personality model that the agent might be using, computational autobiographic memory is necessary here to establish the learning of emotional knowledge and to emphasise the cultural differences of a particular individual.

Furthermore, although we discussed above that empathy is a crucial psychological process to understand others' internal states, modelling the empathic or similar processes, such as Theory of Mind (Premack & Woodruff, 1978; Baron-Cohen, 1991; Leslie, 1994), for agents is a highly challenging task. In the research field of believable IVAs, researchers have attempted to create empathic agents by, for example, using a data-driven affective architecture with human teaching examples (McQuiggan & Lester, 2006), or analysing human users' physiological responses through skin conductance and electromyography to guide the animated interface agents in performing empathic behaviour (Prendinger et al, 2006). However, in both examples the agent's emotional knowledge is predefined by the designer and is not extendable.

Integrating emotion into agents' behaviour modulation mechanisms has recently been widely studied, e.g. as part of a large European project called HUMAINE (HUMAINE, 2004). However, not many studies of agents' emotional learning based on culture can be found. One can imagine the difficulties: learning new emotion concepts means to match the particular expression the user shows with his/her internal emotional states – however, typically virtual agents can neither perceive the user's facial expression nor detect their physiological changes easily in real-time.

We argue that the first important step towards creating IVAs with abilities of learning emotional knowledge about other cultures, and ultimately empathising with others, is to enable the agents' long-term learning from *meaningful* events. For example, through remembering its significant experiences in the past agent_A learned that event_X always has a negative impact on its internal states and thus it generates a dislike emotion. Agent_A, after sometime, creates a concept "*event_X is harmful and leading to a dislike emotion*" and an associated *avoidance* action. With this conceptual knowledge derived from its own experiences, initially agent_A assumes that all other agents whom it meets have the same concept. Therefore when agent_A sees agent_B expressing a dislike emotion, it automatically infers that event_X (or similar events that have a same effect) has happened to agent_B. Afterward, intuitively agent_A expresses its concern to agent_B and expects agent_B's "feedback". The feedback can be either a confirmation of the concept or an unexpected result, both of them will lead to an update of agent_A's existing concept for event_X and thus increase agent_A's cultural emotional knowledge. Note that the complete description of empathic processes is shown in the next subsection *Specifications for computational autobiographic memory*.

In addition to embedding computational autobiographic memory in the agent architecture, it is also essential to consider the "minimum requirements" as specifications for agents interacting with users or other agents. We aim to achieve that, eventually, both the agent's long-term "self" and emotional knowledge can emerge from such social and cultural interactions.

The Character-Based Approach

In this section we elaborate the character-based approach, with the features that computational autobiographic memory can provide, as a potential solution to address the issues we raised above. In order to allow our agents to adapt themselves to distinct cultures and to be able to establish empathic relations with others, the computational autobiographic memory model focuses on agents' knowledge representations and how information retrieved from autobiographic memory can support agents' goal processing with the PSI theory's "needs" as a foundation (see below for a detailed explanation of the PSI theory). In this model, meaningful episodic knowledge derived from an agent's past experience forms events, episodes, themes and life periods[8] in a bottom-up fashion.

Each of them has an abstraction generated for representing general meanings to the agent itself during different periods of its lifetime in a temporal sequence. The technical design for this model can be found in (Ho et al, 2007b).

The main advantage of our autobiographic memory model is that it attributes changes of internal states (e.g. emotions) in action-situation patterns to show the significance (to an agent itself) of past episodic experience. Thus this approach improves agents' learning and adaptation. Moreover, various levels of abstraction can feature the production of narrative storytelling for describing agents' past experiences as well as forming changeable personalities. Using autobiographic memory knowledge to bias planning current goals is particularly suitable in creating dramatic acting for synthetic agents.

Since the full description of the story scenario in ORIENT (eCIRCUS, 2006) goes beyond the scope of this article, we provide 1) the design of a fundamental personality model with its integration into the main architecture, 2) an example of the story scenario, and more importantly, 3) the detailed specifications of requirements for computational autobiographic memory based on the design for the ORIENT scenario and user-agent interaction.

Personality Model and Agent Architecture Implementation

In ORIENT we aim to use the descriptive trait concepts from Big Five for modelling personality. However, in order to allow agents to generate realistic and expressive behaviours in real-time from the personality model, it is not possible to simply use those five static parameters as initiated. It means that we will need to create a set of low-level internal states for agents (as main characters interacting with users in the game) to capture the dynamic changes of these states and to map the Big Five personality traits into them. As pointed out by Schaub (1999), this approach will involve three levels of modelling work:

1. Descriptive level (Big Five) that provides information regarding each main character's general tendency in five (trait) dimensions.
2. Behavioural level (e.g. being friendly, aggressive) indicates characters' expression based on their personality during the gameplay.
3. Low-level implementations of the system that generate behaviour through internal states (e.g. needs, intentions and goals)

The first step is to define the value of each character's personality trait using the Big Five dimensions[9]. Story writers for the ORIENT scenario and psychologists collaborate and revise these trait values based on the original design of each character in the story. Then these (1st level) trait values will be "translated" into low-level internal states (3rd level) for generating characters' motivations, intentions and goals. Finally, we expect that agents' behaviour (2nd level) will emerge from the dynamics of internal states, computational autobiographic memory and planning processes happening in the agent architecture.

To create the low-level system, the first step is to integrate the motivation module from PSI theory proposed by psychologist Dietrich Dörner (Dörner, 2003; Dörner & Hille, 1995). The original PSI theory is based on the idea that humans are motivated emotional-cognitive beings; therefore it integrates cognitive processes, emotions and motivation. The motivation module in our agent architecture includes existential "needs" (*Existence Preservation*, *Species Preservation* and *Affiliation*), and intellectual "needs" (*Competence* and *Certainty*). By mapping the corresponding Big Five trait values predefined by the story writers and psychologists to the set-point (threshold) of each need, an individual character's dynamic personality is created. For example, if character

A was defined as a person who is secretive, wise and rarely speaking to new people, then part of his Big Five traits are: High Conscientiousness, low Extraversion and low Agreeableness. Therefore the relevant set-points for PSI needs translated from traits are: High Competence, High Certainty and Low Affiliation. Table 1 shows a brief guideline for the translation from Big Five traits to PSI needs. Note that the mapping from traits to needs is not one-to-one in most cases.

All needs of each agent must be maintained in order to "survive" in the game environment. Therefore individual agents will try to reduce the deviation of each of their own need from the set-point as much as possible at all times. Intentions of an agent are built according to the strength (as determined by the deviation) of a need, the success probability to satisfy the need from the semantic knowledge, past significant experiences in autobiographic memory, and urgency (the timeframe to satisfy a need). Whenever a need deviates from the set point, it activates the corresponding intentions. In the case when several intentions are active in a given time, the strongest one will be selected and executed. To help depict the main ideas of the motivation-based architecture as well as the interactions between the computational autobiographic memory and other components, the overall design of the agent architecture is shown in Figure 2.

After the integration of needs for intention generation, we also utilise three types of behaviour modulators from PSI theory:

- **Activation:** Similar to the psychological concept of "arousal", activation represents the preparedness for perception and reaction on the agent – speed of information processing. It increases with the general pressure from the motivation system and the strength of the currently active intention. For example, if the environment poses threats to the agent and its activation level is high, we will expect a short reaction time from the agent – it needs relatively quick cognitive adaptations for the satisfaction of current needs. As a result, only superficial perception and planning may be observed. Thus the agent will be highly cautious and try to adapt its responses to the environmental conditions.
- **Selection threshold:** To prevent the currently active intention to be easily replaced by another equally strong intention, a selection threshold increases the strength of the current intention and prevents oscillation of behaviour by giving priority to the currently active intention. Therefore, low selection threshold means that the agent is easily distracted from its current intention, and vice versa.
- **Resolution level:** Resolution level determines the carefulness and attentiveness of an agent's behaviour – the accuracy of cognitive processes, e.g. perception, planning, action regulation. It changes inversely

Table 1.

Big Five trait	PSI needs
Neuroticism	Many needs are highly activated at the same time
Extraversion	High need for affiliation
Agreeableness	Needs are generally not very activated or need long to exceed threshold
Conscientiousness	High need for competence and certainty
Openness	Low need for certainty, high need for competence

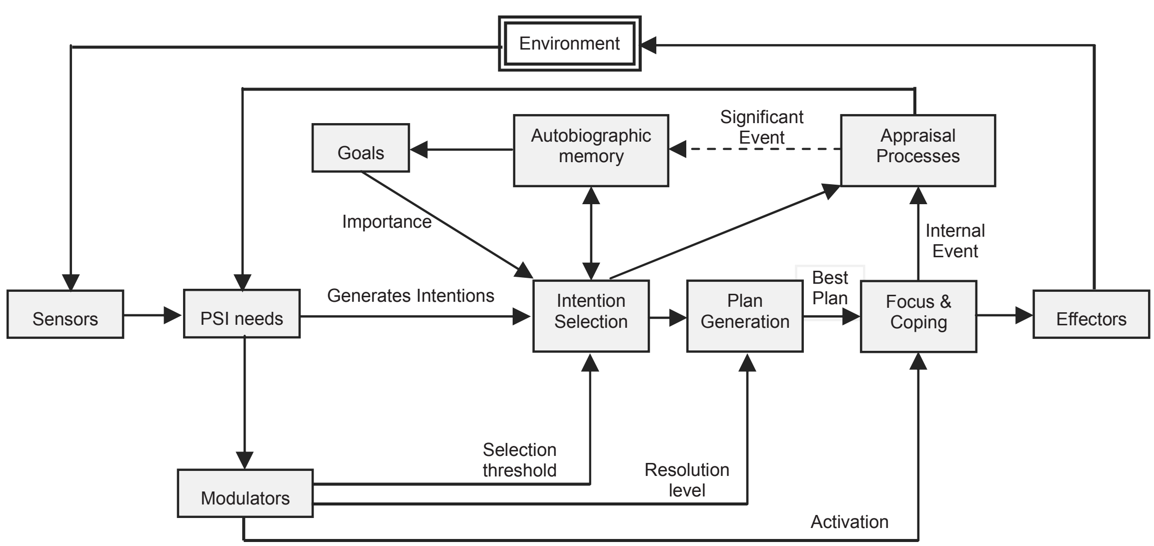
to the activation value. Generally when the resolution level of the agent is high, it performs more extensive memory retrieval and generates either more alternative plans or a very detailed plan for achieving a selected intention.

Altogether these three modulators in the agent architecture establish the dynamic model of emotion as modulation of "cognition" (here we refer to "cognition" as an agent's perception, action-selection, memory access and planning). This unique aspect was derived from PSI theory, in which emotions are not explicitly defined but emerge from modulation of information processing and adaptation to the environment, see Hille (2007) for details. In this case, an agent's complex behaviours become apparent due to the value of these modulators modified by needs.

Taking other agents and events from the environment into account, not only will they be internally represented symbolically in the agents' semantic memory (world knowledge), but the proposed agent architecture will also include their individual influence on the low-level needs. The strength of the influence is dependent upon an agent's personality specification, and is also affected by its own culture, and its existing experiences. Details of events which have brought significant impact to any of the agent's internal needs, together with other agents involved (if there were any), will be stored in the autobiographic memory for guiding the agent's future emotional and behavioural responses to the same type of events or agents. The relevant process is named *appraisal*, in line with other approaches to modelling emotions in IVA architectures, e.g. (Marsella & Gratch, 2003). Similar to our previous work (Ho, 2007a), for the interpretation of different types of emotional impact, e.g. in order to generate an agent's personal narrative, we utilise the OCC taxonomy (Ortony et al, 1988) as appraisal variables in the architecture.

Therefore, we also project the low-level needs to these appraisal variables. For example, *Like/Dislike* refers to how an event impacts the character's need for *affiliation*; *Desirability (of an event to oneself)* is determined by whether it satisfies or threatens to some extend the character's overall needs; *Desirability (for others)* – depending on

Figure 2. ORIENT agent architecture that links components such as needs, goals, emotion and autobiographic memory



how an event affects the other character's needs – is indeed important for an agent's cultural and emotional knowledge learning, and defined by a self-as-first-person evaluation process (see the next subsection *Empathising with others* for details). Furthermore, *Praiseworthiness*[10] is influenced by the agent's need for *certainty* and need for *competence*, also taking into account the social and cultural background of individuals.

At the beginning of an interaction with a user or other agents , each agent's internal needs will be initialised with random values together with a set of predefined "personality thresholds". Based on the level of deviation that each of its current needs has, it generates intention(s) and activates goal(s) that are relevant to the perceived circumstances. The goal with the highest priority to be executed can be determined by the fact that it can satisfy the current most deviated need. Moreover, the agent's competence level plus the past experiences in its autobiographic memory will provide information for the calculation of the success probability for a particular goal. Therefore, both goal importance and goal success probability will be used to manage intention and thus action selections.

We believe that, at a certain level, the composition of an agent's internal needs, goals and autobiographic memory in the architecture can attribute "meanings" to its emotional expressions. During the processes of appraisal, the agent evaluates both 1) internally, the effect of the coping action that it has carried out on its needs and 2) externally, the environmental changes based on that action. This mechanism allows agents with autobiographic memory to link their emotional expressions (for either internal or external events) to the changes of their internal needs. More importantly, their autobiographic memory records these "event-needs" relations as part of their life experiences, and thus they are able to infer the meaning of other agents' emotional expressions.

An Example from ORIENT Story Scenario

ORIENT is focused on friendship and integration strategies and is aimed at 13-14 year olds. It involves small groups of users interacting with a 3D virtual environment populated by intelligent agents from different fantasy cultures, using innovative communication and control devices and a mission that requires the teenage users to work together with the ORIENT cultures to save the planet. The users' task is to interact with each of the cultures through a number of engagement scenarios with the ultimate aim of saving the planet.

One of the scenarios will be a formal meal where agent_C has invited agent_D, which is from another culture on the planet, to join. The impact to agent_C's internal needs starts when it observes agent_D perform (what is to agent_C) a completely novel ritual when eating – the perceived situation reduces the level of both *certainty* and *competence* because agent_D's actions conflict with its own knowledge and expectation. This will then lead to an increase for these needs, and therefore, agent_C will adapt its future behaviour to take into consideration what they have just experienced. Since agent_C finds no relevant actions in the past to cope with the current situation, through the processes of *Intention Selection* and *Plan Generation* it chooses an emotional coping strategy with the display of *surprised* emotion to agent_D. The coping behaviour and changes to internal needs, together with the context as well as the reaction from agent_D are encoded in agent_C's autobiographic memory as a significant experience.

Since agent_D is from another culture, it may have a different reaction when perceiving agent_C's ritual. This is due to the inclusion of the Big Five which provides a foundational personality for each agent to show their own differences form others. The difference of reaction further leads to self-reflection and the creation of empathy – being aware of how others behave (see next subsection for details).

Generally when encountering an unexpected situation, how much agents adjust their behaviour will depend on their personality and past experiences individually. In the same way each significant event, that brings changes to their needs and triggers the elicitation of their emotion, allows them to learn from experience. Therefore, the learning of cultural emotional knowledge can emerge from intercultural agent-agent and user-agent interactions.

Specifications for Computational Autobiographic Memory

Given that the agent architecture supports both motivation-based personalities and appraisal models, the next key step is to produce the requirements that guide the integration of computational autobiographic memory. On the one hand these requirements are important to the conceptual specification of the overall architecture for ORIENT agents. On the other hand they are necessary in providing a method to validate the implementation of computational autobiographic memory.

Agents with "a life": Autobiographic Memory stores and re-constructs significant experiences that an agent derives from a *long-term interaction* with its environment and surroundings (objects, other agents, human users). By using the rich amount of information in autobiographic memory, the agent can largely extend its *temporal horizon* (Nehaniv & Dautenhahn, 1998; Nehaniv, 1999) which serves as an important foundation for an agent's planning process. The extended temporal horizon means that an agent's autobiographic memory and the remembering process provide 'extrasensory' meaningful information for the agent to modulate or guide its immediate or future behaviour – planning for future actions and storytelling about past or imagined events.

For example, it can relate the current situation to some particular moments in its memory, and then an action can be chosen based on the outcome desired by the agent. Therefore, ORIENT agents with autobiographic memory can be seen as "having a life" – a relatively long period of time – through developing such a kind of *interaction history*.

Repeated user-agent interactions: To facilitate the development of autobiographic memory, we aim to have users *interact repeatedly with the same* agent for a considerable amount of time in ORIENT. On the one hand, with an initial semantic world knowledge which is consistent with the agent's cultural background, the users' input can often violate an agent's expectations and thus create significant events in its autobiographic memory. On the other hand, while learning a specific culture in ORIENT, it is important for users to create a long-term relationship with an agent from that culture. This relationship has two important aspects: 1) the behaviour performed by the agent precisely reflects its culture – avoiding knowledge inconsistency which may be created by other agents or users that the agents is interacting with; 2) users can easily relate a currently perceived experience from a particular situation to past interactions with a specific agent. The latter aspect indicates that individualised interactions, as opposed to anonymous ones, can be more effective in learning other cultures for users in ORIENT.

Most importantly, a long-term relationship implies that users are familiar with the agent – understanding its personality through typical reactions to external events. This allows users not only to infer the agent's cultural background easily, but also to naturally engage empathically with the agent in various special occasions.

Forming relationships with agents: Other game characters in ORIENT which can provide pieces of information as cues for users to solve problems can be modelled as reactive agents (no autobiographic memory architecture) with the sole purpose of guiding users in ORIENT. In contrast, in long-term relationships developed through repeated interactions between the agent with autobiographic memory and users, both sides can gradually recognise each other's role e.g. as friend, ally, or enemy, etc. From this perspective, user-agent interactions in ORIENT emerge socially – the relationship drives the agent to behave differently when users are present, and also to behave differently in interactions with alternative users. This aspect also facilitates the link between an agents' emotion and attitude. Furthermore, agents' narratives can also be personalised for users – reconstructing events from autobiographic memory based on the history of the users' interaction.

Supporting Emotional Coping: In Ho et al (2007a) we showed that FearNot! agents (child-like characters inhabiting a virtual environment designed to teach school children how to better cope with bullying) possessing a simplified version of autobiographic memory can express their emotion by remembering past significant events (Ho et al, 2007; Dias et al, 2007). In FearNot! a user can interact with a victim character by offering potential coping strategies, after watching episodes of bullying take place in a virtual school environment. Our aim in the ORIENT agent architecture is to utilize the process of expressing emotion as one of the coping strategies when the agent is experiencing an unexpected situation.

Based on the information available to the agent from its autobiographic memory, a new set of goals will need to be formed in order to cope with the current unexpected situation and to reduce this discrepancy between expected and actual events. If no relevant information can be found to re-formulate the goals, the agent will be forced to fall back on emotion-based coping strategies. In our previous work (Dias et al, 2007), the agent architecture FAtiMA was implemented with a series of appraisal mechanisms and emotion-based coping strategies rooted in the OCC model (Ortony et al, 1998).

In addition to influencing the normal goal formulation process, agents with emotion can also generate coping strategies in the case that their autobiographic memory is lacking. Finally, these new coping strategies are themselves encoded into the autobiographic memory and can be used in the future to create and continuously update the working "self" to support the goal accomplishment.

Empathising with others: In ORIENT, we aim to create a concrete agent model with autobiographic memory and a feasible approach to enable agents to, at a certain level, "understand[11]" and thus empathise with others. The idea is to allow agents, by reconstructing past experiences, to reach the perceived physical-psychological states (e.g. emotions) of the target agents as closely as possible – perception of the target agent's feelings is a projection of the self. From the long-term autobiographic memory base, agents can remember past experiences which associate with specific physical-psychological states individually, as described in Ho et al (2007b). When a target agent's physical-psychological states are perceived by the empathiser (an agent that possesses autobiographic memory) then the empathiser will attempt to "imagine" a series of events in order to understand the target agent's situation. This first step models cognitive empathy. Afterward, through rehearsing the relevant experiences (internally re-perceiving these events from memory), the empathizing agent reaches similar physical-psychological states. This second step models affective empathy. At the end of this process the empathiser will express its physical-psychological states to the target agent; the target agent then may receive this empathy and feel experientially "understood", as suggested by Dautenhahn (1997, p. 20) "the concept of 'experiential understanding' can be described by dynamic mechanisms of resonance and synchronization". She further proposed that the metaphor of viewing artefacts as dynamic systems, studying interactions between an artefact and its environment, and correlating them with dynamics inside the agent could be a useful approach to experiential grounding of 'social understanding' in agents. The computational modelling of empathy discussed in this article is inspired by this view.

Based on the empathy cycle (Dautenhahn, 1997, Barrett-Lennard, 1993) the following necessary requirements and steps for modelling empathy in agents with autobiographic memory are suggested:

1. The "willingness" of the empathising agent after perceiving the target agent's physical-psychological states: a precondition for empathy to occur is to listen personally with truly interested attention and non-judging receptivity (Barrett-Lennard, 1997).
2. The available experience of the empathising agent: this enables the agent to "imagine" and thus "understand" the target agent's situation – remembering experiences, based on its own experiences or told by other agents, to allow an agent to reach the similar physical-psychological states that the target agent is currently in.
3. Rehearsal of the most appropriate experience: after all relevant experiences are retrieved from the autobiographic memory base and reconstructed with general event representations (Ho et al, 2007b), the empathiser selects the most similar experiences to rehearse internally[12]. The selected experience can bring the closest physical-psychological states (perceived from the target agent) to a) itself – if the experience is from its own or to b) other agents – if the experience was derived from story-telling or observation. Note that the reconstruction and selection of the most appropriate event is based on the empathiser's own perspective, therefore cultural differences may create 'difficulties' for this agent to have a good understanding of the target agent's situation. This exploration of such 'difficulties' is very relevant for ORIENT in order to support intercultural empathy.
4. Verbal or other behavioural expression toward the target agent: based on the selected experience that was rehearsed internally, the empathiser performs a certain behaviour to show its understanding of the situation to the target agent.
5. Finally, the target agent will receive empathy and thus feel "understood". Cultural differences may again create problems for the target agent to understand the expressed empathising action from the empathizer.

With this set of minimum requirements given to both agent architecture design and human-agent interaction specification, the *autobiography* of each agent can be richly developed and thus the agent can react to situations in a more believable (human-like) way. Based on the psychologically inspired approach, we can assume that 1) the agent's conceptualisation of emotional knowledge becomes more solid because meaning is now assigned to the individual agent's memory contents, e.g. as emotional impact; and 2) the inference of another's emotions based on unique subsets of internal physiological reactions can be established through the empathic processes.

As a result of having a dynamic personality model, appraisal processes and specifications of computational autobiographic memory for the implementation of the ORIENT agent architecture, we expect that agents in ORIENT can achieve social learning of the "self" and emotion knowledge from other cultures in their autobiographic memory. Eventually the selective memory encoding processes for emotion concepts from an agent will include: observing the target agents' behaviour, empathising, receiving feedback and exchanging experiences through communication with the agent.

CONCLUSION

In this article we discussed how agents can extend their emotional knowledge in social and cultural interactions with other agents or users. The computationally feasible and psychologically supported approach we proposed here for the implementation of IVAs integrates computational autobiographic memory with a cross-cultural personality model and the specification of requirements that facilitate the interactions. Essentially, computational autobiographic memory consists of temporal and episodic information encoded with sensory and emotional contents. As discussed in the previous section, it is critical to enable agents to have this kind of "autobiography" to derive the meaning of emotions and thus to learn new emotion concepts from another culture.

The main direction for this work is to complete the technical implementation of both the personality model and the computational autobiographic memory and the integration of them into the main agent architecture for game characters in ORIENT. As described in the previous section, the main agent architecture will be developed based on the PSI theory, and the emotion and appraisal models from the OCC taxonomy. Autobiographic memory will then play an important role in generating emotions and perception within the character's "mind", e.g. the character may perform individual emotional reactions while encountering other characters or users. In order to achieve this, appraisal variables must be dynamic and determined from the agent's experiences through the information stored in autobiographic memory. We also aim to carry out an evaluation in order to study whether the proposed memory model can increase the believability and interactivity of agents in the game played by different users.

Another future direction is to explore the social interaction between users and agents through gestures. Since using gestures can be a way to express one's emotion, and meanings of a gesture may vary in different cultures, this part of the research can extend the current approach of cultural and emotional knowledge learning for both users and agents. It is supposed that at any time the user can perform any gesture in front of game characters, but some gestures might have very different connotations depending on the context of the social and cultural interaction. Currently our project is examining the possibility of using the Nintendo Wii Remote[13] for recognising users' gestures as new input interface for ORIENT.

Finally, we are also interested to investigate *group* simulations in cultural learning and interactions. As reported by studies in psychology, the peer-group is increasingly important to adolescents and 90% of them identify themselves with a peer group (Palmonari et al, 1992). Also, according to the group socialization theory (Harris, 1996), teenagers' identities are shaped more by their peers than their parents because of peer pressure present in their environment. Therefore, modelling power relationships and the structure among members within a group is interesting – the expression of an agent's emotion can be influenced by both cultural background and the position of the member in the group.

ACKNOWLEDGMENT

This work was partially supported by European Community (EC) and is currently funded by the eCIRCUS project IST-4-027656-STP. The authors are solely responsible for the content of this publication. It does not represent the opinion of the EC, and the EC is not responsible for any use that might be made of data appearing therein.

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ENDNOTES

1. Developmental psychologist Tomasello argues that many unique characteristics of humans are elaborations of one trait that arises in human infants at about nine months of age: the ability to understand other people as intentional agents (Tomasello, 1999).
2. Markus and Kitayama (1991) argue that the independent and interdependent views of the self in psychology can have a systematic influence on different aspects of cognition, emotion and motivation. They suggest that, in many cultures of the world, the Western notion of the self is seen as an *independent* entity "containing significant disposition attributes and as detached from context". Next they point out, however, that in many other constructs the self is viewed as *interdependent* with the surrounding context, and it is the "other" or "the "self-in-relation-to-other" that is focal in individual experience.
3. Note, we do not claim that the artificial agents possess a concept of "self" comparable to that of e.g. human beings. We are using this concept in a computational sense with reference to an autobiographic memory architecture.

4 Bruner (1990) quotes the results of Barlett's serial reproduction experiments in *Remembering* (1932), namely that the most distinctive characteristics of human memory schemata are 1) being under control of an affective cultural "attitude", and 2) any "conflicting tendencies" likely to disrupt individual poise or to menace social life are likely to destabilize memory organization.

5 In this article we define narrative as "a story being told by, perceived by, or remembered (reconstructed) by an agent", thus a narrative requires a story and an agent interpreting this story. The agent's motivations, goals and other internal states, as well as the context of when and where the story is being told, perceived or remembered, will influence how the story is being (re-)created. 'Narrative story-telling' refers to the specific process of how a story is being told by an agent.

6 Childhood amnesia suggests that children from birth to approximately 5 years of age do not seem to form extensive personal episodic memories. For details, see (Wetzler& Sweeney, 1986).

7 The reminiscence bump is the effect in the temporal distribution of autobiographical memory which suggests that people tend to recall more personal events from adolescence and early adulthood (10-25 years) than personal events from other lifetime periods (Rubin et al, 1986).

8 Life-period' or 'life-time' of an agent refers to the computational duration of its memory, in the sense of how long the agent interacts with and remembers experiences in its environment.

9 Note that we are not using the Big Five model to operationalise cultural differences in agents. We use it to create roles for a virtual role-play approach which is only an aid or auxiliary means to implement personality differences in agents through need states. Personality dimensions such as the Big Five can be compared across cultures – empirical data shows that their meaning is comparable across different cultures in each dimension (Pike, 1954; Leung & Bond, 1984).

10 Praiseworthiness is the action that an agent performed a praise- or blame-worthy behaviour, from the observer's point of view. Therefore it relates to an agent's abilities to 1) predict the consequences of actions (*need for certainty*) and 2) master problems and tasks, e.g. satisfy one's needs.

11 Note that "understanding" as used in this article in a computational sense refers to the agent's ability to relate experiences to its internal states and past experiences, it does not relate to the phenomenological nature of understanding in biological systems.

12 Rather than assigning the physical-psychological states associated with a past experience directly to an agent, rehearsing this experience is necessary to allow the agent to have another comprehension of this event based on the existing semantic knowledge and activated goals. Furthermore, when an agent rehearses a past experience internally, both the importance and endurance of this experience in the agent's memory are increased.

13 Please refer to the official Nintendo Wii controllers website: http://wii.nintendo.com/controller.jsp.

This work was previously published in the International Journal of Agent Technologies and Systems, Vol. 1, Issue 3, edited by G. Trajkovski, pp. 51-78, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 2.13
Social Navigation and Local Folksonomies:
Technical and Design Considerations for a Mobile Information System

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ABSTRACT

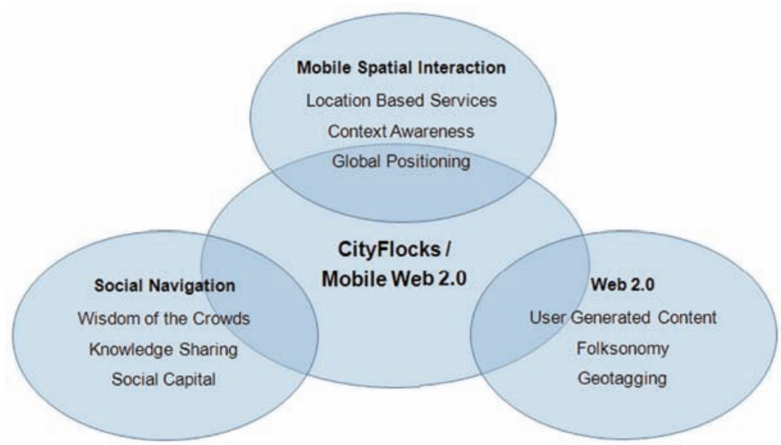
Web services such as wikis, blogs, podcasting, file sharing and social networking are frequently referred to by the term Web 2.0. The innovation of these services lies in their ability to enable an increasing number of users to actively participate on the Internet by creating and sharing their own content and help develop a collective intelligence. In this chapter the authors discuss how they use Web 2.0 techniques such as "folksonomy" and "geo-tagging" in a mobile information system to collect and harness the everyday connections and local knowledge of urban residents in order to support their social navigation practices.

DOI: 10.4018/978-1-60566-208-4.ch005

NTRODUCTION

Our physical world holds certain characteristics that enable us to interpret what other people have done, how they behaved, and where they have travelled. Sometimes, we can see traces on physical objects that provide hints about people's actions in the past. Footprints on the ground left by previous walkers can show us the right way through a forest or, in a library, for example, dog-eared books with well thumbed pages might be worthwhile reading as they indicate the popularity of the text. The phenomenon of people making decisions about their actions based on what other people have done in the past or what other people have recommended doing, forms part of our everyday social naviga-

Figure 1. CityFlocks is placed in an interdisciplinary field, embracing topics in social navigation, mobile spatial interaction and Web 2.0 technology



tion (Dourish & Chalmers, 1994). In contrast to physical objects, digital information has no such 'visible' interaction history *per se*. We do not see how many people have listened to an MP3 file or read a Webpage. In a digital environment people do not leave interaction traces, leaving us, according to Erickson and Kellogg (2000), 'socially blind'. However, the high value placed on social navigation in the physical world has motivated people to start thinking about it as a general design approach for digital information systems as well (A. Dieberger, 1995; A. Dieberger, 1997; Forsberg, Höök, & Svensson, 1998; Svensson, Höök, & Cöster, 2005; Wexelblat & Maes, 1999).

This chapter explores some of the technical and design considerations that underpin the conception and development of a mobile information system called *CityFlocks*. It enables visitors and new residents of a city to tap into the knowledge and experiences of local residents and gather information about their new environment. Its design specifically aims to lower existing barriers of access and facilitate social navigation in urban places. The technical development phase and the empirical usability research of *CityFlocks* has been reported elsewhere (Bilandzic, Foth, & De Luca, 2008). The purpose and focus of this chapter is to discuss the underlying design concepts that informed this social software. These concepts are positioned at the intersection of three broad areas of research and development that inform human-centred and participatory methods for designing interactive social networking systems on mobile platforms: social navigation, Web 2.0, and mobile spatial interaction (Figure 1).

First, the concept of social navigation and how people make use of it in the physical world are examined. Relevant previous studies and examples are discussed that apply social navigation as a design approach, e.g., for virtual information spaces on the Web. Based on the success and popularity of what has now been coined 'Web 2.0' services, the second part of this chapter analyses a number of Web development trends that foster participatory culture and the creation and exchange of user generated content. Some of these developments that introduced more and more social interaction and navigation methods to the Web, such as user participation, folksonomy and geo-tagging, were reappropriated to inform the design of *CityFlocks*. Given new generation mobile phones that allow global positioning, Web 2.0 technologies that were initially aimed to facilitate social navigation on the Web, can now be used to facilitate social navigation in physical places. The third part of the chapter discusses related projects in the field of mobile spatial interaction, a research area covering mobile applications that deal with information related to the user's surroundings. The review of the aims, strengths and weaknesses of previous research projects in this field refines the research trajectory which guides the development of the *CityFlocks* prototype and potentially similar mobile information systems. The chapter thus reveals further opportunities and issues regarding social navigation in the context of new generation mobile phone services, the 'Mobile Web 2.0' (Jaokar & Fish, 2006).

SOCIAL NAVIGATION

The phenomenon of people asking other people for advice is part of a broader concept called social navigation, at first introduced by Dourish and Chalmers (1994). They describe it as 'moving towards a cluster of other people, or selecting objects because others have been examining them' (Dourish & Chalmers, 1994). It can be seen as a form of navigation, where people make decisions about their actions based on what other people have done or what other people have recommended doing. Tourists in a new town for example, often choose to go to restaurants that are crowded with people rather than picking empty places. The fact that a fair crowd of people has decided to walk down a certain path within a space, enables us to be more comfortable to do so as well (Norman, 1988; Rheingold, 2002; Wexelblat & Maes, 1999). We might also take such interaction histories between objects and people as a warning. For example, if we observe skid marks while driving on a road, we implicitly slow down because the marks show us that an earlier driver obviously had to brake rapidly.

Mediated and Unmediated Social Navigation

Compared to physical spaces, in the digital world there are no such visible hints that naturally describe an object's interaction history. In contrast to a physical paperback book or a CD, digital documents or music files do not have dog-eared pages or scratches that give us an idea about their amount or time of usage. Similarly, footprints of earlier walkers in the wood might show us the right way, as opposed to virtual information spaces, such as the Web, that do not provide any natural traces and visible paths that could help following navigators. People have recognised that such traces on physical objects provide important information for their navigational behavior in physical spaces and have constantly been trying to transfer the same sort of navigational aid to virtual information spaces, especially to the Web (A. Dieberger, 1997, 2003; Höök, Benyon, & Munro, 2003).

In the recent years people have developed mediated techniques and technologies that provide much more sophisticated social navigation possibilities. In the physical world we are restricted to visual traces on objects (e.g. dog-eared pages on a book) that only give us a vague hint about its quality. Using the second possibility in a non-digital world to find out about a book's quality, asking people directly about their personal opinion, we are restricted to a number of friends or librarians who might have read it before. In contrast to that, the Web has some clear benefits for making use of social navigation. It connects hundreds of millions of people from all over the world in one medium. People have developed services and technologies that leverage this physical connectivity of Web users to connect them on a social level as well. To continue with the book example, Amazon (http://amazon.com) for instance has created a platform that brings together people from all over the world to comment, review and exchange personal opinions before they purchase a book. The platform keeps track of the books each user has purchased in order to identify and suggest titles that other users with the same shopping history have read as well. As all purchases, reviews and ratings are tracked and saved in a database, collaborative filtering methods can be applied to analyze the taste of many people to automatically predict the book taste of individual users. Providing such a mediated social environment, Amazon has created far more sophisticated social navigation affordances than traditional book stores ever had.

In the last couple of years the social navigation approach for designing Web services has become ubiquitous in the Web due to the appearance of a set of Web 2.0 technologies which facilitate rich user interfaces (e.g. AJAX, CSS), the use of interchangeable data formats (e.g. XML, RSS) and a user based taxonomy (e.g. folksonomy, geo-tagging). The high potential of Web 2.0 technologies combined with the fast development of mobile phone capabilities, such as global positioning technology and high-speed Internet access opens up great capabilities to develop mediated social navigation aids for mobile phone users in physical spaces. Similar to how Amazon leverages the physical connectivity of Web users to provide social aid and recommendations for book shopping, the connectivity of mobile phone users and recent mobile phone technology can be leveraged to enhance social navigational help when searching for places in the physical world.

The Evolution of Social Navigation on the World Wide Web

The problem in the early stages of the Web and its hyperlink based navigation was a lack of navigational and visual structure of space. As Dieberger claims, this very lack of visual structure was the reason that motivated people to start sharing their link references on their personal home pages (A. Dieberger, 1997). Users were ironing out the lack of structure in the Web by providing navigational help to each other. This social sharing of information or hyperlinks with others on the Web is the major enabler of what we call *surfing* or *browsing* the Internet, which turned out to be a popular search strategy for finding Websites on the Internet (Erickson, 1996). People have actually adopted the same strategy they usually apply to find information in the real world: They ask people in their social networks and if they can not help, they would know someone who knows and eventually they would get the information they were looking for. Similarly, people started to search for information on the Web by browsing through personal Websites and following their links to other personal Websites until they found the site with the specific information. Erickson describes this early phenomenon in the World Wide Web as a *"slow transformation from an abstract, chaotic, information Web into what I call a social hypertext"* (Erickson, 1996). With this social hypertext, the Web has become a medium that people can easily browse through the immense pool of social capital and knowledge available in their networks.

Social navigation has become a key principle of how we search for information and navigate the Web today. One example that illustrates its breakthrough on the Web can be seen in the history of search engines. While early search engines until 2001, such as Lycos, Yahoo or Altavista were still based on big Web directories, Google has outpaced all other players with *relevance ranking*, a search concept based on social navigation. Google implemented this concept in its *PageRank* algorithm. For any URL on the Web, it analyses the amount and content of Web pages that refer to it when calculating its position in the search results (Google, 2007). The more people set links to a particular Website, the more important Google considers it to be and the further up it appears on the result page. What Google has achieved with *PageRank* is basically an automation of searching for a Website that most other people hyperlink to from their own Webpage. Thus, for any topic or search request it provides a ranking of pages that are obviously considered to be the most popular among other people on the Web.

The CityFlocks prototype is a similar system designed for local places and services in a city. For any type of local service in a city, e.g. ‘fish restaurant’ or ‘tennis court’, the system comes up with a ranking of the most popular, relevant places in the city, based on the opinion and ratings of the local community of residents. Harnessing the intelligence of local residents and their participation on a shared knowledge platform can democratise urban information, such as opinions about a local service or place. The next section explains how participatory culture has transformed the Web from something we considered as a pure information space to what it has become today, a thoroughly social medium (O’Reilly, 2005).

WEB 2.0

The term Web 2.0 has been coined to identify – arguably – a second-generation of Web services that aim to facilitate collaboration and sharing between users, such as social networking systems, file sharing sites and wikis. These services provide means for users to engage in participatory culture that are no longer limited to the technically versed or the civically inclined. Scholars such as Jenkins (2006) and Burgess et al. (2006) have identified socio-technical trends towards a wider (‘vernacular’) ability of people to participate in digital culture through personal expressions of creativity. Many examples of how participatory culture is enabled by recent technological innovation rely on Web 2.0 applications and services such as blogs, Wikipedia, YouTube, Flickr, and social networking sites such as Facebook, which are arguably more open, collaborative, personalisable, and therefore participatory than the previous internet experience. According to Kolbitsch & Maurer (2006), the participatory qualities of Web 2.0 encourage ordinary users to make their knowledge explicit and help a collective intelligence to develop. In an urban context, Foth et al. (2007) argue that such capabilities present diverse possibilities for a profound urban epistemology to evolve. New tools and practices, inspired by user-led innovation, are springing up faster than our ability to analyse them individually. It has been claimed that such a social navigation approach can foster a new generation of user experience for mobile applications as well (Höök, 2003; Jaokar & Fish, 2006). Bypassing the terminology debate, whether the term ‘Web 2.0’ is adequate, this section focuses in particular on three characteristics of Web 2.0 developments, that is, user participation, folksonomy and geo-tagging. It prepares the discussion in the next section about the ways these characteristics can be applied to a mobile spatial interaction service that facilitates social navigation in the physical world.

User Participation: Let the Users Generate Content

Looking back at the history of the Internet, we can see that its real breakthrough as a social mass-medium first came with the introduction of the World Wide Web, the number of users skyrocketing from 600.000 to over 40 million within only five years (Friedman, 2006, p.61). One major reason for this magnificent success of the Internet was that for the first time people were given a medium which allowed them to participate in the content creation process. In contrast to other media such as television or radio which only enables professional information providers to broadcast information, the Web enabled individual users to contribute. Hypertext Markup Language (HTML) offered users means to codify, upload and share their own content with other users on the network. With hyperlinks they were able to refer and set shortcuts to other relevant or interesting pages. This is in fact how the Internet became a social medium. The combination of user participation and the hyperlink system enabled the Web to be used as a tremendous repository of social knowledge (Erickson & Kellogg, 2000).

However, the majority of Web users were

still only information consumers. The lack of technical background knowledge, such as learning a markup language, uploading a site to a Web server or take care of the site administration has prevented many people from creating their own Webpage (Kolbitsch & Maurer, 2006). This is what the introduction of Web 2.0 technologies has dramatically changed. They flattened the technical obstacles and made it easy for anybody, not only geeks and professional information providers to engage in the content creation process. With wikis, Weblogs or file sharing services for example, people do not need to learn HTML anymore in order to publish content on the Web. Such services provide frameworks, templates and tools that abstract from the technical layers and enable ordinary users to easily become authors of Web content. User generated content became a new paradigm for this revolutionary generation of Web 2.0 services (O'Reilly, 2005). Web 2.0 blurs the strict borderline between consumers and information providers which eventually leads to a trend of entirely community-driven Web services (Lindahl & Blount, 2003).

People were given a tool to discuss ideas, exchange information and give advice to each other. With Flickr (http://flickr.com) and YouTube (http://youtube.com) people can easily share their pictures and videos; Blogger (http://blogger.com) and Typepad (http://typepad.com) allow individuals to publish personal stories, and Yahoo Answers (http://answers.yahoo.com) provides a platform for people to answer each other's questions on specific topics. The content of all those services is almost entirely created by the community of its users. This trend towards flattening technical barriers and giving individuals a voice in a mass medium, what Anderson refers to as 'the Long Tail' (Anderson, 2006), is one of the key success factors of Web 2.0. While conventional Web services have mostly been providing content from a single entity (e.g. a professional content provider), they were outpaced by services leveraging the collaboration of many different entities which would all upload and share their content with others. Following this community driven approach, Wikipedia (http://wikipedia.org), an online encyclopedia, has outpaced Britannica, the most successful encyclopedia till then. The huge amount of Web users, who add or edit Wikipedia articles, renders the content creation process much more flexibly than the relatively small number of Britannica authors. Consequently, the articles in Wikipedia are more current and have a much larger range of topics, covering 3.7 million articles in 200 languages from more than 45,000 registered users who upload about 1,500 new articles every day (Giles, 2006). The benefit of such collaborative information platforms is that their content is based on the collective intelligence of a crowd of people. As Surowiecki (Surowiecki, 2004) puts it, "the many are always smarter than the few", meaning that the information content from a massive user community can not easily be outpaced by a single entity. O'Reilly argues that this paradigm is one of the main drivers of this new generation of Web applications, the Web 2.0 (O'Reilly, 2005).

The community driven design approach of those services transformed the Web in a way that they now take advantage of the dynamic intelligence and content generating power of its community to provide full-blown and highly up-to-date information (Kolbitsch & Maurer, 2006; O'Reilly, 2005). This user participation and uploading of information facilitates social navigation on a much larger scale than we have in the physical world. In fact, the very process of designing proper affordances that allow people to socialise and help each other to navigate digital systems, has been a research topic in various domains (Höök et al., 2003), e.g. online food shopping (Svensson et al., 2005) or Web browsing (Andreas Dieberger, 1995; A. Dieberger, 1997, 2003; Wexelblat & Maes, 1999), where e.g. Wexelblat and Maes have introduced Footprints, a system that tracks and visualises the navigational behavior of a Website's visitors in order to provide future visitors with navigational aids such as maps and paths (Wexelblat & Maes, 1999).

These studies have shown that social navigation affordances do enhance users' experiences in digital information spaces. They have explored a number of design principles that are significant in different use cases and domains. Additionally, there are suggestions for some key principles, e.g. privacy, trust, personalisation and appropriateness that should be considered in general when designing for social navigation in digital systems (Forsberg et al., 1998).

Folksonomy: Let the Users Organise Content

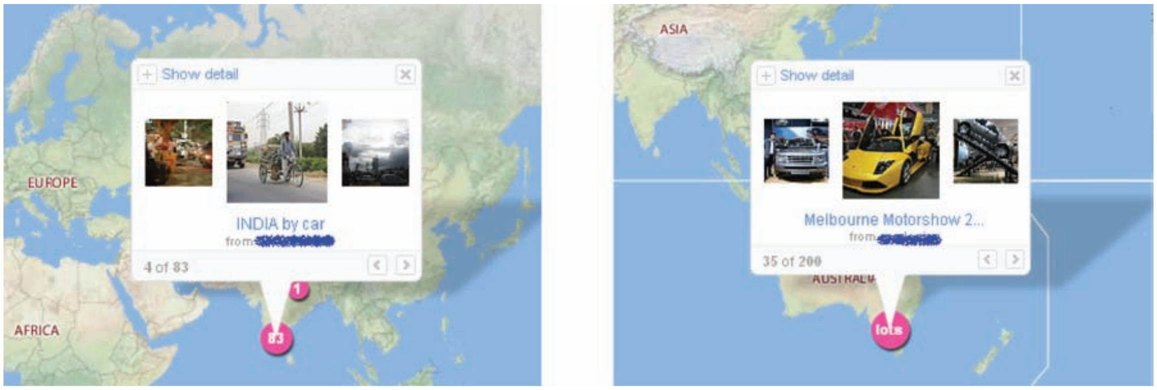
With the amount of user generated content constantly increasing in Web services, there is a need to structure and organise all the uploaded material. This would ensure that the submitted content could be identified and retrieved at a later point in time. One straightforward way is to set up an indexing system, where all the information would be put in pre-fixed categories. This process usually requires highly trained information professionals and is very inflexible, e.g. for storing information that does not fit in any of the existing categories (Macgregor & McCulloch, 2006; Vander Wal, 2007). In order to provide a more flexible storing and retrieval system, recent Web services that deal with huge amounts of user generated content like Flickr or Del.icio.us, have employed a technique that has come to be known as 'folksonomy' (Golder & Huberman, 2005; Macgregor & McCulloch, 2006; Vander Wal, 2007). Folksonomy is a user created taxonomy for people to generate short keywords about their uploaded content rather that putting them in fixed categories. By assigning these keywords or so-called tags, the semantics of various information resources can be easily described (Amitay, Har'El, Sivan, & Soffer, 2004; Casey & Savastinuk, 2007; Coleman, 1988; Macgregor & McCulloch, 2006; Torniai, Battle, & Cayzer, 2005). A user submitting a picture of her new car on Flickr could for instance use the tags 'car', 'automobile', 'porsche' and 'cabriolet'. In contrast to an index, the picture will not be saved in any pre-fixed category in the system, but can be retrieved under any of those keywords. As users can assign such decentralised keywords to their content, there are no restrictions to what information one can submit as opposed to the constraints of fixed categories. The organisation of the information resources are completely controlled by the users themselves, which makes the system cheaper and much more flexible. Most recently, the advantages of this user based contextualisation of items have been used to facilitate information retrieval in libraries as well (Casey & Savastinuk, 2007; Courtney, 2007).

This collaborative tagging method, initially developed to organise information on the Web, can be transferred to a mobile information system that people use to describe places in the physical world. Like Delicious (http://del.icio.us) uses collaborative tagging to let Web users identify, describe, recommend and organise Internet-addresses (URLs), CityFlocks was designed in a way that allows the community of local residents to do the same with physical places in a city. Comments on the ice-cream parlor next door could for example be tagged with 'ice-cream', 'dessert' and 'coffee'.

Geo-Tagging: Spatially Contextualised Content

Encouraging ordinary people as content providers for local information can be an effective way to provide a democratic, current and comprehensive pool of local information and news (We Media, 2003). In contrast to citizen journalism platforms, e.g. MyHeimat (http://myheimat.de) or EdgeX (http://edgex.org.au), which enable local citizens to upload extensive stories relevant to their wider city area, there are use scenarios which indicate that

Figure 2. Example from Flickr.com - Folksonomy and geo-tagging enable a flexible organisation and retrieval of pictures



spatial contextualisation sometimes requires finer granularity. A story or piece of information might for example only be relevant to a neighbourhood in the city or a specific place, like a shop.

In this cases geo-tagging, a method to attach latitude and longitude identifiers, enables people to put their information resources such as text, pictures or videos into a specific geographic context (Torniai et al., 2005). Such spatially and semantically contextualised information can be applied to overlay the real world with a virtual information space to be used for mobile services (Burrell & Gay, 2002; Jaokar & Fish, 2006), and more specifically, create a mediated social environment that helps people navigate physical spaces by using location aware mobile devices. Qype (http://qype.de) for example provides such a service which uses user-generated, geo-referenced comments in a mobile information service.

Similarly, recent photo cameras can automatically attach the latitude and longitude coordinates of the current geographical position when taking pictures. Later, the pictures can be displayed with special programs or Web services on a map where they were taken. Locr (http://locr.com) for example provides such an online service to organise your picture collection on a geographical map and share them with others. As all pictures are geo-tagged people can compare their own pictures with the photos that other people or friends have taken at the same place or city. Or they can use it to see pictures of a place they plan to visit soon in order to learn about it in advance. Collaborative Tagging has enabled Web users to describe the content and theme of their pictures and make them retrievable for other people. Geo-tagging allows them to additionally share the geographic location of where they have taken each of their pictures. Enriching the metadata of one's pictures with both, folksonomy tags and geographic identifiers enables a very specific and flexible organisation and retrieval of pictures in a shared database. Figure 2 shows a search request on a Flickr-map (http://flickr.com/map) for pictures that were taken in Bangalore, India and Melbourne, Australia and annotated with the tag 'car'.

Dealing with respectively large masses of stored data, Web 2.0 services have developed two very powerful information organisation methods – folksonomy and geo-tagging. With the design of the *CityFlocks* prototype we sought to transfer Web 2.0's participatory culture as well as the folksonomy and geo-tagging methods to foster a location and context sensitive mobile information system. Applying collaborative tagging and geo-tagging to a community driven, mobile information system enables people to annotate urban places in their neighbourhood with comments and recommendations and describe their entries with tags for later retrieval purposes. Such an urban information system helps collecting local knowledge and experiences in a shared knowledge platform about inner-city places and facilities. The collective intelligence and knowledge of local residents about particular places and local services in a city is much bigger than any single entity like a professional agency could provide. With the geographical identifiers in its metadata, the submitted content is used to support tourists and visitors in finding popular local services in new cities recommended by locals.

MOBILE SPATIAL INTERACTION

The previous sections have covered related projects and literature on social navigation and relevant Web 2.0 technologies. This section is dedicated to related work and research studies undertaken on the mobile platform, specifically mobile spatial interaction, i.e. location and context-aware mobile applications that refer to information relevant to the current surroundings of the user. Such applications can be classified in four different categories: Systems that facilitate navigation and wayfinding in geographic places, mobile augmented reality applications, and applications that create or provide access to information attached to physical places or objects (Fröhlich et al., 2007). In the context of *CityFlocks*, the latter two categories are of special interest.

Lancaster University's GUIDE project for example is an electronic tourist guide that provides users with context-aware information, depending on their profile, interests and location. Its focus is on providing an automated personalised guided city tour with dynamic, interactive services. However it can only read information, but does not provide any content-generating functions to its users (Cheverst, Davies, Mitchell, Friday, & Efstratiou, 2000; Lancaster University). Another example for accessing virtual context-information on mobile devices, are applications that are based on visual codes (Ballagas, Rohs, & Sheridan, 2005; Rohs, 2005; Rohs & Gfeller, 2004; Toye et al., 2004). Using mobile phones with embedded photo cameras, one can select those visual codes and request information related to the object or place where the respective code tag is attached to. A drawback of this method is that the user can request information only in-situ, but not from remote places.

The other type of applications relevant to the context of this work enables users not only to read but also create spatially contextualised content. GeoNotes (Espinoza et al., 2001) and Urban Tapestries (Proboscis, 2003) for example allow mobile users to attach virtual sticky notes to particular latitude / longitude coordinates. Equipped with Wi-Fi enabled Personal Digital Assistants (PDAs), GeoNotes users can see other users' notes that were left behind in their current immediate surroundings. Even though GeoNotes embraces users as information producers rather than just passive consumers, it is not an entirely community driven service. Its major weakness is that the user generated post-it notes are managed in hierarchical, tree-like location structures that have to be set up in advance manually. Thus people can create location based content, but are limited in specifying how it can be retrieved by other users. Urban Tapestries on the other hand allows users to self-organise their comments and relationships to different places with category-like "threads" (e.g. "my favorite pubs and clubs"). E-Graffiti, a context-aware application evaluated on a collage campus, detects each participating student's location on the campus and displays notes that were left behind by other students (Burrell & Gay, 2002). Just-for-Us (Kjeldskov & Paay, 2005) and the George Square project (Brown et al., 2005) represent context-aware real-time applications that provide an enjoyable shared social interaction of remote users that follow a common goal. While Just-for-Us helps a group of friends in a city to identify a good place to meet depending on their individual current locations, the George Square project focuses on location, photography and voice sharing functions to let on-site and off-site users collaboratively explore a city sight.

Much of the previous work in mobile spatial interaction is on enabling users to access or add content to physical places or objects. They focus on techniques that allow people to retrieve locative information or share it with others by attaching stories, thoughts, experiences and knowledge to specific places. Besides the various use scenarios, the applications primarily differ in the interaction design of specific features (Tungare, Burbey, & Perez-Quinones, 2006), e.g. access virtual post-its from remote places (Espinoza et al., 2001; Proboscis, 2003) vs. in-situ access (Burrell & Gay, 2002; Lancaster University, ; Rohs, 2005), push (Espinoza et al., 2001; Kjeldskov & Paay, 2005) vs. pull services, expiration dates of the messages or private vs. public messaging (Burrell & Gay, 2002; Espinoza et al., 2001). While most of the previous projects discuss such different features around indirect and asynchronous interaction methods (i.e. people exchange information by attaching text or multimedia content to specific places), not much work has yet been carried out on studying direct interaction methods (e.g. phone call, text message) in the context of spatial interaction.

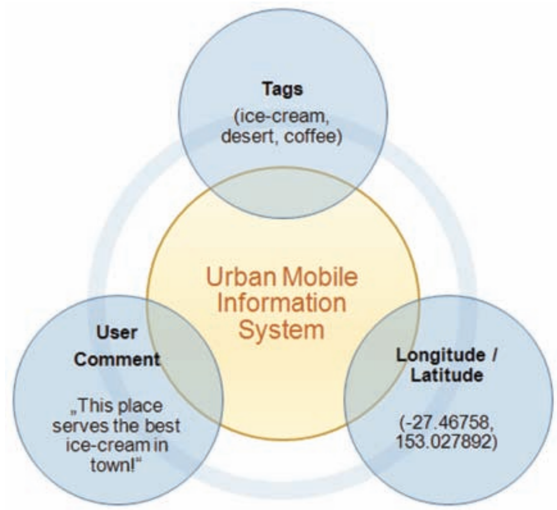
CityFlocks focuses on evaluating the performance of people using direct and indirect social navigation methods when gathering information about a specific place. In a similar context, solely the George Square study supported a voice connection and has shown to be the most valuable channel for people when collaboratively exploring a city sight. In contrast to George Square, our participants were not recruited as pairs of friends, but complete strangers. Furthermore, the context is information and knowledge sharing in urban environments rather than collaborative exploration. *CityFlocks* users can, in addition to leaving relevant text or multimedia content at specific places, also attach their contact information. Other mobile phone users who are interested in more details about the place can then contact the author of the virtual post-it directly via voice-link or a direct text message. In a field study we evaluated which method, direct or indirect communication, users prefer in which situation and context (Bilandzic et al., 2008). The outcomes inform future mobile spatial interaction systems that are targeted in providing information to its users about places and objects in their immediate surroundings.

CONCLUSION

Originally social navigation was restricted to visible interaction histories that were naturally left behind and thus clued on earlier physical interaction between people and the respective object. People interpret these hints as a message, recommendation, warning or just a note telling them something about the type of interaction the previous navigator had with the object. Above, we have seen how online social communities have improved the social navigation experience for special interest groups. With the rapid developments of mobile information and communication technology, the methods which have been developed for such communities on the Web, can also be used to enhance social navigation in physical spaces (Höök, 2003).

There is an emerging trend that sees the network connectivity of mobile phone users leveraged to create a mediated social environment where people who are interested in particular geographic locations can exchange information, personal opinions and experiences with the respective place. This would for example enable visitors of a new city to access the knowledge and experiences from local residents about inner-city facilities. Recent developments in the mobile technology sector indeed have made this scenario become realistic. Multimedia mobile phones with voice recording and photo camera capabilities as well as mobile high speed Internet networks enable users to create and upload location based content anywhere,

Figure 3. A resident-driven mobile information system: A mashup of folksonomy tags, location-based user recommendations, and geographic identifiers



anytime. Equipped with such a device, people can easily capture and digitise whatever they have experienced at the very point of inspiration, using text, video or audio recordings (Jaokar & Fish, 2006). A mobile Web application would let them upload such location based recommendations and make them available for other mobile users who plan to navigate the same space later on. For example they could create a recommendation for an ice cream parlor, saying *'This place serves the best ice-cream in town. They have a wide range, cheap prices and a very friendly service!'* and attach a rating, e.g. 8 out of 10. Applying collaborative filtering techniques, the service provides a ranking of the most popular places based on all mobile users' entries. This mind-shift in designing mobile services towards a high engagement of individuals has great potential to enhance peoples' experience when navigating physical spaces (Höök, 2003; Jaokar & Fish, 2006). Turning mobile phone users into in-situ journalist who can upload location based ratings, comments and recommendations to a shared community platform will eventually form a huge social knowledge repository decentralising control over information about local services.

This idea targets a community-driven urban information service. The service is meant to provide an infrastructure to let residents become authors of information regarding their own neighbourhoods and make them available for interested people in the city, e.g. visitors and tourists. User participation, folksonomy and geo-tagging are three design methods that have become popular in Web 2.0 community-platforms and proven to be an effective information management tool for various domains (Casey & Savastinuk, 2007; Courtney, 2007; Macgregor & McCulloch, 2006). Applying such a design approach for a mobile information system (Figure 3) creates a new experience of collaboration between mobile users, a step towards what Jaokar refers to as the 'Mobile Web 2.0' (Jaokar & Fish, 2006), that is, a chance for mediated social navigation in physical spaces on the move.

ACKNOWLEDGMENT

The author would like to thank Helen Klaebe, Greg Hearn, Ronald Schroeter, and all study participants for their support. This study was supported by the Institute for Creative Industries and Innovation at Queensland University of Technology and the Center for Digital Technology and Management at the Technische Universität München. Further support was received through the Australian Research Council's Discovery Projects funding scheme (project number DP0663854), *New Media in the Urban Village: Mapping Communicative Ecologies and Socio-Economic Innovation in Emerging Inner-City Residential Developments.* The author is grateful to be a scholarship recipient of the German National Academic Foundation (*Studienstiftung des deutschen Volkes*). Dr Foth is grateful to be the recipient of an Australian Postdoctoral Fellowship.

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KEY TERMS AND DEFINITIONS

Folksonomy: In the context of the Web 2.0 discussion, a folksonomy (sometimes also known as a 'tag cloud') is a user-generated taxonomy made up of key terms that describe online content. By assigning these freestyle keywords or so-called 'tags', the semantics of various information resources can be described in a more flexible, decentralised, collaborative and participatory way than fixed categories allow for. The term has been coined by Thomas Vander Wal.

Geo-Tagging: An approach which adds latitude and longitude identifiers as metadata to online content. It enables people to embed their information resources such as text, pictures or videos in a specific spatial and semantic context to augment the physical world with virtual information. Such a mediated social environment can help people navigate physical spaces by using location aware mobile devices.

Local Knowledge: Knowledge, or even knowing, is the justified belief that something is true. Knowledge is thus different from opinion. Local knowledge refers to facts and information acquired by a person which are relevant to a specific locale or have been elicited from a place-based context. It can also include specific skills or experiences made in a particular location. In this regard, local knowledge can be tacitly held, that is, knowledge we draw upon to perform and act but we may not be able to easily and explicitly articulate it: “We can know things, and important things, that we cannot tell” (Polanyi, 1966).

Mobile Spatial Interaction: The increasing ubiquity of location and context-aware mobile devices and applications, geographic information systems (GIS) and sophisticated 3D representations of the physical world accessible by lay users is enabling more people to access information relevant to their current surroundings. The relationship between users and devices as well as the emerging oportunities and affordances are summarised by the term ‘mobile spatial interaction’.

Mobile Web 2.0: The suite of systems and mobile devices which either run existing Web 2.0 applications or re-appropriate Web 2.0 characteristics (tagging, user participation, mash-ups, personalisation, recommendations, social networking, collective intelligence, etc.) for the specific context of mobile use and mobile devices.

Social Navigation: The process of guiding activities aimed at determining our position and planning and following a specific route based on what other people have done or what other people have recommended doing. First introduced by Dourish and Chalmers (1994), they describe it as ‘moving towards a cluster of other people, or selecting objects because others have been examining them’.

This work was previously published in the Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos and S. Warburton, pp. 52-66, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.14
Social Networks Applied to E-Gov:
An Architecture for Semantic Services

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ABSTRACT

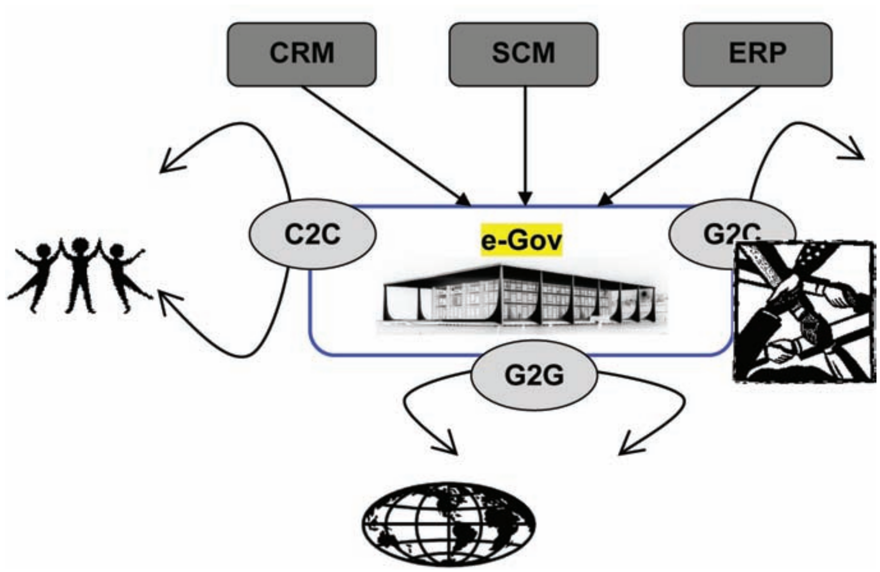
The technological advances establish new communication forms between people and have also reached the government sphere and its activities, improving access to information and allowing greater interaction between citizens through C2C (Citizen to Citizen) Services. Based on these aspects, this chapter presents a proposal for software architecture, using a social network to map the relationships and interactions between citizens, accounting and storing this knowledge in a government ontological metadata network. Using UML notation (Unified Modeling Language) for Software Engineering process and Java platform for development, a software prototype was modeled and developed in order to manage and handle e-Gov-driven social networks, using ontological metadata to computationally represent the social ties. This prototype is also capable of providing graphical display of social networks, enabling the identification of different social links between citizens, creating a tool intended for government agencies, since it allows a quantitative analysis of information in the social network.

DOI: 10.4018/978-1-60566-650-1.ch039

INTRODUCTION

The accelerated advances of Information and Communication Technologies (ICT) have facilitated information exchange among people, geographically separated or not. The availability of faster, computer-mediated interaction devices and technologies enabled the emergence of new kinds of relationships

Figure 1. e-Gov as a merge of CRM, SCM and ERP systems



among people, establishing the concept of virtual communities (Rheingold, 2000).

Similarly, governments have been following the above mentioned technological trends, as a way to improve the services they are meant to make available to their citizens, or even for training civil servants in order to improve the decision-making process. This progress enabled the emergence of a new concept for such strategies of computer-mediated governance, often called e-Government (briefly, e-Gov).

These new strategies of using computer-based solutions for improvement of governmental actions have led governments to look for digital convergence through the integration of different systems (G2G), providing faster and clearer information to citizens (G2C), creating solutions to a more participatory politics with the community (C2G) and promoting interaction and integration among citizens (C2C). The development of such structures should take into account the ability to provide high-quality services, besides facilitating an efficient integration between citizens and government agencies, thus making them each time more similar to CRM (Customer Relationship Management)-based systems (Sang et al., 2005). Such e-Gov systems must also handle massive volumes of data, a considerable number of actors, as well as the multiple variables involved in procurement and financial transactions in a similar way to SCM (Supply Chain Management) systems. Another aspect that must be implemented efficiently is the standardization and management of operations and processes, similarly to the functionalities normally found in an ERP (Enterprise Resource Planning). Figure 1 shows how the merging of such different systems could result in more efficient e-Gov systems.

E-Gov systems that are targeted directly to citizens must promote social integration and must also have tools to help people to meet their needs. A possible way to achieve this goal is through the implementation of adaptive systems that are able to modify themselves according to each information and data inserted into them. Through the use of technical analysis (Hanneman, 2005), each citizen could be represented as an actor in a network; interactions and relationships among them could be represented as relational ties, thus forming an one-mode network.

Knowledge distributed among citizens of a network could also be classified and categorized through metadata, and stored into ontological databases. Thus, ontology-driven computational agents would be able to make inferences about such data and, with this kind of semantic analysis, dynamically expand the social network, consequently extending the relationships of each actor.

Based on the information available through the network, each citizen connected to the system will be able to search and find people which have common needs and interests to discuss possible solutions for individual or common problems. In this context, a social network could be easily viewed in its graphical form, making easier the task of creating groups of citizens, which would be a useful tool for governments to examine the issues discussed in society, and to assist in the creation of more effective public policies.

In this sense, this chapter is organized as follows: first section presents the concept of electronic government, as well as the related stages, platforms and services. Second item deals with definitions, organization and usage of Social networks in the context of electronic government. In the third section it is presented a proposal of an ontology-driven representation and extraction of knowledge in social networks. Fourth item details the development and application of a methodology to implement the previously proposed architecture, showing some tests and results. Finally, last section presents some final comments and indications of future work.

STAGES AND SERVICES IN E-GOV PLATFORMS

As previously stated, ICTs provide new tools and solutions that are changing the processes of governing. Through these innovations, governments are able to create ways to reduce bureaucracy in their processes, modernizing legislation and making faster and clearer the actions of executive, legislative and judiciary branches. These strategies, investments and concepts are commonly grouped under the name of e-Government (e-Gov), as before mentioned. Analyzing the presence and development of e-Gov in several countries, it is possible to identify four main stages, commonly numbered from 1st to 4th (Layne & Lee, 2001)

The first stage, called *Presence* or *Cataloguing*, is characterized by the assembly of electronic information in an unstructured way, with no interactive elements. Each government agency publishes the information on web sites, forming a sort of online catalog. There is no integration among such information, which often leads to the problems of misinformation or, at least, information replication.

In the second stage, named *Interaction* or *Transaction*, information is presented better integrated and organized. In this stage, it is possible to download forms and other types of documents, access links to related pages, among other common functionalities. Citizens are also able to submit suggestions and questions to the responsible for the information, creating a bidirectional way of communication.

The third stage, *Exchange of Values* (*Information*) or *Vertical Integration*, is characterized by a set of processes that can be performed completely online. This is available to citizens in online systems, which enable, for instance, the payment of accounts, taxes, electronic registration in public education systems and some sort of tools for distance learning. Due to the volume of information system' processes required by this stage, these are also elements that promote the integration of different databases, as database management systems that are optimized to operate with distributed databases, components and distributed objects, among others technologies.

In the last stage of development of e-Gov, *Integrated Services* or *Horizontal Integration*, the changes are increasingly more visible and more complex. The government has usually many portals organized by functions or themes. In this stage all governmental bases are integrated and each change in a system must be propagated to other systems.

To achieve each one of these stages of development in the e-Gov-platform, it is necessary to achieve different service' levels in order to update governmental actions, leading to more effective participation of citizens and corporations.

Sang et al. (2005) divide e-Gov systems into six major areas of focus:

- **Government to Citizen (G2C):** Addresses on-line services provided by the government with the aim of providing to citizens pieces of information on procedures for legal proceedings, request and make requests for documents, among others.
- **Citizen to Government (C2G):** Refers to the provision, by the government, of services that enable citizens to introduce a flow of information from them to govern agencies.
- **Citizen to Citizen (C2C):** In this kind of service, the government acts as a provider of integration and interaction between citizens, this occurs through the provision of services and systems that facilitate the exchange of information and interaction.
- **Government to Business (G2B):** Relies on the provision of business services that usually are focused on facilitating and expedition and shipments of documents and information labor and tax, thus promoting more transparent, agile processes.
- **Government to Government (G2G):** It is intended for integration of governmental agencies, thus unifying and facilitating data transfer and internal processes between them. This sort of service could be also be used to promote cross-country integration, for instance, in common market-based economies or political block, as European Union or Unasul, in South America.
- **Government to employer (G2E):** Involves features intended to facilitate the work and enable public services to dialogue with employers, in order to expand the job offers, discuss labor taxes and so on.

In general, the organization of governments is often based on a hierarchical structure, with subdivisions, agencies, ministries and departments. All this structure is barely conducive to solve the real needs citizens have in a timely fashion. One possible solution to this problem is to provide citizens the necessary tools, based on C2C services, so they could establish relationships, though virtual, with other citizens. Through this integration, it is possible to create social networks of cooperation, thus facilitating each citizen to find other people who have, or already have had, the same needs and so being able to collaborate with them.

Next section will explain this kind of collaboration.

SOCIAL NETWORKS OF CITIZENS

By considering the relationships and interactions between people, organizations, groups, institutions, etc., besides establishing a parallel with methods, theories, models and applications normally used for networks analysis, it was coined the term Social networks (Wasserman, 1994). These networks have nodes (or "actors") and specific types of connections. Actors can represent citizens (or social groups), and the relationships between each of these elements may be represented by the connections or relational ties. These social ties between actors could symbolize different kinds of relationships or even the flow of information and resources. Thus, individuals connected to the network could gain and provide access to information or other resources, expanding the opportunities for interact, share or learn (Knoke, 1982).

In order to conduct a more detailed analysis (and at different levels), some key concepts of social networks must be observed: actors, relational ties, dyads (a pair of actors and their relational ties), subgroups, groups, relationships and the network itself (Wasserman, 1994).

Actors refer to any social entities tied together through social relationships and could represent citizens, social groups, cities, countries, government agencies, and so on. This definition allows the grouping of actors into clusters in order to facilitate the study and use of specific analyses. **Relational ties** represent the connections and relationships between the actors of a social network. With the definition of the characteristics of each link, it is possible to define the types of relationships between actors, such as the feelings one person has about another (such as affection, friendship, etc.), or the flow of resources between actors (economic transactions, information exchange, etc.). Physical connections between individuals, cities, states or countries (streets, roads, bridges, etc.) could also be represented by these ties.

Dyads are considered the fundamental social networks' units, formed by two actors and the ties between them. Its study is of utmost importance in the context of the relational aspects in social networks. Through the study of the links and dyads it is possible to identify and classify the relationships of actors in a network, describing them sometimes as central actors, who are involved in many relations with other actors. These central actors are more visible to others, and thus have a higher degree of prestige, identified through the number of links that arrive on and depart from it.

In this context, social networks can be categorized into two groups: Whole and Ego-centered networks. Whole networks can be studied in accordance to the actors involved and the nature of the relationships that they have: one-mode networks or two-mode network.

One-mode networks are formed by a number of actors of the same type, as individuals, organizations, communities, nations, countries, etc. The relational ties among these networks are commonly represented by an index of relationships between dyads of different network levels.

On the other hand, two-mode networks have the focus of study in the relationship between two different types of actors, or between one set of actors with a type of event. The first performs an analysis of links between actors of different types. The types of actors studied in these networks may be the same ones described in one-mode networks.

By analyzing actors and their relations, it can be observed that there is a flow of information and knowledge in the social network. Actors that are part of more than one community could have a continuous learning and benefits from all these communities (Hannerman, 2005), creating a continuous information flow between them.

The knowledge inherently present in social networks can be organized and stored through ontological metadata. By structuring this knowledge in an ontology-driven manner, it would be possible to provide members of a social network different ways of solving problems more effectively, using only the information already made available by other members, and semantic processing to refine that knowledge.

ONTOLOGY: PROPOSAL OF KNOWLEDGE REPRESENTATION FOR E-GOV PLATFORM

The term Ontology has been used in Computer Science from the beginning of the 1990's (Russell & Norvig, 2004) in Artificial Intelligence area, for computational knowledge representation, knowledge engineering and natural language processing. More recently, the notion of ontology has been expanded to the areas of information retrieval on the Internet (as Semantic Web, for instance), knowledge management and development of intelligent educational systems. Therefore, it is computationally possible to represent a particular area through ontological databases, so that communication between people and computers could take place automatically (Swartout, 1999). In this sense, computational agents can share knowledge increasing the relationship that they might have.

To better understand the Ontology concept, several researchers have made their contribution in order to improve this definition, describing concepts and creating new categories to facilitate the construction and use of ontologies. Gruber (1993, p. 3) says that "an ontology is a explicit specification of a conceptualization"; Swartout (1999) also refers to ontology as a shared concept and explicit phenomenon of some thing in the world, described by relevant concepts. Thus it is understood that an ontology describes a field of knowledge in an explicit way, using the relationships that exist between the concepts.

Similarly, an ontology can also be a specialized vocabulary in any field (Chandrasekaran, 1990). However, these vocabularies qualify only the concepts present in a given ontology, which means that this definition makes clear that an ontology is independent of the language in which it was modeled, so that you can translate the concepts of an ontology from English to Portuguese, for example, without changing its essence. In another sense, the ontologies refer to the knowledge base that describes a field.

Besides, according to Berners-Lee (2001), to have a proper knowledge representation, it is necessary to achieve three types of interoperability:

- *Structural interoperability*: Provides the representation for different data types, allowing specify types and possible values for each form of representation;
- *Syntactic interoperability*: Provides precise rules to promote the exchange of data on the Web;
- *Semantic interoperability*: Enables the understanding of data and their associations with other data.

In that sense, it is also possible to classify an ontology in different ways and classifying it in different levels in order to refine the analysis and enable the acquisition of knowledge in a more precise way (Araújo, 2003), as shown below:

- **Generic or top-level ontologies:** Describe general concepts such as space, time, matter, object, event, action, etc., which are independent of a particular area or problem;
- **Field ontologies:** Express conceptualizations of particular fields, describing the vocabulary related to a generic field such as medicine and law.
- **Task ontologies:** Express conceptualizations on the resolution problems regardless of the area where they occur, that is, describe the vocabulary related to an activity or generic task, as diagnose or sales;
- **Application ontologies:** Describe concepts dependent on the field and the particular task. These concepts are often the roles played by entities in the field when carrying out certain activities;
- **Representation ontologies:** Explain the underlying conceptualizations of the formal representation of knowledge.

Complementing this classification, it is also possible to identify five basic elements that define ontology (Perez, 2002): concepts, relationships, functions, axioms and instances.

The wider use of ontologies has made it possible to address different types of problems in various areas of knowledge as Semantic Web, data mining and e-Government systems (Natale, 2008). The e-Government applications that are from the second stage of development have repositories of data and data-processing capacity with volume of information and knowledge in proportion to the size of the population that uses these services.

An example of these applications is the internationally recognized and rewarded Brazilian system of income tax collection. This system has about 600 million records, powerful security features, tools for decision making, identification of fraud and access of approximately two million users. According to the Coordination of Technology-General of Revenue, it is considered the largest database of the world (Receita, 2006).

The development of ontologies for governmental area must produce shareable structures and must provide interoperability in the semantic level. For this, it is necessary to create metadata with vocabularies specific to the context, structuring the field, to allow computational agents to infer new facts and enlarge the knowledge base.

As governments' computational systems will be reaching higher levels of development, complexity and an on-growing base of knowledge, a fertile field for new technology projects appears, including those ones that rely on semantics to perform their tasks. One example is the use of an ontology field of e-Government to store and represent knowledge in a social network formed by citizens. A computational agent committed to this ontology could, through semantic analysis, help citizens to find other citizens in the social network that could, in a collaborative manner, assist to the solution of various issues.

A related work can be found on the OntoGov project, which specifies a platform composed of meta-ontologies with the objective of promoting the development of systems for e-Government services (Ontogov, 2007). In this platform, the domain ontologies consider a high-level ontology, building, in this way, meta-ontologies. From that basic meta-ontological base, it is possible to define information ontologies to represent the knowledge related to flows in services that provide pieces of information to citizens.

It is also possible to use ontologies to establish interoperability between different systems, processes and services. This is the proposal of another related work, the SmartGov platform (2007). In this platform, it is possible to achieve the integration of various areas and government departments, through a knowledge-based system available on,Internet, and directed to the public as end user (Smartgov, 2007).

This type of semantical analysis of knowledge in the social network can work to identify central citizens in a network. This identification can still identify and define characteristics such as degree of influence and importance of each citizen in a social network, creating a tool of social analysis to recognize the leaders of a city, state or country.

Based on theoretical references and on this overview on the use of computational tools in e-Gov, the next item describes a proposal for a system based on C2C social networks and ontology.

DEVELOPMENT OF ADAPTIVE SYSTEMS FOR C2C BASED IN NETWORKS AND ONTOLOGY

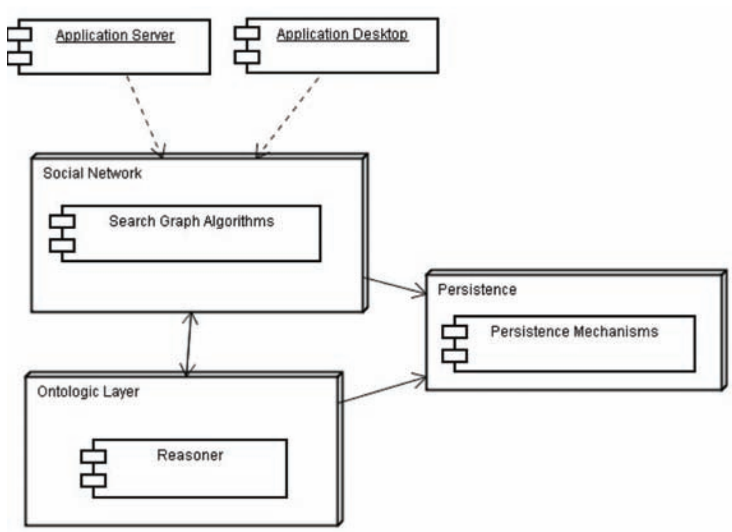
Solutions developed for C2C services must manage a large set of variables, besides every information from every citizen. With that, databases are expected to be each time more complex, making harder the task of extracting and handling, in a optimized way, the knowledge inside. Such a context encourages the use of ontologies and different ways to represent knowledge, as a manner to process such data efficiently.

Tools Used

This section shows the possibility of developing an e-Gov low-cost, design pattern-based, scalable, easily maintainable system which would be able to communicate to others systems. In this sense, a technology-independent architecture was modeled, according to UML (*Unified Modeling Language*), looking for plataform-independence, programming language-independence, easy customization to different requirements from each government, besides being easily expandable.

The diagram shown in Figure 2 presents the proposed architecture for a C2C services-based system. Such architecture is composed by three tiers, allowing the development and integration to diverse platforms, making easier the component reuse.

Figure 2. Proposed architecture



All parts of the system were developed on the Java platform. Such a platform provides a layer between application and operating system, named Java Virtual Machine (JVM). JVM is responsible by interpret the pre-compiled source code, manage memory and threads, intermediate communication and system calls, so providing platform-independence for applications.

Java platform also specifies Java programming language, which follows the object-oriented paradigm, thus allowing faster actualizations, motivating programming practices with high levels of reusability, promoting the use of design patterns and offering a large amount of APIs with diverse functionalities (SUN 2008).

Regarding to Figure 2, Ontologic Layer defines a metadata base and mechanisms used to knowledge representation, providing methods and inference logic that could be used by any computational agents. This data repository stores metadata using a set of OWL namespaces (used to facilitate the properties description), based in XML-Schema (W3C, 2004). With this structure, it is possible to represent explicitly vocabulary terms and semantic relationships among them.

In order to obtain a better expressivity of metadata, while keeping integrity and computational decidability, it was used the OWL-DL sub-language, which has all characteristics refered above. Due to the strategies of modularization used, based on design patterns, it is possible to implement the application in any other language or tools that are metadata-aware.

This layer also has a module responsible for semantic analysis, using Jena API. This API has a handler for RDF triples: (subject, predicate, object), as well as a processor for ontological information expressed in RDF-Schema and OWL. With the use of inference mechanisms, as well as tools for metadata creation, representation and handling that are provided by Jena API, knowledge present in the network is meant to be represented by syntactical, structural and semantical interoperability, allowing the reuse of resources and semantical properties, making easier the sharing of information among computational agents that are committed to the ontology.

Utility algorithms are implemented in Social network layer as tree search algorithms, as well as structures responsible to stores and handle the social network, the citizens and their relationships. This layer allows the implementation of

Figure 3.Social network, before including a new actor (NATALE, 2008)

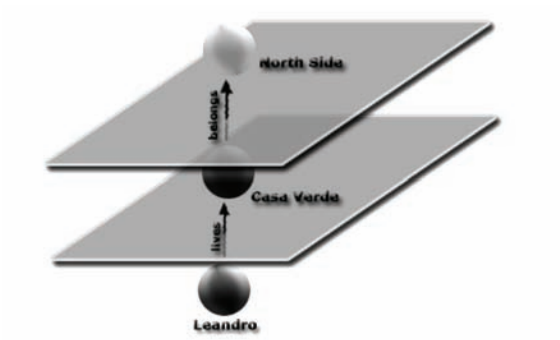
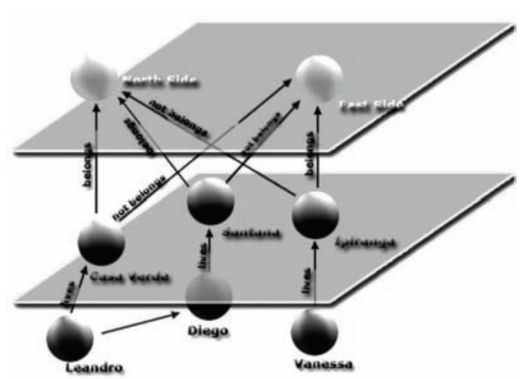


Figure 4. Social network, after including a new actor (NATALE, 2008)



various algorithms, as graph search and minimal path generators, for instance, in a easy and quick way, depending on the specific necessities of each government.

Persistence layer uses different strategies and APIs to store data from other layers, as utilities for creating image files, specialized libraries for XML files and so on. Through a unique interface, it is provided a transparent access to the other layers, in order to store and retrieve necessary data to the system.

By keeping a consistent encapsulation, Presentation layer defines strategies and access interfaces, allowing different system and client applications to have access to specific system's modules, in a platform-independent way.

With this architecture, citizens and governments would have access to social tools provided by the system, through different applications.

Description of Application Operation

Based on typical characteristics and services of an e-Gov platform, this section shows an implementation of a C2C service, aiming to exemplify a real-world application.

The application uses information as addresses, professional activity, marital status, language, educational level, family income, and so on, which are provided by a citizen when he/she logs in the system. Such data are dealt as ontological elements, used to build an ontological database. After the building of this metadata repository, it is possible to dynamically expand a social network.

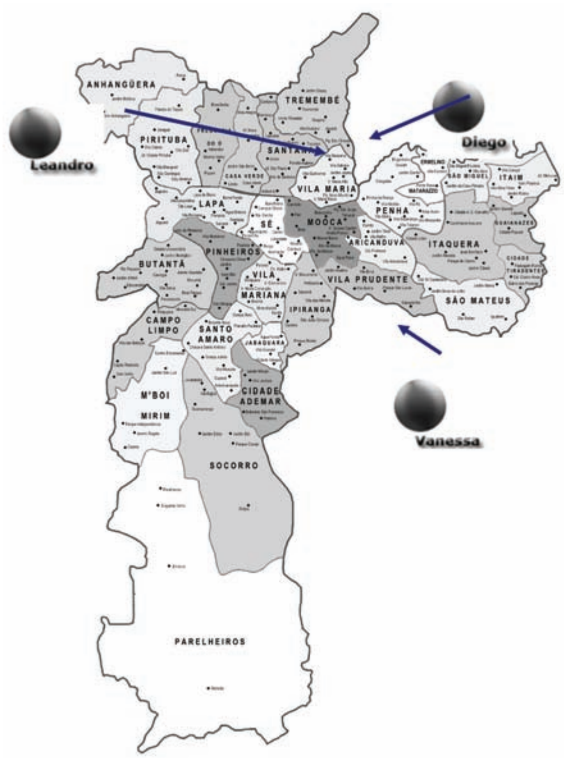
Figures 3 and 4 shows the dynamics of a social network when a new citizen logs in the system.

Figure 3 exemplifies in detail a particular example geographically located in São Paulo, Brazil, where it is possible to observe a citizen named 'Leandro' that lives in 'Casa Verde' neighborhood. This neighborhood is located in a region named 'Zona Norte' (north zone). The relationships among neighborhoods and zones of the city are stored in an e-Gov domain ontology. In this way, it is possible to assign proximity levels among different regions and neighborhoods of a city.

In Figure 4, when the citizen 'Diego' logs in, informing that he lives in 'Santana' neighborhood, the system, through the domain ontology, identifies that 'Santana' is part of 'Zona Norte' in São Paulo city. After this semantic processing, the social network is augmented, with the creation of a link of 'interacting' type among 'Leandro' and 'Diego', due to the fact of living in the same region of the city.

Still in Figure 4, citizen 'Vanessa' logs in the system informing that she lives in 'Ipiranga' neighborhood. By a semantic search on the ontological base, the system identifies that such neighborhood is part of the region known as 'Zona Sul' (south

Figure 5. Map of São Paulo city showing geographic proximity among actors



zone). Figure 5 shows a map of São Paulo city's neighborhoods, in order to clarify this example.

Since 'Vanessa' does not live in a neighborhood in the same region as to other registered actors, the social network controller, after using the information provided by ontological layer, don't create an 'interacting' relational tie among 'Vanessa' and the other citizens presents in the network. Nonetheless, this does not forbid that other information provided by citizen 'Vanessa' would allow her to establish other types of connection to other citizens.

This example also shows the multi-dimensionality of the social network graph. Looking in a dimension, there are actors of the same type (citizens), and their relationships, thus forming an one-modal social network. In a second dimension, there are actors from different types (citizens and neighborhoods) and their relationships, thus forming a bi-modal network.

Exemplification of Results Obtained

In order to exemplify the usage and flexibility of the system, it was created an Web-based interface, as seen in Figure 6, which shows the form for citizens' registering. Data obtained after the fulfilling of this form are refined by ontological layer, and afterwards the citizen in inserted in the social network and connected to other citizens according to the information provided.

Only after registering, citizens have access to search functionality (Figure 7), developed in order to allow him/her to perform a search for information in the social network. System is meant to refine the information given by a semantic search in ontological database, looking for citizens that

Figure 6. Citizen's sign-in interface (Natale, 2008)

Figure 7. Simple Interface for Information Search. (Natale, 2008)

have in their records some information that have some semantical kinship.

With target citizens identified, social network layer, by using Dijsktra's algorithm (Cormen et al., 2001), looks to find the shortest path among these target citizens and the citizen that realized the search. This algorithm was adapted to find the shortest path from only one origin and equally-weighted edges. JUNG (2007) – a Java-based API made to deal with graphs and social networks, is used to generate an applet that exhibits the path to be taken by the citizen to those citizens that could be collaborating to solve his/her questions.

The developed system has also functionalities directed to public administrators, providing different views for the same social network, which was implemented by the before mentioned applet. A JPEG image can also be generated.

Figure 8 shows an example of a complete social network, with different links established, categorized by different labels to make visualization easier.

Figures 9 and 10 shows different kinds of views a government agent could have over a social network, being able to select only the social links of interest. With these specific views, the public administration is able to perform more precise analyzes, by observing social network from the viewpoint of a specific social link. With this, it is possible to observe different social groups presents in different regions of a city, state or country, which could be used to assist in the planning of more effective public policies.

In order to simulate the execution of the system, some tests were performed with fake and real data. In the first experiment, the system was made available in a Web-based environment, running under a servlet container (Tomcat 5). All the system was packed in a single *.war* file. Fifty citizens registered themselves with their own in-

Figure 8. Complete Social network (Natale, 2008)

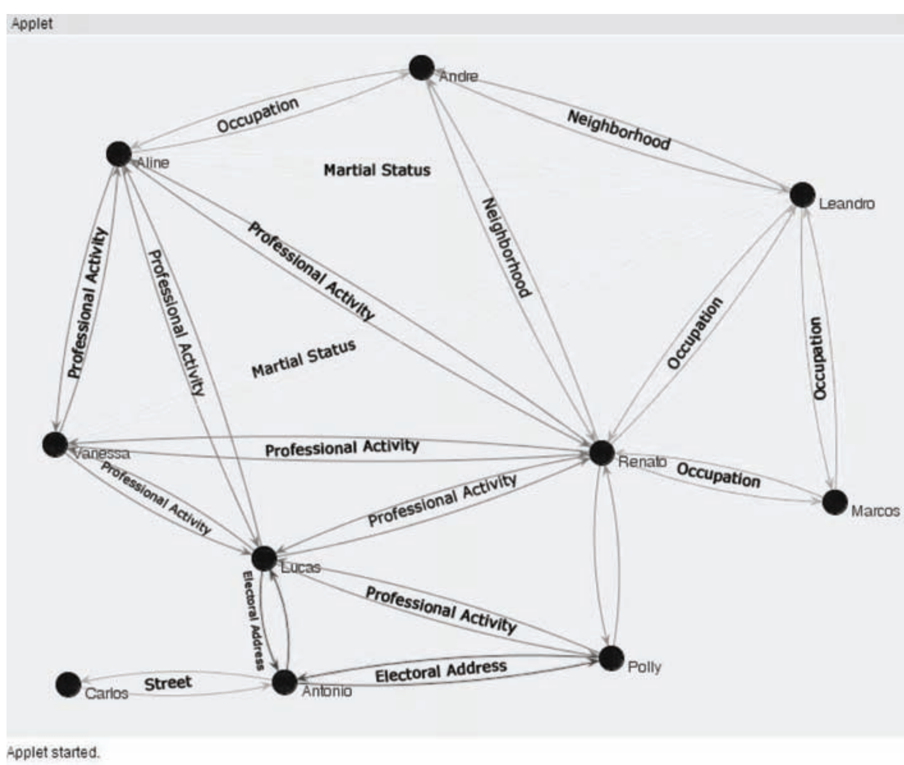
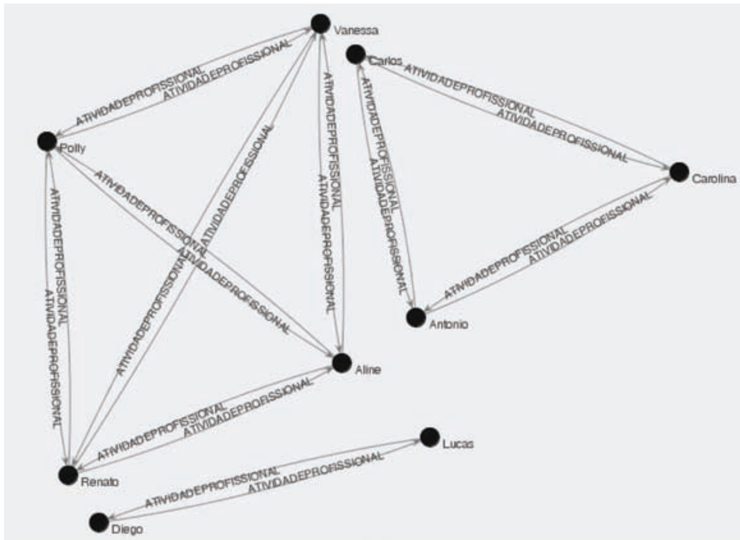


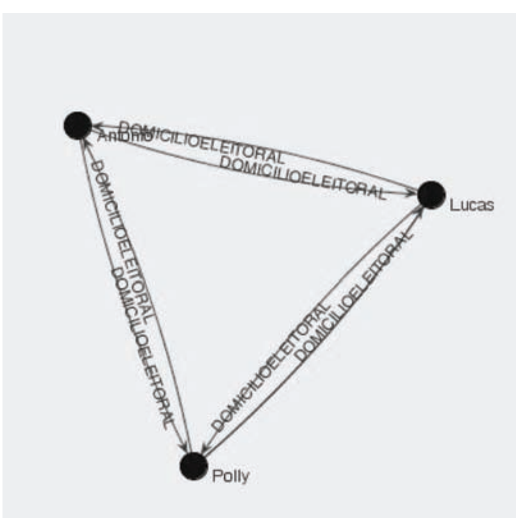
Figure 9. Social network with Professional Activity ('Atividade Profissional') ties (Natale, 2008)



formation. None of the pieces of information was mandatory, and the time spent for each citizen to register was stored.

With semantic refining of each piece of information, a search for citizens with semantic proximity was performed each time a new citizen signed in, in order to find citizens to be connected to him/her. Figure 11 shows the time spent for each

Figure 10. Social network with Electoral Address ('Domicílio Eleitoral') ties (Natale, 2008)



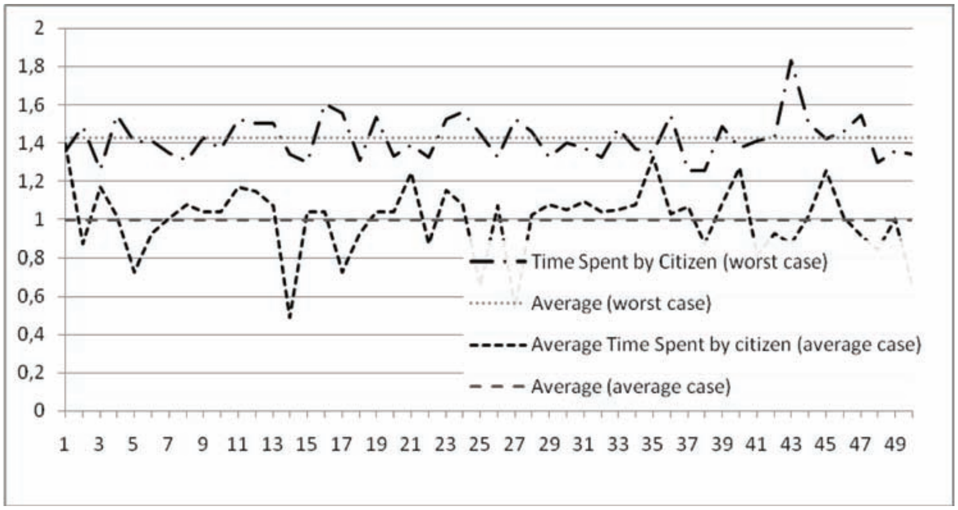
registering process (average time was 59 sec).

In a second experiment, other fifty records were fulfilled, but in this time all fields of information were required. This was done in order to simulate a more complex scenario for the social network layer, as well as for ontology layer. This experiment produced a complete graph, with every citizen connected to all others. In a similar way, the total time spent for each citizen registering was calculated, with average time of 85 sec. Figure 11 shows the results.

After these experiments, the ontological module was disconnected from the rest of the system and a new experiment was realized with the same amount of data, but with no semantical refining. Average time in this case was 10 ms for each record, showing the huge amount of time that is needed for semantic establishment of the social network.

Finally, the last experiment consisted in performing a search for information in a real-world social network, created by real citizens. In this experiment, the system validated the provided information and refined them using the methods available in the ontological layer, which allowed the performing of a breadth search in the social

Figure 11. Performance of the experiments (Natale, 2008)



network in order to find the citizens that had some desired information. After their identification, Dijkstraís algorithm, provided by social network layer, was applied, generating the path a citizen must follow in the network.

FUTURE TRENDS, FINAL CONSIDERATIONS AND FURTHER WORK

E-Gov future trends related to C2C services involve the improvement of ontological databases techniques. In the same way, with Web 2.0 development, it is relevant to point out the need for proposals that adhere to this concept. Regarding to the expansion and easiness of access by multiple platforms, as mobile and desktop, it is necessary also taking into account different ways to present information, according to the device being used. Another trend that must be noted is the dynamic refreshing of information in a way that they could be easily geo-referenced, making easier the integration with GPS systems, for instance. Finally, there is the important necessity of security policies regarding to citizensí information, avoiding information replication or leaking.

Through the studies and comparisons that were shown, it is possible to identify citizens as the main interested in governmental technological advances. Thus, it is extremely relevant to develop e-Gov solutions that follow a service-oriented model. In the case of the present chapter, it was focused the development of a C2C architecture driven to citizen dwelling in a certain area, providing low-cost, easy-maintaining tools to help quotidian information search and problem solving.

In e-Gov context, this work presents the possibility of creating a social network that was built and is able to be expanded using a domain-oriented governmental ontology.

Such structure asserted the possibility of building robust low-cost systems that are able to help citizens to reduce bureaucracy in electronic environments. The governmental strategies used to e-Gov system development must be evaluated and carefully implemented ñ since they are meant to deal with people’s lives ñ and thus reaching a meaningful social effect.

Academically, the present work contributes in the sense that it presents solutions and analysis that are based in a social-governmental context. It dealt with social network analysis, computer-based knowledge representation and retrieval, as well as software design patterns.

As a recommendation for further works, there is need of deeper analyses of the previously mentioned social networks, as well as new implementations based on these new analyses. Such implementations could present some improvements by optimizing the ontology-based mechanisms through multi-thesaurus structures or parallel or distributed engines for inference. These engines could also be internationalized, being language-sensitive. Analyzing the interfaces made to citizens, it is necessary to look for elements that make them more user-friendly, thus improving the access and straightforwardly the utilization of the system.

Another issue to be pointed out is the fact of handling and storing private information, which is meant to be kept in a secure way. Security solutions must be discussed, including basic cryptography, in order to guarantee the privacy and safety of this information in governmental platforms, improving systems' reliability. Other possibility is to apply techniques related to distributed agents to manage the information traffic on the digital e-Gov social network and analyze package exchanges.

Furthermore only authorized users can perform searches by the system. The data of users should also be stored on servers protected by the guidelines of network security organizations, with access only released to authorized analysts.

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KEY TERMS AND DEFINITIONS

Adaptive Systems: Systems characterized by the possibility of adapting themselves according to the behavior of user or some other environmental changes.

Graphs: Structures formed by nodes and edges that connect pairs of vertices, allowing the study of relations between elements belonging to determinate data set.

Knowledge Representation: Abstract model of a knowledge domain that permits the construction of computer-based systems, knowledge databases or expert systems.

Metadata: Characterization/description or information about data. It is commonly used to describe, manage, and localize some data in a data store.

Ontology: Formal specification of entities' representation (as objects, concepts and so on), making possible to establish relationships among terms and attributes through the use of semantic approaches.

Social Networks Analysis: Interdisciplinary area that combines Math, Computer Science and Sociology, among other aspects (as psychological, geographical, and so on) to determinate kinds of relationship between actors – like people, groups, communities and organizations.

Virtual Communities: Groups of people determined by similar interests that establish contact and interact through use of online communications tools and/or virtual environments.

This work was previously published in Handbook of Research on Social Dimensions of Semantic Technologies and Web Services, edited by M. M. Cruz-Cunha; E. F. Oliveira; A. J. Tavares; L. G. Ferreira, pp. 802-818, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.15
DemonD:
A Social Search Engine Built Upon the Actor-Network Theory

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ABSTRACT

This research leverages information retrieval activity in order to build a network of organizational expertise in a distributed R&D laboratory. The authors describe traditional knowledge management practices and review post-cognitivists theories in order to define social creation in collaborative information retrieval activity. The Actor-Network theory accurately describes association processes and includes both human and non-human entities. This chapter compares this theory with the emergence of Social Search services online and Experts' Retrieval Systems. The chapter authors suggest afterward, a social search engine named DemonD that identifies documents but more specifically users relevant to a query. DemonD relies on transparent profile construction based upon user activity, community participation, and shared documents. Individuals are invited to participate in a dedicated newsgroup and the information exchanged is capitalized. The evaluation of our service both ergonomic and through a simulation provides encouraging data.

DOI: 10.4018/978-1-60566-306-7.ch008

INTRODUCTION AND CONTEXT DESCRIPTION

During the early years of the Personal Computer research, two rather distinctive philosophical approaches competed. Artificial Intelligence believers wished to replace humans by machine whereas Human Intelligence Augmentation project, led by Douglas Engelbart, envisioned computers as a technology to augment human mind and eventually network each other's (Markoff, 2005).

This debate is still vibrant in the Information Retrieval community where the algorithmic approach is recently challenged by human approaches leveraging individual's social capital to identify pertinent knowledge sources. Our work contributes to this "Social Search movement", in a corporate environment, and identifies the challenges of a Research and Development laboratory, of 80 persons, in a French telecommunication company. The laboratory observed is distributed, in France, among three cities: Grenoble, Sophia Antipolis and Caen. Its mission is to plan, conceive and support the production of original telecommunication services for businesses. This process involves each distributed team of the laboratory. Ideas are suggested utilizing an email discussion list. Then, marketing teams identify a potential market. Business development teams confirm the financial opportunities of such project. When validated by the steering committee, the service is prototyped and developed. A partner company usually accepts to experiment the service. Business units of the telecommunication company might then decide to market this innovation. In such context, cooperation is a necessity. Teams must be well coordinated to remain creative in order to shorten the time to market of the services. Information Retrieval being a critical task for laboratory members, the company previously attempted two strategies in order to create and share organizational information in a distributed context.

First, they produced an exhaustive knowledge database, trying to externalize and share explicit knowledge. Intranet's folders were also utilized to share content among coworkers. Yet, interviewed employees revealed that the knowledge database was usually obsolete and shared folders not accessible (privileges needed to be granted on each folder) and content was not properly indexed.

Second, the organization, conscious about the shortcomings of a systemic approach of knowledge management, deployed communities of practice (Wenger, 1998). The 'not-so-informal' communities shared a virtual collaborative workplace and face to face member's meetings were scheduled monthly. Yet, this second strategy also turned out to be unsatisfactory. Employees were reluctant to ask/share information with individuals they had never met.

Unlike content, which is perishable and quickly becomes obsolete, experts' informal networks are rather permanent in R&D context. We assert that the real value of information systems is connecting people to people and encouraging them to share their expertise rather than collecting and storing de-contextualized information. (Hertzum & Pejtersen, 2000) already evidenced that individual looking for information usually explore and contact personal communications prior to using documents or knowledge bases. Following this strategy and in order to identify pertinent individuals, we need to evaluate their relevance on a specific subject along with social indicators. Thus, we leverage transparent user's profile modeling techniques to match a knowledge demand with one or many knowledge offers (Delalonde & Soulier, 2007). Relying on Bruno Latour and Michel Callon Actor Network Theory (named ANT throughout this article) our objective is then to validate a hybrid information retrieval model. This model helps specifying DemonD (Demand&responD) a search engine dedicated to collaborative information retrieval and favoring the emergence of a lightly structured information network.

The remainder of this paper is structured as follows. In section "Actor network theory in information retrieval activity" we present Actor Network Theory and its application in Information Retrieval. In section "Related works on social search" we review related work on Social Search. Section "DemonD a social search engine" describes DemonD's specifications. Section "Evaluation" is shared between a simulation of DemonD and its ergonomic evaluation. Section "Conclusion and future works" finally concludes our work with a discussion of future directions for research in this area.

ACTOR NETWORK THEORY IN INFORMATION RETRIEVAL ACTIVITY

As mentioned in the introduction of the article, we believe that information retrieval and acquisition is necessarily a social process, creating ties between individuals and expanding their social capital (Huysman & Wulf, 2003). This section aims to define our vision of "social", constructed through a review of post-cognitivists theory including the activity, the situated cognition, the distributed cognition and eventually the Actor Network theories.

Activity Theory

The Activity Theory (Vygotsky, 1978) is helpful for examining the social dimension of Information Retrieval. (Leontiev, 1979) proved user's actions only make sense in a social context of a shared work activity distinguishing between *activities*, which satisfy a need, and the *actions* that constitute the activities. Engeström's recent contributions to the Activity theory expanded Vygotsky's mediating triangle with a social component (Engeström, 1987) providing the activity theoretical community with a powerful tool for social systems analysis. Yet, the social dimension of activity, in this theory shall be better specified and not "taken for granted" as pre-existing groups (such as family, colleagues). We retain however the importance of artifacts to mediate user's thoughts.

Situated Action Theory

The situated action theory is another helpful framework to analyze information retrieval as a social process. Situated action theory was formulated in contradiction to artificial intelligence formalism. Indeed, Lucie Suchman's research demonstrated the inefficiency of action plans and suggested that activity was constantly constructed and reconstructed from dynamic interactions with the material and social worlds "situated" (Suchman, 1987). Yet, the situated action theory refuses to generalize its observations. Furthermore, the "social", in this theory, is restricted to local interactions. Distributed cognition is then appeared as a coherent theory to apprehend social information retrieval in organizations depicted in the introduction.

Distributed Cognition Theory

Relying on ethnographical methods, Edwin Hutchins analyzed sophisticated activities such as flying airplanes or sailing (Hutchins, 1995) (Hutchins, 1991). His research identified an exhaustive cognitive system formed by human and the artifacts they utilized to achieve their activity. As (Wood, 1993) indicated, "cognition is never simply 'amplified' or 'externalized', but rather cognition is 'mediated' through the external artifacts and collaborators such that the new cognitive system which is formed has a radically different character, structure and functionality than the cognition of the unsupported individual". This theory illustrates efficiently the distribution between human and non-human in the analysis of a cognitive system yet, the social dimension of the system being observed, lacks specification.

Situated Cognition Theory

Diffusion and acquisition of knowledge, in a distributed group, shall also be observed with Albert Stutz theory of social knowledge (Schütz, 1946). The author regards the knowledge as socially derived and transmitted to the individual by relations of all kinds. He describes three forms of knowledge. The store of experiences is a form of knowledge strictly individual that includes recipe and routines practical or theoretical. Second, the socially transmitted knowledge created when interacting with other agents. Third, the approved knowledge validated by members considered as cognitive authorities of a group. We are particularly interested in the second form of knowledge, since, this distribution of knowledge justifies cooperation between individuals and is built through a relation that coordinates a demand and an offer of information. When this relation is extended to multiple individuals, cooperation occurs and a community is created. Numerous researches have been conducted to utilize information technologies to support cooperation among agents distributed in the organization or geographically in virtual teams. Computer Supported Cooperative Work and Groupware developments results from this evolution.

We investigated existing typologies of communities offering a new paradigm for social information retrieval activity. The theory of socially shared cognition recognizes the importance of a network or a community in the study of human cognition (Resnick *et al.*, 1991).

Cognition as a social and cultural phenomenon requires, in a computer mediated environment, artifacts able to transmit individuals awareness and create a context for the completion of collaborative activities (Erickson & Kellogg, 2000). R&D teams which we observed share knowledge and cooperate with information technology (cf. introduction). In the related literature we found three forms of communities, observed in the organizations, and supporting the transmission of knowledge like: community of interest, epistemic or of practice. When considering the activity of information retrieval as a social practice, we are interested in a network, slightly structured, whose principal objective is the transmission of knowledge.

In communities of interest (Bergé & Périn, 2002), members share information on a specific subject whereas epistemic communities (Conein, 2003) are conducting a cognitive activity relying on globally distributed individuals. Communities of practice (Lave, 1988) (Lave & Wenger, 1991) (Soulier, 2004), initiated by employees willing to improve their professional practice, do not describe either the networks of information we observed in R&D teams. As a consequence, we suggest a new form of information network, relying on information retrieval activity as a social process in order to build an organizational network of expertise (Twidale & Nichols, 1998).

Actor Network Theory

ANT constitutes a distinctive approach to represent a society of heterogeneous entities both humans and non-humans. Bruno Latour suggests a dynamic vision of social ties constructed when entities interacts with each other (Latour, 2006). The result of this movement leaves footprints named a “social reassembled”. (Table 1)

Other post-cognitivists theories (activity theory, situated cognition, distributed cognition, situated action) previously investigated to describe Social Information Retrieval activity usually envisioned the social aspect prior to the activity. ANT appeared as the only theory crystallizing social components to achieve an activity. This theory does not assume existing social ties between entities (humans and non-humans) but constantly create

Table 1. Post-cognitivists theories to define “social” activities

	What is the “social” made of ?
Activity Theory	Takes the social for granted.
Situated Action Theory	The social is restricted to local interactions.
Distributed Cognition theory	The social is only a consequence of a distribution / repartition between elements of a system.
Situated Cognition theory	The social results from a dialectic between micro and macro structures.
Actor Network Theory	Does not pre-assume existing social ties between entities (humans and non-humans) but observes their creation through various associations.

them during each query. Furthermore, ANT's non-distinctive inclusion of both human and non-human entities seemed to be the most suitable to describe a hybrid information retrieval system relying on assembled heterogeneous resources.

ANT's author utilize a specific vocabulary including the terms "entities", "intermediaries", "mediators" and "associations" that we will describe below.

In the information retrieval activity, entities might be: a query, personal or shared documents, discussions taking place on a dedicated environment, articles extracted from a knowledge base, votes, tags, colleague's profiles… Each query catalyzes a network containing at least one entity. Entities are related between one another. The relationship between each related items is described in Figure 1. The various arrows between entities describe some type of association. For instance, tags might be set on documents, profiles, articles or discussions. Votes evaluate the quality of comments or articles.

Intermediaries are in charge of conveying information without any kind of modification.

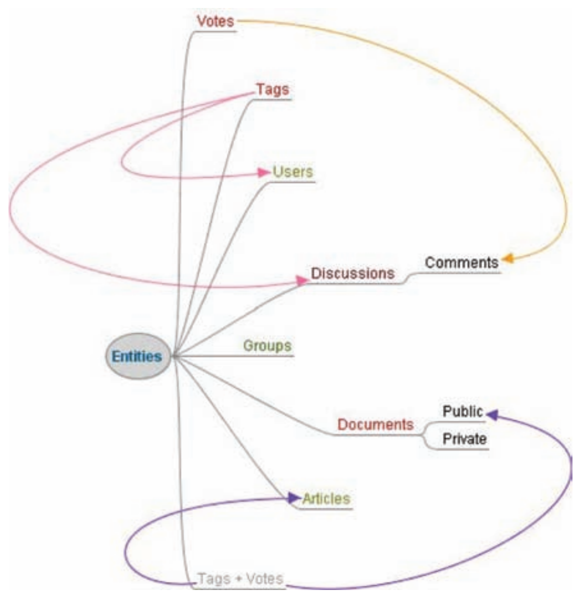
Mediators modify the information they are conveying. In fact, mediators are in charge of translating information to facilitate its propagation in a distributed system. The association of heterogeneous entities relies on such mediators.

Associations represent different stages of a network of intertwined entities. Three types of associations are relevant for the information retrieval activity we will describe: social vacuity, hybrid community and society.

The first association is a social vacuity and describes a state where entities are not linked between one another (Soulier *et al.*, 2007). The hybrid community designates a dynamic stage where entities are incessantly associating. The association eventually stabilized and give birth to a society (Whitehead, 1929/1995).

Information retrieval creates social capital in distributed teams. ANT appeared as a pertinent theoretical framework to represent such social search practices. We will now review specific implementation of this theory in Social Search services online and in organizations.

Figure 1. Relationships between various Entities



RELATED WORKS ON SOCIAL SEARCH

Considering the activity of information retrieval as a social practice, we are interested in a network, slightly structured, whose principal objective is the transmission of knowledge.

A non exhaustive definition of social search services could be: *a type of search engine that determines the relevance of search results by considering users' interactions or contributions*. Within the huge amount of available information and sources and due to frequent search engines manipulations, Social Search is recently garnering a lot of attention on the Web 2.0. In order to increase the ranking of their websites in Google search engine, unscrupulous webmasters utilize fake blogs to promote goods and services. As a matter of fact, a page will be ranked higher if the sites linking to that page use consistent anchor text.

Two significant social search services are emerging including navigating on previously recommended web sites and addressing a question to pertinent individuals. After reviewing recent social search initiatives online, we will identify Expert Retrieval Systems ERS in the corporate environment (Referral Web, Agilience and Answer Garden 2).

Social Search Initiatives Online

Social Search takes many forms online. Among them, navigating on content previously approved or recommended by other has been implemented in the Web Of People. This service has been developed by (Plu *et al.*, 2003) and helps individuals sharing relevant information with their peers. The system eventually propagates the pertinent resources to a network of individuals.

Google Co-op (Google Co-op, 2006) allows users to personalize the list of websites being suggested by the search engine. Yahoo! 360 (Yahoo! My Web 2.0, 2006) acts quite similarly by restricting search engine results to websites suggested by individual's declared social network.

More recently, Social Search methods revolve around Questions and Answers services and put in relation a demand and an offer of knowledge. Web 2.0 emerging collaborative services (wiki, weblogs) give each user the ability to be an information consumer or producer. For instance, Yahoo! Question and Answer (200520052005Yahoo! 2005!!!) let anyone ask any willing user to respond to one of his question. Yet, the questions are not automatically appointed to the respondents resulting in many unanswered questions. Yedda (Yedda, 2007) adopts another strategy leveraging light profiling techniques and to forward unanswered questions to pertinent profiles. Profile creation is unfortunately quite poor and relies only on declared keywords.

Expert Retrieval Systems

Information technologies also contribute to sharing and constructing knowledge in distributed organizations thru specific systems named: Expert Retrieval Systems (ERS). Multiple ERS have been deployed but usually failed for not taking in consideration the importance of informal social networks in the construction of knowledge or not allowing final users to manage their profiles.

Referral Web (Kauntz *et al.*, 1996) is an ERS created in AT&T labs. User's profile is constructed based on keywords extracted from web pages or shared documents where individual's name appears. Social network is also drawn based on co-occurring names on published research or public documents. Individual utilizing Referral Web selects the reach of his request and the number of hopes between him and knowledge offer.

Agilience (Agilience, 2006), another ERS, relies on sent email messages to create user's profile. During initiation phase, emails are analyzed and significant words extracted and compared to an existing taxonomy. User is able to manage his profile by adding or deleting keywords. To retrieve pertinent individuals, users send an email with a description of his request. The content of the message is analyzed by Agilience that returns back a list of documents, a list of individuals and a list of individuals able to forward the request to other potential respondents. Requests and responses are leveraged to accurately define user's profile. Agilience conceptualize knowledge construction or sharing as a dialogue between a demand and an offer. In reality, knowledge usually emerges from collaboration between multiple individuals. The creation of a dedicated collaborative workspace could definitely enhance this solution.

Answer Garden 2 (Ackerman & McDonald, 1996) follows the realization of an earlier version and relies on a multi agent system to select a recipient for a request. AG2 replicates progressively user's request based on recipient's proximity, privileging first near-by contacts. Recipients are invited to cooperate on specific discussions groups with instant messaging and emails functionalities. This powerful ERS presents a major constraint for end-users: individuals do not control the reach of their request. In fact, AG2 retransmits the request without prior approval.

In conclusion, the description of three ERS (Agilience, Referral Web and AG2) presents three challenges that need to be addressed. First of all, user's profile modeling must be extracted from heterogeneous sources (documents, user's activity, social networks…) (challenge 1). Second, a knowledge exchange should take place in a collaborative environment, with multiple participants (challenge 2). Finally, user must be able to manage the reach of his request and ensure privacy, especially in R&D teams depicted in the introduction (challenge 3). Furthermore, social search initiatives online or thru ERS usually rely on preexisting social networks of individuals. Our approach is rather different, following Actor-Network theory, a query catalyze a network of entities, human or non-human. Online social search services and Expert Retrieval Systems that we reviewed are summarized in Table 2.

DEMOND A SOCIAL SEARCH ENGINE

In opposition to the solitary information retrieval activity, we model information retrieval as a social process of association able to structure an organizational network of expertise. The information seeking process is not restricted to content retrieval / distribution but initiate a negotiation between a demand and one or many offers. The negotiation is followed by the capitalization of

Table 2. Social search services

Type of service	Name	Description	
Browsing On Trusted Websites	SoMeOne	SoMeOne arranges user's documents in shared folders along with discussion groups and suggests contacts based on a specific query.	**Online**
	Google Co-op	Google Co-op is a customized search engine allowing user to query pre-defined websites.	
	My Web 2.0 Yahoo!	My Web 2.0 from Yahoo! is also a customized search engine querying websites previously approved by members of a defined community.	
Questions And Answers	Yahoo! Answers	A knowledge-sharing community where anyone can ask and answer questions on any topic.	
	Yedda	A knowledge-sharing community where questions asked by users are transmitted to pertinent respondents based on basic profiling techniques.	
	Google Answers	A social search service for users to get help from other with expertise in a specific domain. Users post a question and specify the price they are willing to pay for an answer.	
	LinkedIn	A business social network service giving each member methods to question his network.	
Expert Retrieval Systems	Responsive	Instant messaging service in charge of broadcasting a query to user's existing contact-list.	**In Organizations**
	Agilience	Service relying on email logs to create user's profile. Agilience eventually suggests documents or pertinent individuals able to respond to any question.	
	Referral Web	Referral Web creates user's profile based on keywords extracted from web pages or shared documents where individual's name appears.	
	Answer Garden 2	AG2 creates users profile and replicates progressively user's request based on recipient's proximity. Recipients are invited to cooperate on specific discussions groups.	

exchanged information and the social structure utilized. The recurrence of the exchanges of information supports the constitution of mutual aid (caring) network and eventually the emergence of a knowledge community. ANT's specific vocabulary includes "entities", "intermediaries", "mediators" and "associations".

In the information retrieval activity, entities might be: a query, personal or shared documents, discussions taking place on a dedicated environment, articles extracted from a knowledge base, votes, tags, colleague's profiles… Each query catalyzes a network containing at least one entity. Entities are related between one another.

As mentioned previously, intermediaries are in charge of conveying information without any kind of modification. The information retrieval engine, we conceived, contains three intermediaries including a database, a collaborative environment and a knowledge base. Intermediaries are indeed indispensable in the association process.

The information retrieval engine, described in the following section, contains three mediators: the Profiler, the ContactRank and the Coop. Profiler creates, for each individual, a transparent profile based on tags declared, shared documents, and groups created. ContactRank sorts each knowledge offer (including human or non human entities) based on their proficiency on a specific subject and their propensity to respond. Coop creates a dedicated collaborative workplace and invites pertinent individuals to contribute.

DemonD is available in the corporate information systems (intranet). It is comprised of four main stages including initialization and information retrieval - diffusion - negotiation and capitalization that we will describe successively. A workflow of information retrieval activity in DemonD is available in Figure 2.

Initialization & Information Retrieval

The user's profile is modeled with the "Profiler" algorithm and consists of a list of weighted keywords also named tags. Distinct profiling techniques are utilized to provide web personalization (Brusilovsky & Kobsa, 2007) but in order to overcome the first challenge presented in 3.2, user's profile is modeled from multiple sources and updated when individual utilizes DemonD. It is important to underline that modeled profile are not utilized to personalize search engine results based on user's characteristics since profiling is leveraged to match a query with pertinent knowledge offers. (Figure 3, Figure 4, and Figure 5)

In DemonD, corporate information system directly provisions socio demographic data including (name, address, email, phone, occupation…). Individual also declares a list of competency through keywords complementing his profile (cf. Figure 6).

To enrich his profile, individual shares a set of documents (curriculum vitae, publications, patents) with the rest of the community. Recurrent keywords are extracted from these documents and enhance user's profile.

User also creates workgroups known as a list of contacts. DemonD utilized the group creation activity to extract recurrent keywords from group member's profiles. Such keywords are also utilized to complement user's profile.

Individuals are able to add or delete tags (keywords) on any resources on DemonD (his/others profile, his/others documents, and discussions) (cf. Figure 7). Various tags utilized by the individual are added to his profile. (Figure 8)

Diffusion and ContactRank

After registration and if the user is logged on, DemonD welcome page suggests recent articles or discussions. During an information retrieval activity, user enters a query in the search engine (cf. Figure 9). In Figure 10 we see that DemonD extracts the keywords from this query and suggests, to the information seeker, relevant and heterogeneous resources including:

Figure 2. Workflow DemonD

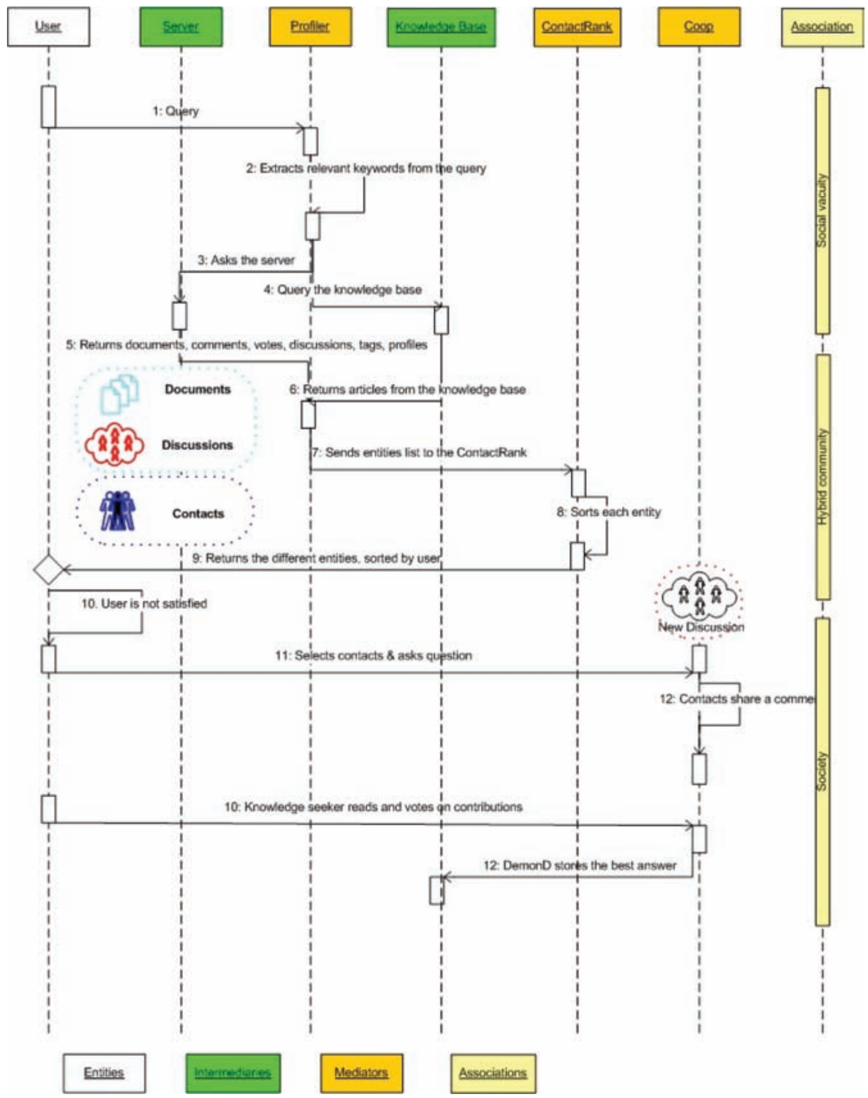


Figure 3. User's registration

Figure 4. Documents sharing

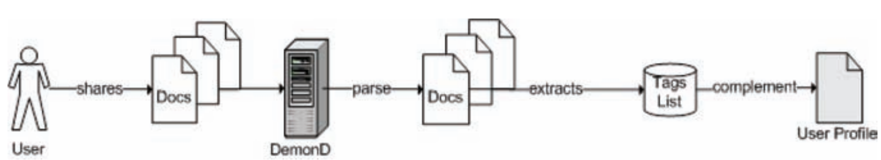


Figure 5. Extracting recurrent keywords from groups

Figure 6. User's registration

Figure 7. User's tags declared

− documents [1];
− ongoing discussions [2];
− articles [3];
− pertinent users [4].

The results are sorted according to their provenance:

− local refer to documents stored on user's computer;
− groups refer to documents, discussions or individuals declared by information seeker;
− corporate refer to documents, discussions or individuals unknown from information seeker.

Users are sorted according to the ContactRank [5], an algorithm compiled with the following criteria (knowledge, proxy, participation and reputation) (cf. Figure 10).

Knowledge Criterion

Knowledge criterion (C) suggests profiles (extracted from Profiler cf. 4.1) containing tags directly embedded in seeker's query. After being calculated, this criterion is utilized as a coefficient of the overall sum of proxy, participation and reputation criterion. This coefficient is comprised between 0,5 and 2:C(t)[o] = number of times that tag (t) is found in the profile of user o; ∑P[o] e [0.5 ; 2].

Participation Criterion

The second criterion Participation (P) is the number of times a potential recipient has responded to requests. Participation is a sum comprised between 0 and 17:∑P[o] = sum of participations of user o; ∑P[o] e [0 ; 17].

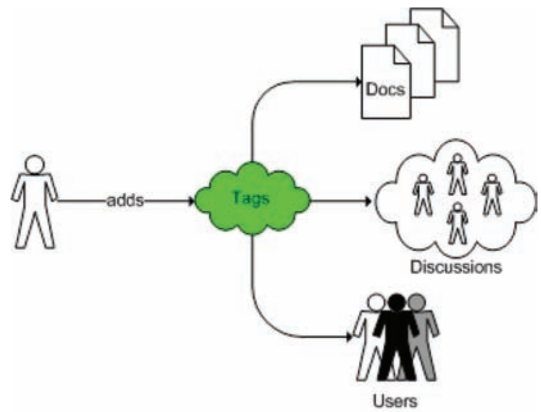
Reputation Criterion

The third criterion Reputation (R) compiles positive minus negative potential recipients' participations. Reputation is comprised between 0 and 17:∑R[o] = sum of reputation of user o; ∑R[o] e [0 ; 17].

Proxy Criterion

The fourth criterion Proxy (Pr) is the number of contacts of a potential recipient unknown from the information seeker. This criterion is also comprised between 0 and 17:∑Pr[o] = sum of contacts from user o's unknown from an information seeker and∑Pr[o] e [0 ; 17].

Figure 8. Tagging activity



Overall ContactRank

The ContactRank algorithm is in charge of sorting potential recipients of a request according to four criteria including: knowledge, participation, reputation and proxy. For a recipient "o" following a query on tag "t" ContactRank is:C(t)[o](∑P[o] + ∑R[o] + ∑Re[o]); et C(t)[o] e [0 ; 102].

If documents or existing discussions does not match seeker's query, he chooses to send a request.

Figure 9. DemonD's welcome page. ©2007 Charles Delalonde. Used with permission.

Figure 10. Potential Recipients sorted with ContactRank. ©2007 Charles Delalonde. Used with permission.

In order to follow the second challenge (cf. 3.2), knowledge seekers manage the reach of their requests by selecting one or many recipients.

Negotiation and Capitalization

The recipients selected are invited to provide a collaborative answer on a dedicated workspace (cf. Figure 11). Such workflow follows the third challenge of ERS (cf. 3.3).

When an individual initiates a request the "Coop" algorithm automatically creates a dedicated workspace. Coop also invites previously selected recipients to provide a collaborative answer. Validation takes place with peer reviewing and grading other member's participations.

Figure 11. Dedicated collaborative workspace. ©2007 Charles Delalonde. Used with permission.

During the capitalization phase, the best answer validated by the community is inserted in the organizational knowledge base. Information network constructed previously is also available on DemonD.

EVALUATION

To evaluate our Social Search engine we collected quantitative and qualitative data. First evaluation was a simulation of DemonD allowing us to test multiple scenario. Second evaluation was qualitative and is comprised of a focus group and 50 interviews with end-users.

Simulation

In the short period of time granted, it was unfeasible to collect statistically significant data in the laboratory depicted in introduction. DemonD's simulation has consequently been useful to evaluate the workflow of our system and identify efficient information retrieval strategies. The simulation has been developed utilizing a WAMP (Windows Apache MySQL and PhP) architecture and consisted of two stages: entities generation and information retrieval simulation.

Entities Generation

Before running multiple search cycles, we generated 100 users, theirs documents, their groups and built their profiles as presented in Figure 12.

In order to represent the diversity of user's involvement in social search services, Individuals' attitudes toward DemonD are distributed among: "search engine", "opportunistic" and "social network". Search engine's type of users are reluctant to diffuse their requests to other individuals and utilize DemonD only as information rather than a contact retrieval engine. Social network's type of users use DemonD as a social medium to create and maintain social ties. As a consequence, "social network's" users share documents and tag their profiles. "Opportunistic" types of users get partially involved by declaring a couple of tags and creating few groups. At the initial stage of simulation we discovered that a fourth profile was missing in our system: documents' holder. Indeed, the system could not function without the 200 documents initially shared by this last profile whom represents organizations' knowledge bases (okb). Two likelihoods are also added to each profile including the odds that this individual initiates a query at any given time (likelihood 1); the odds that this individual responds to any demand from another (likelihood 2). Each profile and information associated is described in Table 3.

Figure 12. Data generation

Table 3. Data generated (Search Engine, Opportunistic, Social Network)

Profiles	SE	O	SN	OKB
Number of this profile	50	25	25	1
Number of declared-tags	5	10	15	0
Shared documents Number of tags per doc.	0 0	2 10 tags	5 25 tags	200 5
Groups created Number of tags per group	0 0	2 10 tags	5 20 tags	0 0
Likelihood	30	40	50	0
Likelihood 2	10	20	50	0

Search Cycles

After generating the users and their documents, we ran multiple search cycles.

For each query, users might be:

− satisfied by documents ongoing, discussions / articles recommended by DemonD;
− satisfied by the responses brought by other individuals;
− not satisfied at all.

Four situations lead to an evolution of users' profiles (Likelihood 1 and 2 cf. Table 3) including:

− probability to ask a new question if a user is satisfied with previous responses received;
− probability to respond to a question if a user is satisfied with previous responses received.

During 50 cycles, 100 fictitious users queried DemonD resulting in 2133 queries and an overall satisfaction greater than 70%. 621 users were satisfied by documents / discussions and 877 were satisfied by responses given by other individuals. In addition, users (regardless of their profiles) trust DemonD's ability to retrieve the right information since 45% of the "search engine" profiles and 70% of the "social network" profiles queried the system. Furthermore profiles tend to become altruistic. Search engine's profile had an initial probability to respond to other's request of 10%. At the end of the 50 cycles their probability to respond is above 48%. The activity model of DemonD appeared coherent and able to retrieve information through pre-existing shared entities (documents, articles) or social ties.

Yet, such encouraging data hide the fact that 82% of the responses were given by users with "social network's" profile. A thorough analysis of user's selected profile indicates a malfunction in the ContactRank. Indeed, the ContactRank algorithm (cf. 4.2) selects, for each query, 10 potential respondents based on a set of criteria that auto-aliment each other. An effective methods to correct this sorting algorithm have been deployed and limit the size of certain criterion. As a reminder, ContactRank is for a user "o" and a tag "t":C(t)[o](∑P[o] + ∑R[o] + ∑Re[o]), where:

− C(t)[o] = number of times a tag (t) exists in a profile o ;
− ∑P[o] = number of times a user o has responded to user's questions ;
− ∑R[o] = difference between negative and positive evaluations from user o ;
− ∑Re[o] = number of unknown contacts between o and other potential knowledge giver.

ContactRank is frequently maximized with the criteria ∑P[o] et ∑R[o] auto alimenting each other. Indeed, if reputation and participation are high, knowledge giver (o) has a greater ContactRank. As a consequence he gets selected more often, participate more often increasing naturally the criterion ∑P[o] and ∑R[o]. To avoid this situation, we maximized the size of the following: ∑P[o], ∑R[o], ∑Re[o].

Focus Group and 50 Interviews

In order to confirm potential usages of DemonD qualitative data were also needed. An ergonomic study, with 50 respondents and potential end-users followed by a focus group, simulated a geographically distributed company willing to export "nanotechnologies" in China.

As mentioned earlier, existing ERS we evaluated usually face three challenges (cf. 3.2) that we attempted to address. DemonD's workflow appeared coherent to most surveyed users whom reacted very positively to DemonD's approach of collaborative information retrieval.

Yet, two challenges need to be taken in consideration. First, the collaborative tagging approach, critical in DemonD (users tags their/other's documents, their/other's profiles…), must be assisted. As Richard (one of the respondents) indicated:

"Tagging is costly to the User, you should consider automatic tagging functionalities. Metadata on documents should be extracted automatically" Richard B.

In fact, tagging might create inaccuracy (noise) if it does not rely on a semi-structured ontology. Furthermore, tagging is time consuming and not yet included in worker's practice. To respond to this first challenge, we are contemplating the possibility to suggest tags based on user's context following Nicolas Pissard's algorithm (Pissard, 2007).

Knowledge capitalization is also a challenge that need to be addressed. Wiki's technology are progressively entering organizations (certainly due to wikipedia's success) and constitutes a strategy to structure user generated content produced in DemonD. SweetWiki a semantic wiki is a technology that could replace DemonD unstructured knowledge base (Buffa *et al.*, 2007).

In addition, our sharing assumption embedded in DemonD must be leveraged by proper incentives. Users usually rely on their personal network of information. Sharing knowledge with unknown co-workers must be secured (in terms of intellectual property) and encouraged. To respond to this second challenge, we included a "confidential" functionality to restrain and control information diffusion. We also gave "proactive users" a specific status on DemonD.

CONCLUSION AND FUTURE WORKS

In conclusion, Social Search certainly constitutes a promising alternative to traditional information retrieval methods. Our model, relying on Actor-Network Theory, has revealed very encouraging data both quantitative and qualitative however certain flaws identified during evaluation needs to be corrected.

The Actor Network Theory utilized to specify our system might also be slightly criticized for two reasons.

First, treating humans and non-humans in an equivalent manner might also be criticized (Bloor, 1999). For instance, in social search activities, tags given by a user to define his profile and tags inherited automatically from the documents he is sharing must be treated differently. We suggest to include coefficients on tags based on their provenance when Profiler creates user's profile. Furthermore, as (Mutch, 2002) indicated in (Pentland & Feldman, In Press), ANT has been criticized as being "flat". Associations are observed at a given time but fail to encompass the history or context of the network. When social information retrieval takes place in organizations like the one described in introduction we must take into account the context.

A new version of DemonD is currently in progress and will be deployed in the laboratory depicted in the introduction. Quantitative data will then be collected based on user's improved effectiveness when utilizing the system. A beta version will also be experimented and the telecommunication company, funding this research, protected DemonD's algorithms thru a French then a European patent (Delalonde *et al.*, 2006) and plans to commercialize the system.

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This work was previously published in Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modeling, edited by M. Chevalier; C. Julien; C. Soule-Dupuy, pp. 165-183, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 2.16
RapidOWL:
A Methodology for Enabling Social Semantic Collaboration

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ABSTRACT

In this chapter we give a brief overview on the recently emerging concepts of Social Software and Web 2.0. Both concepts stress the adaptive, agile methodological character of communication and collaboration. In order to lift the adaptive collaboration and communication patterns of Social Software and the Web 2.0 towards a truly semantic collaboration, we outline an adaptive knowledge engineering methodology–RapidOWL. It is inspired by adaptive software development methodologies from software engineering and emphasises support for small end-user contributions to knowledge bases.

INTRODUCTION

Examples from software development, communication and knowledge management show that the support for agile collaboration scenarios has an enormous potential for the reduction of resources, reducing development times and increase of quality. In software engineering, for example, the shift towards more adaptability in processes started long ago with methodologies like eXtreme Programming, Scrum and Adaptive Software Development. These individual approaches were later unified by the "Manifesto for Agile Software Development" (Beck et al. 2001). Subsequently, agile methods in software engineering led to the creation of complex software applications like the GNU/Linux operating system, the Web browser Mozilla Firefox, and the office software OpenOffice. But the success of adaptive methodologies is by far not limited to software engineering: just recently, adaptive communication methods of social software (such as blogs, the Jabber or Skype networks and platforms like LinkedIn) have enabled entirely new communication patterns. The domain of collaborative publishing and content management was revolutionized by blog and wiki technologies, which resulted in far reaching news networks without central control and made the creation of the most comprehensive encyclopedia possible, which is edited solely by volunteers - Wikipedia.

The aim of RapidOWL now is to take advantage of the potential of adaptive processes for collaborative Knowledge Engineering. The major aim of RapidOWL is to make the elicitation, structuring and processing of knowledge and thus the cooperation among domain experts and knowledge engineers more efficient. The RapidOWL methodology is based on the idea of iterative refinement, annotation and structuring of a knowledge base. Central to the paradigm for the RapidOWL methodology is the attention given to the smallest possible information chunks (i.e. RDF statements). The collaborative aspect comes into its own by allowing those information chunks to be selectively added, removed, or annotated with comments and/or ratings. Design rationales for the RapidOWL methodology are to be light-weight, easy-to-implement, and supportive spatially distributed and highly collaborative scenarios.

RapidOWL is, on the one hand, inspired by the XP.K methodology (eXtreme Programming of Knowledge-based systems, (Knublauch 2002)), which extends Extreme Programming to an agile methodology for the development of knowledge-based systems. On the other hand, RapidOWL is influenced by the Wiki idea (Leuf & Cunningham 2001}, which established agile practices for collaborative text editing. However, contrary to XP.K the RapidOWL methodology stresses the generic nature of a knowledge base and thus focuses on development of knowledge bases, whose final usage scenario is either not a priori known or a single usage scenario is not easily definable. This is usually the case for conceptualizations targeting at information integration as well as for shared classification systems and vocabularies. Different from the Wiki idea on the other side RapidOWL's artifacts are structured information and knowledge represented in statements rather than the Wiki's unstructured text documents. Wiki's are commonly seen as part of a development described by the terms Social Software or Web 2.0.

The concepts *Social Software* and *Web 2.0* were coined to characterize a variety of (sometimes minimalist) services on the Web, which rely on social interactions to determine additions, annotations, or corrections from a multitude of potentially minor user contributions. Non-profit, *collaboration-centered* projects such as the free encyclopedia Wikipedia belong to this class of services, as well as commercial applications that enable users to publish, classify, rate and review objects of a certain content type. Examples for this class of *content-centered* Web 2.0 projects are del.iciou.us (for Web links), Digg.com (for news), Flickr (for images), YouTube (for movies). *Communication-centered* services such as MySpace or XING enable individual communication and search for and within spatially distributed communities. So-called Web 2.0 *mashups* integrate and visualize the collected data and information in novel ways, unforeseen by the original content providers. The most prominent examples of mashups are based on Google Maps and overlay external content on a map. All these developments have a common approach of collecting metadata by making participation and contribution as easy and rewarding as possible.

Even before Social Software and Web 2.0 applications emerged, prior attempts had been made to enable rapid assembly of data on the Web into more informative content: the most well-known such project is the *Semantic Web*, although researchers had been working on "information integration for the Web" for many years prior (Ambite et al. 1998, Garcia-Molina 1997), with very different methodologies but a similar end goal. The Semantic Web is conceived as an extension of the existing Web to enable machine reasoning and inference: a prerequisite to this is that "information is given well-defined meaning" (Berners-Lee, 2001). This approach is based on a standardized description model (Resource Description Framework, RDF (Lassila et. al, 1999)) and semantic layers on top for semantic nets and taxonomies (RDF-Schema) as well as ontologies, logic axioms and rules (OWL and SWRL). However, the Semantic Web is not ubiquitous to this point, in part because of the

Table 1. Similarities and differences between Social Software and the Semantic Web

Social Software & Web 2.0	Semantic Web
Collaboration and integration focused Based on the Web Provide enhanced means for search and navigation	
End-user and business centred Community intelligence Post-encoding of semantics Opaque, homogeneous content Light-weight standards & technologies	Technology centred Artificial intelligence Pre-encoding of semantics Complex, heterogeneous content Heavy-weight standards & technologies

high level of effort involved in annotating data and developing knowledge bases to support the Semantic Web.

The Web 2.0 and Semantic Web efforts, which have largely gone on simultaneously, pose an interesting study in contrasting methods to achieve a similar goal. Both approaches aim at integrating dispersed data and information to provide enhanced search, ranking, browsing, and navigation facilities for the Web. However, Web 2.0 mainly relies on aggregate *human* interpretation (the collaborative "ant" intelligence of community members) as the basis of its metadata creation, conflict resolution, ranking, and refinement; the Semantic Web relies on complex but sophisticated knowledge representation languages and machine inference (cf. Table 1). A natural question to ask is whether the different approaches can be combined in a way that leads to synergies. We discuss in this chapter how the question is being answered in the affirmative by providing an adaptive methodology – RapidOWL – for the creation of comprehensive knowledge bases. The main goal of this methodology is to support collaborative knowledge engineering in social networks, with high reward and little effort. After some preliminary concepts in Section 2, we exhibit the paradigms RapidOWL bases on in Section 3. In Sections 4 we describe the RapidOWL process in the light of its values, principles and practices. We give an overview on how these can be successfully combined in Section 5 and conclude with remarks concerning future challenges in Section 6.

PRELIMINARIES

Social Software and Web 2.0

The concepts social software (Webb, 2004) and Web 2.0 (O'Reilly 2005) were recently conceived to explain the phenomenon that computers and technology are becoming more and more important for human communication and collaboration. In particular the following aspects are important with respect to software enabling social collaboration: (1) usability, (2) community and participation, (3) economic aspects, (4) standardization, (5) reusability and convergence. In addition to that, a precise delimitation of the concept social software is due to heterogeneity of applications, applicants and application domains complex. It was proposed (Shirky 2003), to define the concept of social software not just with respect to characteristics of a certain software, but also with regard to communication patterns leading to the formation of a virtual community. Typical communication patterns of Social Software are depicted in Table 2.

On the technological side the popularity of social software is related to the development and use of the software development- and communication paradigms AJAX (Asyncrounous JAvascript and XML), REST (Representational State Transfer), and JSON (JavaScript Object Notation). These, in comparison to their counterparts Web-services, RPC or remote desktop light-weight, technologies enable completely new adaptive and interactive

Table 2. Typical communication patterns for social software

Pattern	Name	Partner	Direction	Example
	Point-to-point	1:1		Email, SMS/MMS
	Bi-directional	1:1		IM, VoIP
	Star-like	1:n		Webpages, Blogs, Podcasts
	Net-like	n:m		Wikis, content communities

application architectures and services.

Based on these technologies a number of methods for user-interaction established, which encourage and simplify spontaneous contributions, help to organize a multiplicity of contributions, as well as to syndicate and mutually integrate the gained data. These include:

- **Folksonomies:** Content annotation by means of tags (i.e. self-describing attributes attached to content objects) enables the fuzzy but intuitive organization of comprehensive content bases (Golder et. al. 2006). Tag clouds visualize tags to support navigation and filtering. Tags are co-located in a tag cloud when jointly used and emphasized differently to stress their usage frequency.
- **Architecture of participation:** Already the usage of an application creates an added value. For example, the added value can be generated by interactively evaluating usage statistics to determine popular content objects or by collecting ratings from users to classify content with respect to quality.
- **Instant-Gratification:** Active users are rewarded with enhanced functionality and their reputation in the user community is visibly increased. This promotes contributions and helps to establish a collaboration culture.
- **Mashups and feeds:** The content collected in the system is syndicated for other services (e.g. as RSS feeds, JSON exports or public APIs). This allows seamless integration of different data end transforms the Web into a Service Oriented Architecture.

From a methodological point of view these Web 2.0 and Social Software methods contribute to make communication and participation on the Web more adaptive.

Knowledge Engineering Methodology

Concerning the way humans think, the notion of knowledge is difficult to define. There has been a debate on the topic for millenniums and the field of epistemology dealing with it continues to be vibrant and dynamic. With regard to computer systems, knowledge is commonly differentiated from data and information. Since all three ultimately have to be stored as bits in the computer's memory, it is obvious that the borders between them are not clearly marked. However, within the CommonKADS methodology (de Hoog et al. 1996) a characterization system has been proposed. This is demonstrated in the following example.

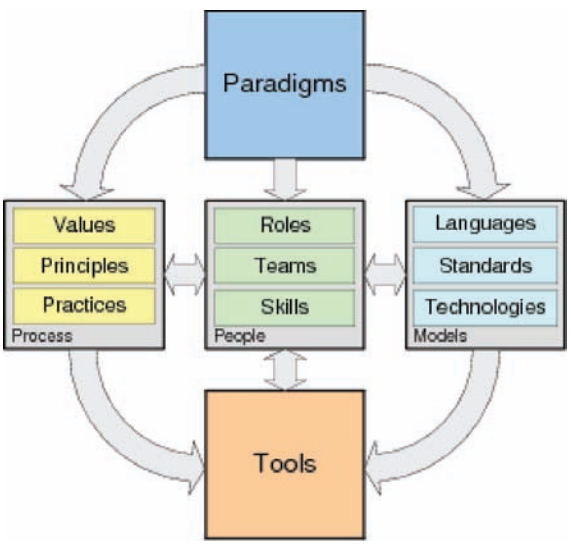
Data are supposed to be "raw signals", such as the name of a person (e.g. "Vincent van Gogh").

Information attaches meaning to data, such as the statement that a person is male (e.g. "Vincent van Gogh is male").

Knowledge in turn attaches purpose and competence to information, potential to generate action, e.g. "A human male must be a man."

Knowledge Engineering now subsumes the process of eliciting information and condensing the elicited information into knowledge by structuring, formalizing, and operationalizing. According to a widely accepted viewpoint this process is mainly carried out in order to construct a knowledge-based system that can perform a difficult task adequately (cf. (de Hoog et al. 1996)). From our point of view another aspect is important too: the structured sharing and exchange of knowledge between humans (and computer systems). The initial aim of such an approach is no longer the imitation of human intelligence by problem-solving methods of a single knowledge-based system, but the generation of human "swarm intelligence". In other words, relevant knowledge fragments from different sources can be dynamically combined, aggregated and visualized. We are convinced that such an interlinking of knowledge can have a similar impact as the interlinking of hypertext documents on the World Wide Web had.

Figure 1. The way of portraying agile methodologies according to Alistair Cockburn



In this document we will adopt the view of Alistair Cockburn (2000), who defines a methodology as "an agreement of how multiple people will work together. It spells out what roles they play, what decisions they must reach, how and what they will communicate".

A *knowledge engineering methodology* is an agreement of how multiple people will work together. It defines a process in which domain experts and knowledge engineers will build a knowledge base. This knowledge base is represented in a knowledge representation language with suitable tools. Processes, languages and tools are based on knowledge representation paradigms.

The RapidOWL methodology is presented in this document following other agile methodologies. Figure 3 summarizes the important ingredients, i.e. people, paradigms, processes, models and tools. RapidOWL is grounded on paradigms (see Section Paradigms). Paradigms influence the process (see Section Process), they lay the foundation for the models, and have to be internalized by people. Last but not least, tools implement the collaboration processes between people on the basis of the methodologies models. This docu-

Figure 2. The building blocks of RapidOWL: Values, Principles, Practices

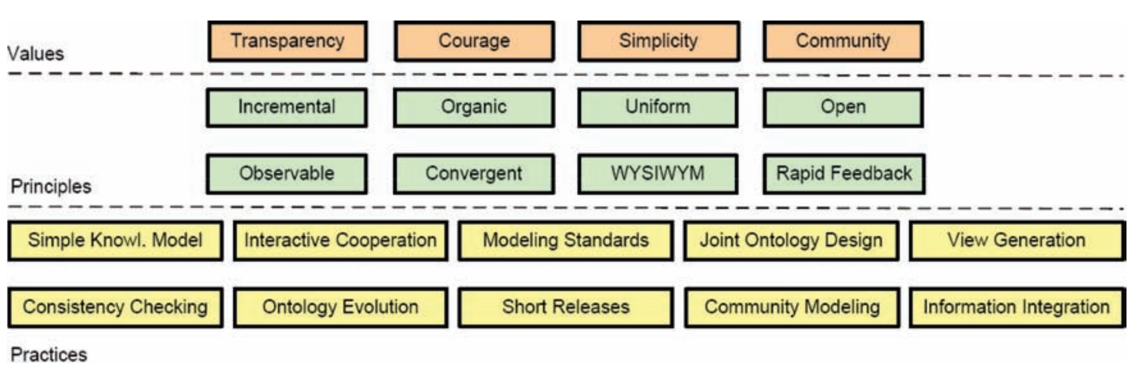
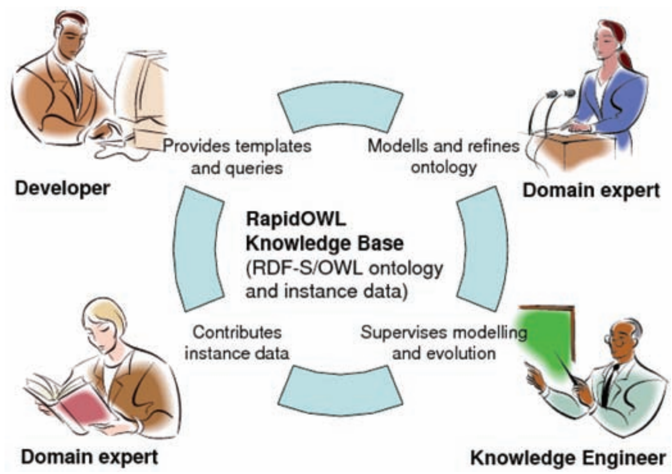


Figure 3. Collaboration between different parties on the basis of RapidOWL



ment primarily aims at characterizing the agile Knowledge Engineering process of RapidOWL. However, prospective strategies supporting the methodology are mentioned whenever possible.

Existing Approaches

Related approaches can be roughly classified into two groups. Accompanied by the formation of knowledge engineering as an independent field of research several Knowledge Engineering methodologies were developed. Most of them are much inspired by Software Engineering methodologies. In the Software Engineering domain, in the 90's several Agile Software Engineering methodologies emerged. Triggered by the fact that flexibility, in particular fast and efficient reactions on changed prerequisites, becomes increasingly important, agile methodologies recently also appeared in other areas than Software Engineering. The most prominent representatives from each of these directions are briefly presented in the following.

Knowledge engineering. Traditional knowledge engineering methodologies, such as the ones by (Uschold 1996), (Grüninger and Fox 1995), (Methontology 1997), CommonKADS (de Hoog et al. 1996) take a task as the starting point, i.e. they suggest performing knowledge base construction with the knowledge base's usage scenarios in mind. This requires significant initial effort and makes changes to and reuse of the resulting ontologies inherently difficult. More recent approaches such as DOGMA (Spyns 2002), Diligent (Pinto et al. 2004), HCOME (Kotis et al. 2004) appeared, which conceive the building of knowledge structures and knowledge bases more in the sense of finding an agreement within a community of domain experts. This is a major step towards reusability of knowledge bases, but still requires significant initial efforts and makes processes to obtain an agreement within a community complex and inflexible.

Agile methodologies. Agile methodologies have recently gained growing success in many economic and technical spheres. This is due to the fact that flexibility, in particular fast and efficient reactions to changed prerequisites, is becoming increasingly important in the information society. This development started in Software Engineering after the realization in the mid 1990's that the traditional "heavy" methodologies do not work well in settings where requirements are uncertain and change frequently. Several adaptive or agile Software Engineering methodologies subsequently evolved (e.g. eXtreme Programming (Beck & Andres 2004), Crystal Clear (Cockburn 2004), Scrum (Schwaber & Beedle 2001) Adaptive Software Development (Orr & Highsmith 2000), Feature Driven Development). Agile methodologies are especially suited for small co-located teams and for the development of non life-threatening applications. Since the problem of uncertain, changing requirements is not limited to the Software Engineering domain, the idea of establishing adaptive methodologies, which can react to changing prerequisites, was also adopted by other domains than Software Engineering. These include "The Wiki Way" (Leuf & Cunningham 2001) for Content Management, Rapid Prototyping (Gebhardt 2003) for Industrial Engineering. Also, the Lean Management method was used to some extent in the business management domain.

SPECIFIC CHARACTERISTICS OF KNOWLEDGE ENGINEERING

The analysis of the application of the existing knowledge engineering methodologies and tools shows that they are up to now virtually not used in practice (Knublauch 2002, p 16). This stands in contrast to the often proclaimed necessity for knowledge engineering. What can be the reason for this discrepancy? Most of the existing knowledge engineering methodologies adopt techniques and apply process models from software engineering. However, in many scenarios required knowledge engineering tasks reveal specific characteristics, which a knowledge engineering methodology should be aware of. In the following, we describe some specific characteristics of Knowledge Engineering important for RapidOWL.

Knowledge engineering is not a business in itself. There is no market for Knowledge Engineering as there is for Software Development. This is not because Knowledge Engineering is less important in the economic sphere, but due to the fact that the flow of knowledge in most cases accompanies the development of products and services, rather than being an economic asset itself. Hence, Knowledge Engineering services are often required when spatially distributed users have to collaborate on a semantic level. For example, this is the case when a common terminology has to be established, dispersed information must be integrated, or when shared classification systems and taxonomies have to be developed. This type of semantic cooperation is for example often required for Virtual Organizations (Appel & Behr 1996), scientific communities or standardization boards, or intra-organizational use. Thus, the actors within Knowledge Engineering processes are often not bound together by a legal contract, or the Knowledge Engineering processes are not part of such a contract. Since this is usually the case for Software Development processes, some practices from agile software development methodologies seem to be out of place in the context of Knowledge Engineering.

Lack of a unique knowledge serialization. Agile methodologies rely heavily on sophisticated versioning and evolution strategies due to their focus on small incremental changes. However, agile methodologies, as well as their respective versioning and evolutions strategies within software development, do not seem to be reasonably applicable to knowledge engineering. For example, contrary to software development paradigms, most knowledge representation paradigms do not provide unique serializations. In other words, the ordering of statements or axioms in a knowledge base is irrelevant, while the ordering of source-code lines in software is fixed. Consequently, the use of existing software versioning strategies (e.g. delta method) and their respective implementations (e.g. CVS, Subversion) is not suitable.

Spatial separation of parties. Most agile Software Development methodologies assume a small team of programmers working closely (especially spatially) with domain experts. This is a reasonable assumption for commercial software development, where a client requests software developers to implement certain functionality. But when the involved parties are spatially separated, the use of a formal, tool-supported Knowledge Engineering becomes particularly important. Furthermore, the knowledge engineering tasks of establishing common classification systems, shared vocabularies and conceptualizations are is especially important in distributed settings. When teams are co-located implicit knowledge representation in the form of text documents in conjunction with verbal communication turns out to be more efficient and for a long time established.

Involvement of a large number of parties. The growing together of the world by Internet and Web technologies enabled completely new mechanisms of collaboration. Open source software projects as for example the Linux kernel or collaborative content authoring projects as Wikipedia demonstrate this power of scalable collaboration impressively. However, Knowledge Engineering is especially challenging when a large number of domain experts have to be integrated into the knowledge-engineering process. Agile software development methodologies claim to be best suited for small to medium sized development scenarios. This is mainly due to the accent on and need for instant communication. On the other hand, the interlinking of people and tools using internet technologies facilitates scaling of agile cooperation scenarios. Knowledge Engineering scenarios in most cases differ from software development scenarios: it is usually not optional, but crucial to integrate a large number of domain experts, knowledge engineers and finally users of the knowledge bases.

PARADIGMS

In this section we outline the paradigms RapidOWL is based on. The basic paradigms of conventional knowledge engineering methodologies are the generic architecture of knowledge-based systems, ontologies and problem-solving methods. We argue that the paradigms of an agile knowledge engineering methodology, with a focus on Semantic-Web knowledge representation standards, must both reflect the distributed interlinked nature of the Web and recognize statements as being the smallest building blocks of Semantic-Web knowledge bases.

Generic Architecture of Knowledge-Based Systems

As widely accepted, ontologies and problem-solving methods are the central components in a generic architecture for knowledge-based systems (cf. (Fensel et al. 2003; Grosso et al. 1999)). One question, however, is whether real problems can be solved on a major scale by problem-solving methods alone, or are tighter interactions with humans needed in order to perform (real) intellectual tasks? In the latter case, knowledge-based systems should initially focus more on the efficient provision of knowledge for use by humans. Thus, the RapidOWL methodology is based on a generic architecture, the core components of which are semantic enabled user interfaces in conjunction with efficient querying and aggregation strategies. The main benefit of a knowledge-based system seen from this point of view will not be achieved by the application of elaborated problem-solving methods, but by providing a scalable platform for a semantic collaboration between humans and a semantic inter-operation between machines.

Semantic-Web Data Model

The notion of ontology, from our point of view, is too vague for the RapidOWL methodology to be based on. However, in the context of the Semantic-Web activity, the use of RDF triples provides a precise frame for knowledge representation. Statements consisting of subject, predicate and object can be viewed as the smallest manageable pieces of knowledge (cf. (Kiryakov et al. 2002)). More complex facts can be expressed by using several statements with the same subject or by connecting two statements by using the object of the first statement as subject of the second one. This mechanism has proved to be reasonable to build vocabularies, classification systems and ontologies including instance data adhering to these (cf. RDF (Klyne & Carroll 2004), OWL (Bechhofer 2004)). An ontology of a distinct species is now an allowed combination of statements as, for example, has been defined in the OWL lite, OWL DL or OWL Full standards. All higher level constructs such as classes, properties or axioms can be broken down to a number of statements. For novices, moreover, this way of representing knowledge on the basis of simple subject-predicate-object statements is very easy to understand, yet expressive enough to formalize complex relationships.

Web Technologies

RapidOWL inherently requires the use of Web technologies when interlinking parties and tools in the Knowledge Engineering process. Universal Resource Identifier (URI) enable the unique global referencing of resources and concepts. Consequently, URI references can on the one hand build the basis for the referencing of arbitrary entities within RDF statements. On the other hand, they can be used within tools supporting RapidOWL to locate information about the referenced entity on the Web. The HTTP family of protocols here facilitates the exchange of digital resources, while the UTF encoding and XML technologies aim at easing the exchange and transformation of information in a serialized form. Such a procedure is simple, intuitive and eases the implementation. Beside this rather technical aspect of basing on Web technologies, RapidOWL projects should be socially Web-centered, too. Domain experts, knowledge engineers and software developers commit themselves to using the Web as a primary medium for publication and communication.

PROCESS

Conventional methodologies distinguish different phases within the life-cycle of either software or knowledge. Agile methodologies give the importance of applying a change a much higher value than being located in a certain stage of the life cycle. Consequently agile methodologies do not provide a phase model. Instead, they propose values from which (on the basis of paradigms) principles are derived for the engineering process in general, as well as practices for establishing those principles in daily life. We will describe RapidOWL along these dimensions in the following subsections, and then give an overview of how they can be combined and applied in practice.

Values

RapidOWL adopts the values of eXtreme Programming, namely Communication (to enable collaborative ontology development), Feedback (to enable evolution), Simplicity (to increase knowledge base maintainability) and Courage (to be able to escape modeling dead-ends). However, RapidOWL combines the values of Communication and Feedback in its Community value. This includes the social constructs that underlie the communication and subsumes feedback as a special form of communication. In addition to XP's values, RapidOWL includes the value of Transparency. These values are explained in the sequel.

Community. The Semantic-Web knowledge representation paradigm that RapidOWL bases on is especially suited to represent terminological knowledge, i.e. shared classification systems, vocabularies and conceptualizations. To be applied and used in a broad scope, such terminological knowledge has to be agreed on by a community. The value of community thereby induces the involvement of the community in the process of knowledge elicitation, modeling and knowledge base evolution. Since fluent communication is not easily achieved RapidOWL supports and even strengthens communication with the use of several practices such *as interactive cooperation*, *joint ontology design*, and *community modeling*.

Simplicity. In many areas it was recognized long ago that simplicity is a key factor for achieving efficiency, usability and maintainability. See for example David Ungar's and Randall B. Smith's influencing paper about simplicity in Software Development (Ungar & Smith 1991), Kristiina Karvonen's article about "The Beauty of Simplicity" for user interface design (Karvonen 2000) or Jack Trout's book on employing simplicity in the economic sphere (Trout 1998). For knowledge representation, however, the biggest opponent of simplicity is expressivity. A variety of incompatible knowledge representation languages emerged, each of them finding a different compromise between simplicity and expressivity. However, there is hope that on the basis of the RDF statement paradigm these different representation languages can be smoothly integrated into a layered architecture with increasing expressiveness. Hence, RapidOWL demands and promotes simplicity in both, the knowledge representation paradigm which it is based on and the modeling achieved by making use of this representation paradigm.

Courage. Courage enables domain experts and knowledge engineers to make relatively big changes in order to solve problems that cannot be solved with only minor changes. Courage is especially important because modeling in RapidOWL is deliberately performed with little pre-planning. Courage can be also seen as an analogue to the Wiki philosophy of "making it easy to correct mistakes, rather than making it hard to make them". In that, the value of courage also advocates to trust the expert's intuition and creativity instead of putting him on a leash of rigid processes and relying on hierarchical decision-making.

Transparency. All activities can be watched and reviewed by any other party. All changes to the knowledge model and to the instance data agreeing on it can be easily and timely observed by interested parties. This attracts attention and invites people to collaborate. Transparency results in an instant gratification of the contributing domain expert or knowledge engineer, since his contributions can be seen instantly by others. In addition to establish transparency to humans other software systems should be enabled to instantly obtain changed parts of the knowledge base, too. This enables different Semantic-Web applications (or knowledge-based systems) to interact smoothly. Transparency is (amongst others) promoted by the RapidOWL practices of *view generation*, *simple knowledge model* and *observable development*.

Principles

Based on the four values which represent long-term goals, the RapidOWL development process is guided in the mid-term by various principles. They are partly inspired by Ward Cunningham's design goals for the first Wiki system (Cunningham 2003). The principles describe the single RapidOWL process axiomatically in the sense that they define characteristics the RapidOWL process should possess. In the next section concrete practices are derived from the principles aiming at achieving these desired characteristics in daily routine without prescribing a rigid process.

Open-world. Should a concept be found to be incomplete or poorly described, any domain expert can add and change the description of the concept as they see fit. Contributions by domain experts should require little or no initial investment. Knowledge engineers are enabled to provide more detailed ontological descriptions, classifications and axiomatizations at any time.

Incremental change. Concepts can refer other concepts, including ones that have not been described yet. This promotes (small) changes by people, even if they are aware of required additional work to be done. In that it supports collaboration between people with different knowledge.

Organic evolution. The knowledge base is open to editing and evolution. Contributors need not worry about destroying something because all changes are tracked and easy roll-back mechanisms are in place. To implement reliable applications it is possible to access the state of the knowledge base at a certain point of time.

Uniform authoring. The mechanisms of modeling and organizing are the same as those of data acquisition, so that any data contributor is automatically a modeler and an organizer. Furthermore, this is very useful as the borderline between model and instance data is often not clear.

WYSIWYM. What You See Is What You Modeled - the visual representation of the knowledge bases content will suggest the input required to reproduce it. A knowledge base is usually structured on different levels: statements, classes and instances. This structuring should be made visually explicit, so that it is easy to understand which information represents a statement, which information stands for an instance etc.

Observable development. Making the authoring of the knowledge base observable is important for two reasons. Firstly, it should be possible for any interested party to watch and review activity within the knowledge base. In conjunction with effortlessness of contributing this stimulates people to actively participate. Secondly, changes and contributions should be published instantly to ensure direct editor gratification for his (hopefully) minor effort.

Rapid feedback. Observers can provide direct feedback on every single addition or change to the knowledge base. This feedback would either encourage the original contributor to intensify his efforts or to rethink his modeling decisions. Ideally, this alternation of changes and feedback leads to conceptualizations which are really shared by the parties of a community, since they are result of a clash of different (or similar) viewpoints in a social ecosystem.

Convergent. Duplication can be discouraged or removed by finding, proposing and referring to similar or related concepts. This results on the one hand in simpler and smaller knowledge bases and on the other hand allows inaugurating new insights due to the increased interlinking of the knowledge base.

Traveling light. RapidOWL suggests focusing on a single modeling artifact. This artifact is the domain model expressed in the form of statements. This model can be enriched with documentation, feedback and comments. Instead of maintaining multiple models for the different levels of abstraction, RapidOWL promotes the use of different views.

Practices

The practices of RapidOWL are inspired by the practices of eXtreme Programming (XP) and from Holger Knoblauch's modifications for software / knowledge base co-design XP.K (Knublauch 2002). Due to the specific characteristics of knowledge engineering (cf. Section 3) not all practices from XP have an equivalent in RapidOWL and inversely. However, as in XP the practices support each other, so that the weakness of one practice is overcome by the strengths of other practices. This implies that most benefit from using RapidOWL lies in applying all of the practices together. In contrast to software development, where the team of full-time programmers can be easily instructed to put the values and principles of XP into daily routine, RapidOWL aims to turn domain experts into part-time knowledge engineers by keeping practices as simple as possible and by proposing strategies to support them with tools.

Interactive cooperation. Instead of requiring an on-site customer (or as in XP.K an On-Site domain expert) we propose to establish methods of interactive on-line cooperation between domain experts and knowledge engineers. A first step, is to transparently and timely publish ontologies and traces of changes for easy access by other modeling or reviewing parties. This can be technologically supported by interactively publishing the ontology and changes on the Web. Current developments of equipping Wiki systems with support for representing semantic relationships (cf. (Aumüller 2005), (Krötzsch et al. 2005)) are good candidates to accomplish this task. By applying recent content syndication standards (such as RSS (Winer 2002) or ATOM (Nottingham & Sayre 2005)) for the announcement of changes, experts can be timely and conveniently kept up to date.

Joint ontology design. Based on the simple subject-predicate-object statement paradigm, domain experts initially only define and describe concepts in a quite spontaneous manner. For this, they make use of worldwide unique concept identifiers (URI references) as subjects, predicates and objects within statements (i.e. RDF triples). After the information is thus represented, it can be enriched by more experienced domain experts or knowledge engineers with more detailed categorizations, classifications and logical descriptions (e.g. OWL axioms or SWRL rules).

Community modeling. To enable collaborative semantic cooperation, domain experts can attach comments to the statements and vote on how usefulness of the statements. In order to technically achieve this, RDF reifications may come into effect. To observe changes on higher conceptual levels than that of additions and deletions of statements, multiple added or deleted statements can be put into change sets. This is comparable to the way that patches subsume multiple atomic changes in software source-code versioning. Hierarchically organizing changes even allow change reviews on different levels of detail.

Information integration. The awareness of the need for developing a knowledge base often arises when a multiplicity of information sources exists and their interrelations are hard to maintain. Hence, it is crucial for the success of a knowledge engineering project to integrate existing information sources. Two approaches are possible to achieve this goal: *Importing information* into the common knowledge base - all further maintenance of the information has to be done within the knowledge base. This method can be easily applied for simple structured information sources as for example Excel sheets containing tabular information (Powl as described in (Auer 2005) contains such functionality). The other possibility is to *interlink existing data sources* with the knowledge base. This method will be the preferred way if information sources are highly structured (such as e.g. relational databases or LDAP directories), existing applications rely on access to the information sources in conventional ways and the maintenance of the information should be performed in established processes. For relational databases the problem is tackled by D2RQ (Bizer & Seaborn 2004). LDAP2OWL (Dietzold 2005) is an approach to make information from LDAP directories accessible to knowledge bases.

View generation. An aim of classical knowledge engineering is to realize problem-solving capabilities comparable to a domain expert (Studer et al. 1998)). In addition knowledge engineering can be seen as a support strategy helping users and experts to transfer knowledge between individuals or to gain new insights by presenting knowledge in unforeseen ways. Generating different views on a knowledge base will support greatly the latter mentioned aspects of knowledge engineering. Views select and combine certain parts of the knowledge base for human users. On type of views are user generated views, where the user or viewer is identical to the generator to the view. Such `self service' views can be realized in a user friendly manner by provision of full-text searches in combination with filtering and sorting functionality. However, for certain investigations more sophisticated selection strategies than filtering and sorting might be needed or the presentation for humans should be tuned. In this case view generation will require either a more experienced user, able to cope with query languages and aware of the knowledge structures or knowledge engineers assisting in generating the view. Fresnel (Bizer et al. 2004) for example is a declarative way to encode presentation knowledge in RDF with the primary goal of reusability across different representation paradigms.

Modeling standards. Modeling Standards are the counterpart to the XP practice of Coding Standards. Modeling Standards are agreed-upon naming conventions (e.g., “properties should start with a verb”) and syntax rules (e.g., “classes start with an uppercase letter”). Since the ontology language RapidOWL bases on (i.e., OWL) is much simpler than programming languages, it only requires the use of a few standards. In (Knublauch 2002, p 74) standards are described as being “essential to enable model exchange, collaborative modeling, and to minimize the dependency of the team on specific members. Furthermore, they contribute to the original vision of ontology research to enable global knowledge sharing”. Whilst it is relatively easy to enforce syntax rules within tools, the compliance check for naming convention could prove more challenging. The prefixing of properties with verbs though, can be checked with the aid of electronic thesauri (e.g. WordNet (Fellbaum 1998)).

Ontology evolution. Ontology evolution is the counterpart for the XP practice Refactoring. The more spontaneous new modelings and information is integrated into the knowledge base the higher is the demand later to adopt modelings and migrate instance data accordingly. Many approaches to ontology evolution emerged recently ((Stojanovic 2004) gives an overview), most of them, however, presuppose a well-defined and fixed set of possible knowledge base changes. To be able to review changes on different levels of detail (e.g. statement, ontology, domain level) we developed a hierarchical versioning strategy (cf. (Auer & Herre 2006)) which also facilitates automatic migration of instance data by providing a framework for the detection of ontology evolution patterns.

Short releases. A long-lasting develop-release cycle as in traditional software engineering would not adequately reflect the continuous information integration and knowledge structure evolution, which is characteristic for shared classification systems, vocabularies and conceptualizations. Instead we propose to make the development process as transparent as possible, by publishing changes immediately and releasing stable versions frequently. The sooner an ontology is released to the public, the easier it is to discuss changes and the earlier it is that potential problems become visible. Short releases will be facilitated if the consequences of changes to the ontology are known, i.e. if data adhering to the ontology has to be migrated or if queries about and views on the data have to be adopted.

Simple knowledge model. According to XP.K, simplicity is a “key to making models easy to understand, communicate, and maintain” (Knublauch 2002, p 75). Hence, the best knowledge model for RapidOWL is the model that has the fewest possible classes, properties and instances, provides semantic transparency for users as well as software systems, provides the needed querying facilities and passes consistency checks without violations. RapidOWL envisions a middle-out strategy for concept identification to implicitly achieve simple modelings: Domain experts are required to initially integrate all that information into the knowledge base they assume being relevant and worth represented. Such instance and sample data is in the following only thus far condensed into classifications and enriched with logical axiomatizations as needed for querying and/or reasoning services provided to the users. Hence, a RapidOWL knowledge base is not required to anticipate (all) future requirements a priori. Increasing complexity is therefore mainly driven by domain experts (i.e. users) of the knowledge base, thus ensuring comprehensibility.

Consistency checking. RapidOWL envisions the successive enrichment of a knowledge base with additional structure and logical representations according to the Semantic-Web language stack. However, this process should be mainly driven by users insofar as the increased semantics gives them real benefits with regard to querying and reasoning capabilities. Due to the size of real-life knowledge bases a strategy to enable reasoning services is to extract distinct parts or "slices" of the knowledge base adhering to a distinct OWL species or a rule language (e.g. SWRL (Horrocks et al. 2003)) to perform constraint and/or consistency checks (e.g. by means of Description Logic reasoner as FaCT (Horrocks 1998) or Racer (Haarslev & Möller 2001).

PUTTING IT ALL TOGETHER

The values, principles, and practices described in the previous section are the major ingredients of the RapidOWL methodology. They are also the main things that domain experts, knowledge engineers and especially tool developers for RapidOWL enabled knowledge engineering and management systems, should be aware of. In contrast to systematic engineering methodologies, RapidOWL does not prescribe a sequence of modeling activities that should be precisely followed. Furthermore, RapidOWL does not waste resources on comprehensive analysis and design activities. Instead, it follows the philosophy of agile methodologies, in which agility in the face of changing requirements and knowledge models is a major goal.

The individual tasks and contributions of prospectively involved parties in building a knowledge base on the basis of the RapidOWL principles are presented in the next paragraphs.

RapidOWL encourages *domain experts* to initially express all facts they assume as true and worth being, represented by means of RDF statements. This can be simply the adding of a statement which attaches an rdfs:label or rdfs:documentation to a URI reference, to give that URI reference an informal meaning. Or, instance data can be gathered by importing existing documents (spreadsheets, listings, text documents) into the knowledge base. A spreadsheet containing structured information in tabular form, for example, can be interpreted as a class, where columns indicate properties and rows usually represent instances. This activity promotes a shallow learning curve, since domain experts can instantly participate. As soon as an expert starts working on such a knowledge representation, other experts can observe every single step. They can add comments, vote about the usefulness of certain representations, add their own knowledge fragments and/or delete other ones.

More *experienced domain experts* assist in restructuring, interlinking and consolidating the gathered data. Importing information from legacy documents often results in duplicates, because, for example, columns in different spreadsheet documents representing the same information are not labeled in a uniform manner. Such duplications have to be detected and eliminated (e.g. by merging the respective properties into one). To reduce the costs of such changes, RapidOWL will rely on implemented wizards assisting in the detection of frequent modeling errors and by providing (semi-) automatic resolution to support evolution and migration. It might also be necessary to convert literal data, as, for example, two properties to be merged can represent the same information differently (e.g. names like "Auer, Sören" or "Sören Auer"). This kind of consolidation activity also includes the establishing of relationships which are not yet represented.

Knowledge engineers can support such a community of domain experts with advice for reasonable representation methods and by providing ontology evolution and data migration strategies. Knowledge engineers can further enrich the knowledge base with logical ontology axioms. This includes property characteristics (e.g. transitivity) and restrictions (e.g. cardinality restrictions). Class descriptions are refined with set operators (owl:intersectionOf, owl:unionOf, owl:complementOf). The knowledge engineer can also extract distinct parts or "slices" of the knowledge base adhering to the OWL species, DL and lite to perform consistency checks using a Description Logic reasoner. Since RapidOWL does not restrict domain experts in their usage of RDF it is likely that the knowledge base does not fall into the OWL DL or OWL lite categories. The species validation of an OWL reasoner, however, can give hints about how the knowledge base has to be modified. Another task is the testing of existing queries and views on the knowledge base after changes have been incorporated.

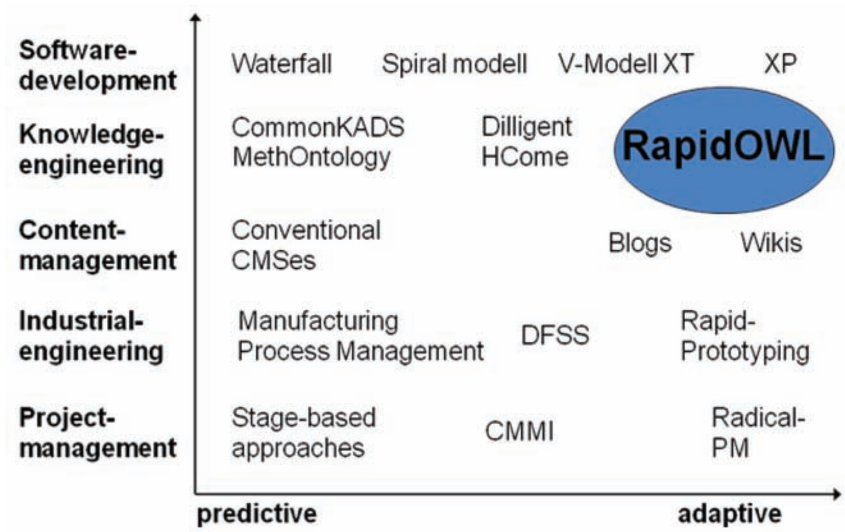
RapidOWL focuses primarily on establishing conceptualizations for information integration as well as the establishing of shared classification systems and vocabularies. Hence, tools supporting RapidOWL will have a rather generic than domain specific nature. However, *software developers* participate in the collaboration by developing domain specific applications providing specific views onto the knowledge base, or by assisting domain experts and knowledge engineers in formulation more complex queries to the knowledge base.

RapidOWL does not enforce a distinct succession; neither does it require all the just mentioned tasks and activities to be accomplished by the respective parties. The quality of the knowledge base, however, is determined by carefully performing activities related to consolidation, restructuring and modeling as well as consistency checking. Tools on the other hand, can highly automatize and integrate these activities into the Gathering activity.

In order to provide tool support for RapidOWL we developed OntoWiki (cf. Figure 5). OntoWiki facilitates the visual presentation of a knowledge base as an information map, with different views on instance data. It enables intuitive authoring of semantic content, with an inline editing mode for editing RDF content, similar to WYSIWYG for text documents. It fosters social collaboration aspects by keeping track of changes, allowing comments and discussions on every single part of a knowledge base, enabling to rate and measure the popularity of content and honoring the activity of users. OntoWiki enhances the browsing and retrieval by offering semantic enhanced search strategies. All these techniques are applied with the ultimate goal of decreasing the entrance barrier for projects and domain experts to collaborate using semantic technologies. In the spirit of the Web 2.0 OntoWiki implements an "architecture of

Figure 4. Screenshot of the RapidOWL tool OntoWiki

Figure 5. RapidOWL's placement in terms of predictive vs. adaptive methodologies



participation" that allows users to add value to the application as they use it. It is available as open-source software and a demonstration platform can be accessed at http://demo.ontowiki.net. OntoWiki is described in detail in (Auer et at. 2006).

CONCLUSION

The purpose of RapidOWL is to bring about a stable state of the knowledge base through small incremental changes from a multiplicity of contributors. To achieve that, RapidOWL applies various techniques and practices with the explicit goal of reducing the cost of change. Much of the assumption that the cost of change can be reduced is based on the value of *Transparency*. The practice *Short Releases* for example promotes that ontologies are published quickly and frequently, so that expensive misunderstandings can be uncovered and eliminated early, when the costs of changing them are still low. *View Generation* furthermore enables domain experts to timely review the representations from different perspectives. *Joint Ontology Design* and *Community Modeling* promote communication between domain experts (and knowledge engineers) and thus help by detecting errors earlier and spreading the knowledge. *Ontology Evolution* enables to undo problematic changes and to estimate prospective effects on instance data. Early *Information Integration* helps that the ontology really captures needed conceptualizations adequately. The *Simple Knowledge Model* of the statement based approach of Semantic-Web knowledge representation standards is very easy to understand. In conjunction with *Modeling Standards* domain experts are thus enabled to efficiently contribute to a knowledge base, even in absence of knowledge engineers. Finally, *Consistency Checking* helps to build robust and terminologically correct knowledge bases.

Although each of these practices has weaknesses when applied individually, their benefits greatly outweigh their weaknesses when they are used as a combined approach. In other words, the practices of RapidOWL support one and other. This analogous to other agile methodologies (cf. (Beck & Andres 2004), (Knublauch 2002)) and due to the "axiomatic" description of their single process. An example for individual weaknesses and mutual compensation of such is the interplay of the practices of *Short Releases* and *Ontology Evolution*. *Short Releases* of the ontologies may result in instabilities of the resulting knowledge-based systems. However, *Ontology Evolution* supports the early detection of prospective problems and enables the revoke of individual problematic changes in a simple way.

In (Fernández-López 1999) a number of criteria for analyzing methodologies were proposed. In the following we discuss RapidOWL in the light of these criteria.

Detail of the methodology. RapidOWL is a rather lightweight methodology. This is primarily due to the recognition that knowledge engineering is usually not a business in itself and thus significant resources for evaluating the methodology and later controlling the compliance of the processes with the methodology are not available. RapidOWL rather banks on tools supporting it than on exhaustive documentation.

Recommendations for knowledge formalization. RapidOWL bases on representation of all knowledge in the form of triples, i.e. RDF statements. A concrete degree of formalization is not prescribed. However, RapidOWL proposes to justify the degree of formalization according to the required reasoning capabilities of the resulting knowledge base.

Strategy for building ontologies. Regarding this criterion it is questioned whether the strategy to develop ontologies is (a) application-dependent, (b) application-semi-dependent, or (c) application-independent. RapidOWL focuses on the development of rather application-independent ontologies. However, RapidOWL is primarily suited for information integration tasks and tasks related to the establishing of shared classification systems, vocabularies and conceptualizations.

Strategy for identifying concepts. RapidOWL here follows a middle-out strategy, i.e. from the most relevant to the most abstract and most concrete. By stressing the collecting of example or instance data RapidOWL tries to abolish knowledge elicitation by means of face-to-face communication between domain experts and knowledge engineers.

Recommended life cycle. Due to its adaptive nature RapidOWL does not explicitly propose a rigid life cycle. However, many aspects of stages in the life cycle of conventional methodologies can be discovered in RapidOWL's single process.

Differences between the methodology and IEEE 1074-1995. This criterion is related to the conviction that knowledge engineering processes should be similar to conventional software development processes. In this regard RapidOWL is different in two ways: Firstly it stresses the need to react on changed prerequisites, i.e. being agile. Secondly it assumes knowledge engineering to be fundamentally different from software engineering in certain scenarios (cf. Section 3).

Recommended techniques. RapidOWL stresses the importance of providing concrete techniques for performing the different practices of which the methodology is composed. However, in the description of RapidOWL's practices within this document only starting points on how to put them into effect are mentioned.

Usage and application. Due to the fact that RapidOWL is rather new and significant resources had not been at our disposal for a broad evaluation the number of successfully realized RapidOWL projects is still small. However, ontologies and applications have been building on the basis of RapidOWL containing approximately 20,000 concepts and serving 3,000 parties (cf. the case study in (Auer & Pieterse, 2005)). Also, the large DBpedia multi-domain ontology extracted from Wikipedia (Auer et al. 2007), can be seen as a confirmation and working example for large-scale social semantic collaboration in the spirit of RapidOWL.

FUTURE RESEARCH DIRECTIONS

As we already mentioned earlier, a pivotal Social Software concept is the collaborative tagging of content leading to folksonomies (i.e. taxonomies created by folks). Applied to the sphere of the Semantic Web the challenge is to employ human "swarm intelligence" in the spirit of tagging to create not just *comprehensive* but also consistent knowledge bases. Consistent here is meant less from a logical point of view than from the perspective of achieving an agreement in the user community. When knowledge bases are collaboratively developed by loosely-coupled communities a way to improve the consistency is the development of RapidOWL extensions for moderation and decision processes. A field of future research is also the investigation of possible indicators for the degree of consistency.

A different approach of tackling the consistency problem represent policies and access control mechanisms for accessing, editing and annotating content. Due to the variety of the possible expressivity to be considered the formulation of policy models and access control strategies turns out to be difficult. In addition, policies should be adequate for a spectrum of knowledge bases with a varying degree of semantic richness.

Another challenge, lying less in the scientific than the software engineering field, is to increase the flexibility and robustness of storage backends, libraries and frameworks for the development of social Semantic Web applications. In addition to that standards for semantic widgets and user interface elements can support user acceptance and interoperability.

Last but not least *economic aspects* play a crucial role to make the Semantic Web a success. Due to the fact that semantic collaboration is in many cases not a direct business in itself, specific business models are needed, which are focused on services and products supporting the generation and curation of semantic content by communities.

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APPENDIX: QUESTIONS FOR DISCUSSION

Name three adaptive methodologies in different domains.

Extreme Programming in software engineering, "the Wiki Way" for content management, Rapid Prototyping for industrial engineering are adaptive methodologies in different domains.

What are smallest possible information chunks in RapidOWL knowledge bases?

RapidOWL is based on statements in the shape of RDF triples consisting of subject, predicate and object.

How can the unique identification of entities be assured on the Web?

Universal Resource Identifier (URI) enable the unique global referencing of resources and concepts, both within RDF statements and for retrieving further information about the referenced entity from the Web.

What are the typical ingredients of adaptive methodologies?

Adaptive methodologies can be described on the basis of their roles, paradigms, processes, models and tools. Paradigms influence the process; they lay the foundation for models, and have to be internalized by people. Tools support the collaboration processes on the basis of the methodologies models.

How can we distinguish data, information and knowledge?

Data are supposed to be "raw signals", such as the name of a person. Information attaches meaning to data, such as the statement that a person is male. Knowledge in turn attaches purpose and competence to information, potential to generate action.

Which roles of participating actors are envisioned by RapidOWL in the creation of knowledge bases?

RapidOWL envisions domain experts, knowledge engineers and software developers to participate in semantic collaboration scenarios. However, RapidOWL is primarily focused on domain experts and should be applicable even in the absence of knowledge engineers and developers.

How is the creation of knowledge bases different from the creation of software?

Knowledge Engineering is usually not a business model in itself. It also lacks unique knowledge serializations as there are with source code for software. Knowledge engineering scenarios mostly have to deal with a large number of spatially separated parties.

Describe differences and similarities of Social Software and the Semantic Web

Both paradigms are collaboration and integration focused, based on the Web and provide enhanced means for search and navigation. They differ, however, with regard to the involvement of communities, the incorporation of business aspects as well as the complexity of content and technologies.

What are the typical communication patterns for social software?

Typical communication patterns for social software are point-to-point, bi-directional, star-like, net-like communication.

This work was previously published in Semantic Web Engineering in the Knowledge Society, edited by J. Cardoso; M. Lytras, pp. 267-289, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Section III
Tools and Technologies

This section presents extensive coverage of the tools and specific technologies that change the way we interact with and respond to our environments. These chapters contain in-depth analyses of the use and development of innumerable devices and also provide insight into new and upcoming technologies, theories, and instruments that will soon be commonplace. Within these rigorously researched chapters, readers are presented with examples of specific tools, such as social television, wikis, mobile photo galleries, and personal digital libraries. In addition, the successful implementation and resulting impact of these various tools and technologies are discussed within this collection of chapters.

Chapter 3.1
A Modern Socio-Technical View on ERP-Systems

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ABSTRACT

This chapter sketches an Organization Design perspective called "Modern Socio-technical Design", and subsequently discusses the implementation of Enterprise Resource Planning Systems from this perspective. The authors argue that the praxis of ERP-system implementation is often at odds with socio-technical insights, leading to various problems that ERP-end users are confronted with. These tensions may not be inevitable, but simply result from taken-for-granted organization assumptions underlying ERP-implementation praxis. The socio-technical insights are intended to help practitioners reflect on ERP-implementation praxis, and discuss to what extent an ERP-system is appropriate and if so, where socio-technically inspired choices may be made within configuration processes.

DOI: 10.4018/978-1-60566-264-0.ch029

If you automate a mess, all you get is an automated mess

—Anonymous Saying

INTRODUCTION

Do ERP and teamwork coincide? Koch and Buhl (2001) studied 24 cases where teamworking and ERP-systems were introduced simultaneously. Their answer to the question is negative, as they argue:

[s]ince the concepts of teamwork and ERP-systems appear widely diffused, one might expect that both are closely aligned when they are implemented [...] As we demonstrate, however, this is not the case [...] Although ERP is possible to configure in such a way that autonomous teamwork on the

shop floor is supported, we found that ERP and teamwork rarely interact directly. When they do, they are potentially competing change programs, and indirect competition predominates. (Koch & Buhl, 2001, p. 165)

They argued that the problem was not the configuration of ERP-systems for autonomous teamwork, but that there were (1) no modules available for this configuration process and (2) no consultants with the necessary knowledge. To illustrate this, they discuss the case of a machine building company where an attempt was made to align ERP-systems and teamwork. The attempt was unsuccessful however, as it started from different premises: the consultants implementing the ERP-system focused on enhancing production planning and control from a central perspective and "did not push for supporting teamwork" (2001, p. 173). Furthermore, "in-built features" of the ERP-package used "were realized in a way that led to a strengthening of other parts of the planning than the teams" (2001, p. 173). Finally, the technical aspects of implementing the system were so complex and time-consuming that organizational aspects received little attention. The members of the self-managing teams in the project team could not turn this tide. Whilst the teams were authorized to take certain decisions, the key tasks of (local) production planning was centralized. In a second round of ERP implementation, the shop-floor teams' experiences were not taken into account and the new tasks were confined to data entry and providing feedback on production orders. Koch and Buhl stress that the outcome was not a necessity but "a mixture of intended and not intended actions both from the ERP-coalition" and members of the self-managing teams (2001, p. 174).

Their findings do not stand alone. At a more general level, Soh and Sia (2004) studied how ERP-systems were used in three hospitals in East Asia. They wondered whether empowerment or control would prevail in how these systems were used. The result of their study was that while both outcomes are possible, in praxis control tended to get the overhand. In terms of Orlikowski (2000), the 'control' potential of ERP-systems is apparently and in the course of time more easily enacted than the 'empowerment' potential (cf. Boudreau & Robey, 2005).

Koch and Buhl's study gives rise to the question why it is apparently so difficult to combine self-managing teams and ERP-systems. Answering this question calls for a more integrative view on organization design because teams are embedded in organization structures and information systems such as ERP-systems are to support decision-making in such organizations. This view remains implicit in Koch and Buhl's study, but is necessary if their recommendation of developing "practical templates" to support configuring ERP-systems for self-managing teams is to be realized. In a broader perspective, self-managing teams are seen as a hallmark of modern organization, for instance as part of "high performing work systems".

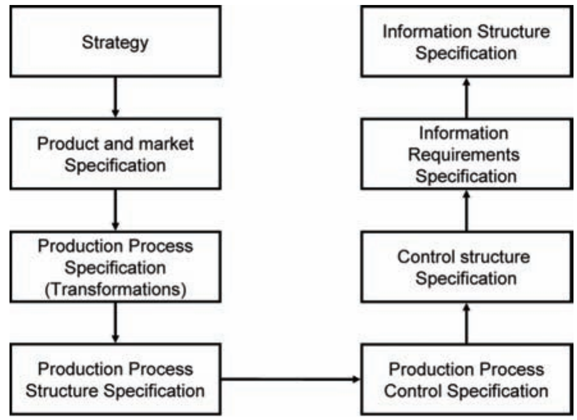
In the remainder of this chapter we first present an organizational design methodology that provides an integrated view on structuring organizations so that suitable organizational environments are created for self-managing teams and subsequently, after this structure has been designed, the informational requirements are analyzed so that information systems may be configured and implemented. This so-called "Modern Socio-technology" incorporates some organizational design principles which, as Koch and Buhl's (2001) work shows, tend to sit uncomfortably with ERP-systems in practice. These tensions are discussed after presenting Modern Socio-technology. This analysis is necessary as a first step for developing the templates for which Koch and Buhl signaled the need.

MODERN SOCIO-TECHNICAL SYSTEMS DESIGN

What was to become socio-technical systems design (STSD) started with studies in the late 1940s in a number of British coal mines. In 1951, Trist and Bamforth published a founding article on STSD while the London-based Tavistock Institute played a key role in further developing socio-technical design into practical applications. During the 1950s and 1960s these notions were picked up in many countries, with Norwegian and Swedish researchers playing key roles. In the Netherlands a strand of socio-technical scholars and practitioners developed a widely accepted research based organizational design methodology (De Sitter, Den Hertog, & Dankbaar, 1997; De Sitter, 1998). This Dutch variant, called Modern Socio-technology (MST), builds on the classic STSD. In the 1970s Ulbo de Sitter played a key role in developing this socio-technical systems theory (with some roots in German sociology). During the 1980s this design theory was enriched with a proper design methodology based on action research. MST mainly differs from STSD by its integral approach. Whereas classic STSD provides a set of static and partial design principles, MST offers detailed structural principles in terms of design content, while at the same time specifying a theory of change by means of worker participation and training (Van Eijnatten, 1993). To emphasize the integral character of this approach, Van Eijnatten and Van der Zwaan (1998) labeled it Integral Organizational Renewal (IOR).

Since MST provides an integrated body of knowledge comprising analysis methods as well as (re)design rules (Van Eijnatten & Van der Zwaan, 1998), it is this Dutch variant of STSD we use for our analysis of the effects of ERP on organizational design. Team based organizations are a central concept in this approach aimed at meeting organizational requirements, as well as improving the quality of working life. To achieve this the design order principle as depicted in Figure 1 was developed (Groep Sociotechniek, 1986; De Sitter, 1998).

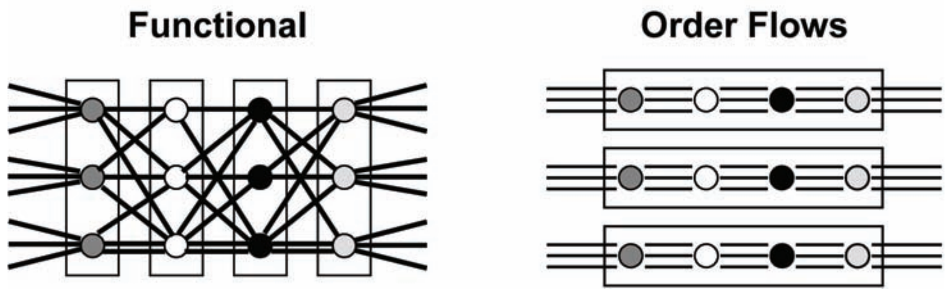
Figure 1. The Socio-technical design order principle (based on De Sitter, 1998)



The Design Order Principle: Reduction of Complexity

The production structure of an organization should reduce the variety and the number of possible interferences as much as possible. The principle is to effectively break down complex demand/transformation systems into a number of far less complex sub systems that are as independent as possible. In practice this implies parallelization and segmentation of order flows. Based on this, control structures can be governed by autonomous groups according to the principle of minimal critical specification. This actually follows Ashby's law of requisite variety (Ashby, 1969) holding that a system's control capacity should be at least equally as the variety it needs to control. By parallelization the number of interferences and dependencies between transactions can be drastically decreased. Parallelization can be contrasted with production specification into functional departments, in which every department is responsible for only one kind of transformation. Figure 2 illustrates the complexity reducing effect of parallelization in a functional organization (job shop like) compared

Figure 2. Functional Organization compared to Parallel Order Flows (based on De Sitter, 1998)



to a set of parallel order flows.

Socio-technical systems design implies a top-down development of the organizations' production structure, and a bottom-up development of the control structure needed. Starting at the left-hand side of Figure 1, the (top) management level, business strategy initially drives product and market specification. Based on this the required production processes and structures are designed. Within this top-down chain of actions, production process specifications consists of a large number of 'transformations' ranging from integrated production lines to traditional job shops. Depending on the scale and requirements of these transformations the production structure specification is defined. Each transformation has to be controlled towards a number of aspect related targets, such as quality, quantity, efficiency, costs, environmental impact and timely delivery. All these control activities can also be aggregated accordingly, ranging from task specialization in a bureaucratic hierarchical structure to self-directed work teams for specific product market combinations. At this first part of the MST design, basic decisions on production and job structure design ('what needs to be done?') are taken.

Moving to the right-hand side of Figure 1, the next steps particularly consist of the required information specification. These are derived from the control activities (information requirements specification) as specified top-down, and – bottom-up – developed into an aligned information structure (information system or set of information systems). Here, information structure specification implies the effective and efficient support of production and control activities. In this chain of the design different levels for control are to be distinguished. At the macro level strategic control of external relational are addressed. At the meso level inter-group coordination is concerned, while at the micro-level control teams and employees are responsible for controlling individual transformations. At this second part of the MST design, basic decisions on control and job design ('how should it be done?') are taken.

The Minimal Critical Specification Principle: Segmentation

Once parallel flows are created, task assignments allocated to units or groups should aim for an 'optimal' level of independency. This may be achieved by splitting the flow into a number of so-called "segments". This implies that tasks are grouped in such a way that the number and content of interfaces with other organizational units are minimized. Each interface creates the risk of interference and disturbance and hence a need for co-ordination. As shown in Figure 2, the reduction of the number of interfaces is achieved because incompatible grouping of transformations, such as welding and coating of metal parts, or nursing and operating in hospitals, are divided by flows into segments. In defining the number of transformations or people involved one should note that co-ordination and direct communication between segments or people will accumulate accordingly, leading to higher levels of required co-ordination. In this respect, the socio-technical design of teams by segmentation is also guided by the principle of minimal specification.

The Task Completeness Principle: Quality of Working Life

In an MST-design, segments are generally operated by self-managing teams. The preceding steps made sure that the tasks assigned to the teams may actually be carried out as independently as possible. The local control makes quick interventions possible in case of unexpected events.

The notion of maximum local control also applies at the level of individual employees. The organizational advantage of such local control lies in the potential for quick local interventions, but also in positive effects on employee behavior. This subscribes to Karasek's plea to balance job demands (i.e. control needs) and decision latitude (i.e. control capacity; cf. Karasek, 1979). A job is considered a 'good' job if it (1) consists of complete tasks and sufficient control capacity to deal with control needs conclusively, and (2) offers sufficient challenges to job holders. Creating such jobs removes a source of stress, namely that employees see undesirable events happen but are not allowed to intervene. By creating "good jobs", workers are to be motivated with positive effects on, behavior and absenteeism, and thus productivity.

MODERN SOCIO-TECHNICAL VS. ERP-SYSTEMS DESIGN

As stated, deploying ERP-systems may have negative consequences for employees and organizations. Below, we aim to understand these negative effects by projecting the socio-technical principles on (explicit and implicit) design of organizations through ERP. We systematically confront the key MST principles discussed above with ways in which ERP-systems are commonly implemented.

ERP-Systems at Odds with Design Order Principle

A first and key difference between a socio-technical design and ERP implementation is the starting point. ERP, both as a business concept and an Enterprise Information System (EIS) automation concept, was originally developed to fully integrate different information systems that (particularly large) organizations deal with. Instead of creating middleware applications to connect separated Information Systems (for instance production planning and billing systems), ERP radically replaces them all. With ERP, the total information architecture needs to be redesigned in order to automate all processes in a similar way. The input and creation of information by users is designed to take place according to a one single point of entry principle, to avoid data redundancy. Business rules are formally translated in work and information flows throughout all of the ERP-modules, thereby similarly modelling departmental and functional roles. And finally the information representation is designed by standard templates and forms. In ERP-systems the traditional presentation, application and database layers are strongly integrated, with one single database and meta-model as its main core. Therefore, socio-technical organization design departs from design criteria, derived from a strategic position, to design the production structure and the control structure. The information structure is derived from the production and control structure. In the case of ERP, the information system provides the starting point and must be configured to fit organization structure and processes. These often follow the ERP-system rather than the other way around. In practice the complexity of ERP software enforces that organizations tend to 'stick to the standard' offered by the ERP vendor (Benders, Batenburg, & Van der Blonk, 2006).

This design order problem becomes particularly clear when multi-site organizations are considered. The central concern is about the fit between the systems to be integrated on the one hand, and the particular practice of organizational subunits on the other. The more subunits deviate from other subunits and the more these subunits are dependent on each other, the more likely that ERP implementations will need to depart from standardization of the information structure (i.e. the IS infrastructure or architecture). Customization of the ERP-software by bolt-ons, add-ons and spreadsheet workarounds are discouraged, while from a MST perspective these might be allowed to assist local decision-making and enhance control capacity. In other words, ERP violates the parallelization principle in cases these parallel flows demand differing information support functionality. This is problematic as ERP implementations usually entail the implementation of only one business model in the software to save on implementation and software maintenance costs (Swanson, 2003).

ERP-Systems at Odds with Minimum Critical Specification Principle

In ERP-systems design there is a central database while integration by control is organized in functional software modules making use of one common IS/IT environment. The modular design of ERP-systems, however, also implies functional decomposition as there are separate modules for control domains such as finance, quality management, logistics and HRM. In addition, different functionalities, such as data input, query dialogues and management reports, are separated with ERP-systems. As modules are configured by functional specialists, the design of ERP-systems leads to a tendency to create tasks that are functionally decomposed as well. Obviously, this segregation of control aspects contradicts the fulfilling of the socio-technical requirement of integrating primary and supporting functions. In terms of Figure 2, the existing functional organization (similar operations grouped together) is maintained. The complex product flows in between different organizational units is followed by the software (as is the case with workflow management software). Figure 2 illustrates the risk of this approach, seen through a socio-technical lens. At the left, the functional structure is shown. A product that has to undergo various functional operations is taken from one functional department to the next, leading to complex routings through the organization. The socio-technical solution is, wherever possible, to place the operations in the same sequence as needed to make this particular product in multi-functional departments, as shown in the right-hand part of Figure 2.

Current ERP practices usually keep the complex functional structure intact, and follow the product through the different departments with an information system. From a socio-technical view this situation could be called 'technology-enabled complexity maintenance': instead of simplifying the situation to be controlled, the complex situation is maintained and the control possibilities are improved. In effect, this process orientation is the electronic equivalent of the 'chasseur', the French name for a person who used to be sent into a factory to track and speed up orders. The risk of using an ERP-system is that the symptoms of a complex structure are fought, but that the underlying problem of unnecessary complexity is not solved (De Sitter et al., 1997).

ERP-Systems at Odds with Task Completeness Principle

ERP-implementations directly affect job decision latitude in various ways. During the configuration process, (future) users are authorized to take particular decisions. In granting authorizations, ERP implementers directly influence job decision latitude. However, as with other organizational changes, it appears that only in exceptional cases ERP-implementers take these effects on job content explicitly into account. Instead, predefined user groups and role structures tend to be used. The control perspective often comes back in the form of the "segregation of duties", a key principle in administrative organization which is to prevent creating opportunities for fraud. Control cycles are not closed, as modern socio-technical design prescribes.

A similar aspect concerns authorizations for data access and data entry. In standard authorization schemes, these are often concentrated with a limited number of users, generally those at higher hierarchical levels. This may cause problems at the shop floor, as work can not proceed in the absence of the authorized. A frequently used option to 'work around' these authorization problems is granting employees more access rights than controllers see as proper (Pollock & Cornford, 2004; Le Loarne, 2005). A user may formally or informally arrange access to additional user IDs and passwords to be able to perform all necessary tasks. In a socio-technical design user requirements would be the starting point for getting access. Obviously, data entry jobs within ERP-systems consisting of monotonous and short cyclical tasks are, in socio-technical terms, seen as "passive jobs" (Karasek, 1979). In a socio-technical design, data entry tasks would be integrated with other tasks into complete jobs. More broadly, ERP-users often need to put data in for other functions in the organization. A comment as "SAP creates work" (Le Loarne, 2005, p. 526) signals that this may not always be efficient and is certainly not always perceived to be efficient. The empirical examples described above support this notion.

Soh and Sia (2004, p. 25-26) see the ability to track products as a form of empowerment: what they call ERP's 'process orientation' allows employees to track the progress of individual products. Compared to a situation where this is not the case and hence employees are confronted with orders, insight into these orders' process statuses may be seen as progress for employees. However, as long as they are not authorized to take action, this may have the effect of increasing stress levels, because of lack of control capacity: seeing problems happen without being able to solve them, or insight alone is not sufficient. As a result, the control capacity needs to be adjusted as well.

Implications

Implementing ERP-systems goes along with organizational changes. Their breadth and depth, however, seem generally underestimated. As Koch and Buhl (2001) showed, organizational consequences are not always, and probably generally not, taken into account when implementing ERP-systems. Consequently, unintended and negative results are likely to occur. As Koch and Buhl's machine building case showed, organizational changes as a result of ERP and teamwork ask for contradictory directions for change. Whereas ERP-implementers strive for standardization and centralization, teamwork implies empowerment and decentralization, enhancing team autonomy. Especially in terms of job decision latitude, ERP may easily be at odds with team working. If the consequences of an ERP-implementation for job design are not explicitly considered, teams' potential to deal with environmental complexity and flexibility is not used or even negated. ERP's focus on standardization, authorization schemes and central control limits the job decision latitude (control capacity) at individual and team level (Karasek, 1979). As a result, the balance between control need and control capacity at individual and team level (an objective of MST and team working for reaching organizational goals) is disturbed and increasing stress levels and organizational inefficiencies may result.

However, these contradictory directions do not necessarily have to lead to negative results. As Buhl and Richter's use of participatory design tools shows, the implementation of an IT-system "can be productive and constructive if they are explained to other employees and if they, for their part, get room to and time to develop alternative models and their own perspectives" (Buhl & Richter, 2004, p. 270). These participatory design tools fit into MST's design methodology and action research approach. Starting from organizational requirements and building autonomous teams as the building blocks of the organization, the technical systems must fit this organizational design. Participation of team members in the configuration of ERP enhances mutual understanding between different groups in the organization and, as a result, the system's productivity and the worker's enactment of the technology (cf. Orlikowski, 2000). Furthermore, it does justice to the teams' autonomy and decision latitude.

Two points of special attention are attached to this participative approach. First, it requires that ERP-systems are truly open for configuration in terms of the underlying technology (as with customization), business rules (as with parameterization), and the financial barriers of these system adaptations. Scott and Wagner (2003) state that ERP can be customized to adapt the principles of socio-technical design. By longitudinal and participatory design analysis of an Ivy League University in the US they conclude that – in contrast to the opinion that ERP is uncontrollable (or even a "technological monster") – temporal turns and negotiations during the ERP project led to "a hybrid working rhythm that is inscribed into its socio-technical infrastructure" and hence a socio-technical information system was created. It should be noted however that the adaptability of ERP-systems in practice often deviates from the "anything goes" adage that SAP and other ERP vendors use in promoting their systems as total business or industry solutions.

The second point of special attention is that staff participation may result in single-sided attention for quality of working life. Following MST's design methodology, first and foremost the organizational structure must be built in order to meet organizational (corporate) requirements. Self-managing teams are the main concept in this design, but these teams' autonomy cannot be a goal in itself. In MST balancing organizational requirements and workers' needs (quality of working life) is essential and a logical consequence of the design process. As a result, participation of teams in, for instance, decisions about authorization schemes in ERP, rather than the technical specifications, seems highly important. For instance, Buhl and Richter (2004) show that shopfloor worker participation in accessibility rights in the system resulted in modifications that supported the teams' competencies and some autonomy to plan their own time and production capacities. These are important aspects of control capacity and therefore positively influence the balance between control need and control capacity (cf. Karasek, 1979).

Example: A Board Manufacturer

A solid board manufacturer delivers special products to a number of market segments and areas. The organization faced the problem that some clients demanded rather short delivery times but were willing to pay premium prices, whereas others accepted longer delivery times and ordered longer in advance. To serve both market segments a partial parallelization of order flows was suggested, namely of sales and order acceptance functions. Nothing changed in the manufacturing process, as the heavy machinery in the mill was too expensive to re-group.

The process of order acceptation was delegated from the central planning department to the regional sales offices. To minimize mutual interdependencies between sales offices or between sales offices and production, the production capacity was administratively distributed over contingents per area. The areas only needed to co-ordinate their activities in the occasional event of over- or underbooking.

However, the standard ERP-features did not allow for this tailor-made organizational solution. Thus, to facilitate this parallelization the ERP system was extended with a bold-on, a 'sales budget and order acceptance subsystem'. This interfaced with the sales forecast, the budgeting and production scheduling modules of the ERP software used by the organization.

DISCUSSION AND CONCLUSIONS

Our analysis is a first step in identifying some of the main potential causes of tension in implementing ERP-systems while creating suitable organizational environments for self-managing teams. As Koch and Buhl (2001) described the misalignment of ERP-systems implementation and teamworking, MST provides a useful lens to describe possibilities for aligning ERP and teamworking. Both include change programs aimed at dealing with organizational problems concerning lack (or loss) of effectiveness and flexibility. The existing literature shows that awareness of the organizational consequences of ERP implementation is an important condition for aligning ERP and teamworking. Centralization and standardization that go along with many ERP implementations are at odds with the three MST design principles we discussed. These are aimed at organizational structures that best respond to environmental complexity and in which the design and development of autonomous teams is the main concept. Being aware of these possible consequences opens the route to designing effective and efficient organization structures around autonomous teams that are supported by ERP-systems that are configured to meet the organization's requirements. Moreover, following MST design principles the work in teams or individual jobs should result in meaningful and complete jobs, due to the balance between job demands and job decision latitude. As Buhl and Richter (2004) show, communication, participation and cooperation of different participants, such as shopfloor workers, line managers, production planners and IT specialists, are important means to create the necessary awareness.

A limitation is that our chapter focuses on what one may call 'traditional' ERP implementations, i.e. the deployment of product software solutions within organizations to integrate, automate and support business processes. Several developments can be recognized that go beyond the standard type of ERP implementation. A major movement is that more and more organizations use ERP software to extend and virtualize their organization, their supply chains and corporate networks. Most ERP software offers e-business functionalities to support this virtualization by tools and modules for e-sales, CRM, e-procurement, e-sourcing and so on. These cross-organizational functions put new pressures to adjust ERP-systems to these new organizational settings. Boersma and Kingma (2005) presented an in-depth case study of mutual ERP adaptation and virtualization through enforcing supply chain conditions. This type of external adaptation will obviously multiply fast if organizations increasingly extend their information exchange and system integration with other chain and network partners. As a consequences new developments within the software profession emerge like Service Oriented Architecture (SOA). SOA particularly fits the idea of transformation of a static functional organization to a dynamic network of services. Flexibility is the key competence to achieve, by rapidly creating new services from existing ones, and by adjusting the services network onto the fast changing environment. Almost all ERP-vendors have announced a reshaping of their products towards this service orientation. Applying SOA can enable software solutions to dynamically support specific organizational needs, while combining and re-using product software and existing IT.

These developments might retune the disadvantages of classic ERP we here brought up in this chapter. They do not change the core characteristics of ERP as an integrative and control-oriented system however. Research is rightly to explore about the impact of fast-moving technological developments, such as e-business and SOA on the (inter-)organizational fit of ERP. This might actually be an interesting momentum for ERP-vendors and consultants to rethink their architectures and implementation methods taking the socio-technical principles here referred to into serious consideration.

The Modern Sociotechnical design perspective seems to sit comfortably with the adage "First organize, then automate". In sharp contrast, the current ERP-implementation praxis can be characterized as "first implement, then re-organize". This has a couple of implications for practitioners. These include various IT-specialists, consultants from "implementation partners', and at the demand site, managers and (end) users. These different "stakeholders are likely to have partially diverging interests. The MST-perspective probably serves managers and end users best: this perspective may strengthen them to point to critical aspects during implementation. Given the political realities in many organizations, the ERP-implementers will probably be in a strong position and argue against "first organize, then automate" as this may lead to questioning the wisdom of ERP-systems. Less radically, however, the socio-technical perspective may influence choices within the scope of ERP-systems. These include:

- business process analyses should precede ERP-implementation;
- be critical about maximal coupling and consider de-coupling organizational units;
- use the notion of "local control" in authorizing end users;
- allow, when needed, local support tools.

Within ERP-design, templates for implementing self-managing teams may be developed. These can assist implementers to resolve the dilemma between centralistic, top-down control and specialization tendencies inherent in ERP-system design on the one hand, and on the other the socio-technical ideas of reducing system complexity, maximum local control and minimal critical specification.

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KEY TERMS

Control Structure: The structure (logical set up and distribution among jobs) of control tasks that together try to safeguard the intended outcomes of an organization.

ERP-Systems: Enterprise resource planning (ERP) systems attempt to integrate several data sources and processes of an organization into a unified system. A key ingredient of most ERP systems is the use of a unified database to store data for the various system modules.

Information Structure: Information structure refers to all information that is relevant to the organization's strategic and operational processes and decision making, that can be stored, used and managed by Information Systems and Information Technology (IS/IT).

Modern Socio-Technology: Modern Socio-technology (MST) is a Dutch variant of the classical socio-technical systems design (STSD) that focuses on organizational design.

Organizational Design: The process of setting up (designing) the structure of transformations, its coordination, control and the information flows needed to manage the transformation according to the organizational strategy.

Production Structure: The structure (physical lay-out and interdependence relations) of the transformations that together result in the constitution of the goods and services that an organization intents to deliver to their customers.

Teamworking: Teamworking involves a group of workers, generally between 4 and 20 persons, responsible for a rounded-off part of the production process, and entitled to take certain decisions autonomously.

This work was previously published in Handbook of Research on Socio-Technical Design and Social Networking Systems, edited by B. Whitworth; A. de Moor, pp. 416-428, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.2
Social Shaping of Technologies for Community Development:
Redeployment of Information Communication Technologies among the Kelabit in Bario of the Kelabit Highlands

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ABSTRACT

Using electronic-Bario (e-Bario) project in the Kelabit Highlands of Sarawak in East Malaysia, this chapter explores how the introduction of information communication technologies (ICT) as developmental tools have been mediated and reconfigured by webs of social relations and the intricate interplay of social, political and cultural conditions specific to different social and technical settings. One crucial factor conditioning the effects of the project has been the Kelabit's own desire for, and expectations of, "development" and "progress." This is a quest which ties in closely with two fundamental Kelabit concepts: doo-ness and iyuk. As a result, the social and economic effects of ICT have unfolded through countless open-ended strategic and everyday decisions made by the Kelabit themselves, who actively consume, apply and make use of objects, ideas and services in the Highlands.

DOI: 10.4018/978-1-60566-735-5.ch013

'The new electronic interdependence recreates the world in the image of a global village'. -- Marshall McLuhan, The Gutenberg Galaxy in Daintith, John (ed.) Quotations, Bloomsbury (1996, p.256:1).

INTRODUCTION

Over the last 15 years information and communication technologies (ICT) have been increasingly and optimistically promoted as a means of transforming developing countries into "modern" and knowledge-based societies and to alleviate some of the social and economic problems of developing world, particularly those in rural areas. Yet very little is known about the veracity of these aspirations, much less about the long-term social and economic effects of these technologies upon development in rural areas (Keniston, 2002).

Informed by a social shaping technology (SST) framework, this chapter explores how the introduction of information communication technologies was mediated and reconfigured by webs of social relations and the intricate interplay of social, political and cultural conditions specific to the Kelabit Highlands. In this way the chapter seeks to achieve a more critical understanding of the relationship between ICT and society that provide an understanding of the implications of ICT for social and economic development and inform current discussions about the emerging "Information Society."

SOCIAL SHAPING AND CONSEQUENCES OF ICT

The social shaping of technology (SST) approach to technology-society relationships has emerged in the late 1980s as an important framework to explore whether technology can be seen as a main force that shapes society or whether society and social values shape the way in which technology affects our lives. With regards to information communication technologies, the approach builds on two main themes: the design and implementation of ICT artifacts and systems; and the implications of ICT for individuals, organizations and society. Within this broad remit the SST approach could not, and will not deny that technology has an effect on society but at the same time emphasizes organizational, cultural, economic and other factors influencing the process of technological change and innovation (Williams and Edge, 1996; Kling, 2000). In other words, deviating from a technological determinism standpoint, SST embraces the centrality of users, society and social values to shape the way in which information communication technologies (ICT), affect our lives, (Dutton, 2001; Rohracher, 2003; Fischer, 1992).

Taking the lead from the SST framework, this chapter explores the social and economic effects of electronic-Bario (e-Bario), an ICT-based community development project implemented in the Kelabit Highlands of Sarawak. This is in order to shed some light on the character and significance of ICT in different social and technical settings and at the same time to illuminate the processes of shaping the use and impacts of ICT in Bario. It takes into account the role of the Kelabit's own desire for, and expectations of, "development" and "progress." This is a quest which ties in closely with two fundamental Kelabit concepts: *doo*-ness and *iyuk*. As will be made clear later in the chapter, both notions signify movements and good-ness in terms of social status among the Kelabit. By highlighting their significance, this chapter argues that it is the local cultural logic of *doo*-ness and *iyuk* among the Kelabit which is central to the shaping of technology especially how meanings (symbolically) are "inscribed to technologies" (Rose, 2001, p.69), creating a desire for new technologies, and informing their development and appropriation by users in the Highlands. In short Kelabit notions of *iyuk* and *doo*-ness are central to functional and symbolic encoding of technologies in Bario and are crucial factors conditioning the effects of the project. This is evident by the ways in which the social and economic effects of e-Bario have unfolded through countless open-ended strategic and everyday decisions made by the Kelabit themselves, who actively consume, apply and make use of objects, ideas and services in the Highlands.

BACKGROUND: THE E-BARIO PROJECT

Considered the traditional homeland of the Kelabit, the Kelabit Highlands is situated above the rapids found at the headwaters of the Baram and Limbang in Northeast Sarawak, close to the border between Kalimantan and Malaysia in the Miri Division. Although there is no official boundary to define the area, Thong and Bahrin (1993, p.17) estimate that the Highlands comprise an area of approximately 2,500 square kilometers. With an average altitude of 1000 meters above sea level, it is surrounded by some of the highest peaks and rugged mountains in Central Borneo. This out-of-the-way situation is well noted by Harrison (1959): 'There is one [of] or two places on the map of Borneo and, more widely, on the map of the world – where you can get farther away from a known place …, from what most people call "the world." There are fewer places where you (or I) are likely to be able to feel more remote, more "cut off" from the great outside…' (p.5). Nowadays, flying into the unofficial capital of the Kelabit Highlands known as Bario, is the only practical way to get there. There is no road, and a land expedition requires a river journey plus an additional weeklong trek across forested mountains (Bala, 2002).

But, who are the Kelabit? Numbering at 5,240 in 2000, the Kelabit are one of the smallest ethnic groups in Malaysia. For the past thirty years many have left the Kelabit Highlands for education and job opportunities. As a result only a thousand still remain in the Highlands while the rest are living in cities like Miri, Kuching and Kuala Lumpur, or even overseas in the U.K., U.S.A., Canada, Holland, Australia and New Zealand. This high level of rural-urban migration has led to a geographically-dispersed community, creating almost a clear distinction between the Kelabit who remain in the Highlands (rural Kelabit) and those who have left to live in urban areas (urban Kelabit).

Ironically, it was because of these two social situations: high levels of rural-urban migration of the Kelabit and the geographical remoteness of the Kelabit Highlands that Bario became a test-bed for the e-Bario project. Initiated by an interdisciplinary team of researchers from Universiti Malaysia Sarawak (UNIMAS), e-Bario explored the use of telephones, computers, Very Small Aperture Terminals (VSATs) and the Internet to improve the lives of marginalized groups in remote areas of Sarawak. Initially funded by International Development Research Centre in Canada, it was later adopted by the Malaysian Government as one of its Demonstrator Application Grant Schemes. The project was largely initiated in response to Malaysia's approach to adopt ICT as essential developmental tools in generating a knowledge and information-based society (UN, 2000, p.9) - a form of society which Malaysia aims to attain by the year 2010 (Goh Beng Lan, 2002, p.190).

In order to facilitate this mass development program, the Malaysian government has set out specific targets. These include: to become an Information Society by the year 2005, whereby people would have access to information, and information becomes a commodity; and to be a Knowledge-based-Society by 2010, with a Malaysian society that values the culture of life-long learning and the creation of knowledge-based products and services. Known as the National Information Communication Technologies Initiatives, the following is a brief review of the mechanisms by which the government aims to attain these targets:

a) establishment of a National IT Council;
b) formulation of a National IT Agenda;
c) development of the Multimedia Super Corridor;
d) implementation of Bridging the Digital Divide Program (BDDP);
e) awarding of the DAGS (Demonstrator Application Grant Scheme).

The design of this multi-faceted strategy and the mechanisms, however, does not include a clear picture of how the rural sector of the nation will be situated within the larger framework. Therefore there exists a huge gap between what are in effect two worlds: the government's aspirations for a future knowledge-based economy, and the realities of rural living.

It was within this perceived hiatus in national development planning that e-Bario was conceived as a pilot project to explore whether provision of equal access to ICT can bring economic, social and cultural benefits to rural communities in Sarawak. This is particularly significant for the state of Sarawak, where 60 per cent of its 2.027

million people live in rural areas. Although Sarawak has been promised a full and equitable allocation within Malaysia's mass development plan, many communities have no access to good roads or to telecommunication services (Harris, 1999). Most rural areas lack both telephone lines and a continuous supply of electricity. Bario, in short, exemplified the disconnected portion of the digital divide, and presented a challenging environment in which to test the usefulness and effectiveness of ICT in rural Malaysia (Harris et al., 2001). Since access to ICT is predicted to promote new social, economic and cultural opportunities in rural areas (Enberg, 1998), e-Bario also provides a useful window to explore the roles that ICT can play in advancing community-based development in developing countries. With this in mind, the villagers in Bario were systematically connected to a range of ICT in September 2000 and have grown to include the following physical and technological components.

1) *Computer Laboratories:* Two computer laboratories were designed and equipped with 16 computers due to demand from students and teachers. The lab was also equipped with 2 printers and a scanner.
2) *Telephonic equipment:* The new technologies were installed within the existing communications network, the telephones were placed at strategic locations or important meeting places in Bario, such as the airport, the shop area, the school and also the clinic.
3) *Very Small Aperture Terminals & Network Configuration:* To provide access to telephone (voice) and Internet networks four Internet ground station technologies known as Very Small Aperture Terminals (VSATs) were installed by Telekom Malaysia Berhad. These were located at the shop area, the clinic, the school, and the airport.
4. *Telecentre:* A permanent telecentre, known as Gatuman Bario (Bario Link), was set up in 2001. It is located at Pasar Bario and has 5 rooms: a room for computing services, a visitor's room with table and chairs for meetings and resting, 2 rooms for administration purposes – one for the e-Bario coordinator and the other for technical assistance - and another for staff to monitor and run the day to day management of the telecentre. The telecentre is equipped with 10 computers, an inkjet printer, a laser printer, a laminating machine, a photocopier and Internet access.
5. *Power Supply:* Since Bario is outside the national grid, the telecentre was initially powered by diesel run generators. This power supply has evolved into a hybrid diesel (80%) – solar panel (20%) power supply, and more recently a solar panel – diesel system.
6. *Training and skills:* An Information Technology (IT) Literacy Programme was introduced by the research team from University Malaysia Sarawak in conjunction with COMServe, a local IT company based in Kuching. Training was identified as an ongoing process, and not a one-time or once only activity. The training included word processing, key-board usage, e-mailing, browsing the web, and the management of technologies including trouble shooting.
7. *Website creation:* Due to web hosting problems this information was incorporated into a web site designed by UNIMAS at www.e-bario.com. The web site contains information on the project, and also on the Kelabit Highlands. It was designed to promote Bario as a tourist destination, and is linked with other web sites developed by or used by Kelabit, such as the Online Kelabit Soceity (OKS).
8. *Storage of information – Bario Digital Library:* An experiment with recording, documenting and disseminating Kelabit songs and dances on CD ROM has been developed under the project. It is called the Bario Digital Library (BDL). The first record

contains nine lakuh songs by women in Bario with digital images of each singer singing the *lakuh*. Each song has been transcribed in Kelabit, with English translation. It is a step towards the creation of an electronic record of Kelabit oral stories.

9. *Management and Administration:* "Management and Administration" is not a physical or technological component of e-Bario, but rather a management system, which has been put in place in order to manage the project in Bario, and also the community telecentre. To achieve this, a project coordinator-cum-manager has been appointed by the Council of Elders, Authority for Village Protection and Development (Malay, *Jawatankuasa Keselamatan, Kebersihan Kampung* (JKKK)) and University Malaysia Sarawak to oversee the workings of the initiative in Bario. In addition to the project coordinator, a technical assistant was also trained and appointed to oversee the technical aspects of the project, such as trouble shooting and managing all the equipment and software.

Technologically, the initiative was a milestone in terms of providing equal access to ICT in the Malaysian context, and was identified as "one of the most notable of Malaysia's Internet development initiatives" by the International Telecommunications Union (ITU, 2003). In the international arena, the initiative has put Bario and the Kelabit on the world map - a remote community connected with up-to date technologies – leading to its selection as one of the Top Seven Intelligent Communities of 2001 by The World Teleport Association in New York.

ASSESSING "EFFECTS": WHAT REALLY HAPPENED IN BARIO?

This technological development nonetheless raises important questions. What of the Kelabit themselves? What meanings do they inscribe to the technologies? How have the new technologies come to be incorporated in existing social practices? That is, how have the technologies have been appropriated and used by the Kelabit in Bario?

To explore these questions in detail the next section will highlight two fundamental Kelabit concepts: *iyuk* and *doo*-ness. An understanding of these two concepts can help us to understand on going Kelabit engagement with e-Bario and in turn can highlight the social processes taking place that shaped meanings and usage of technologies in Bario.

Kelabit *Iyuk* and *doo*-ness

Between August 2005 and September 2006, when engaging the Kelabit with discussions on the impact and effects of ICT in the Highlands, their response was always quick and straightforward. I have been told it is about *iyuk* (movement) and the attainment of *doo*-ness (good-ness and better well being). Traditionally these two notions indicate movements and good-ness in terms of social status among the Kelabit. While *iyuk* broadly refers to the notion of movement and specifically to status mobility, *doo*-ness embodies notions of good-ness, success and better well being, or rather the qualities required to constitute a good person such as knowledge, endurance and perseverance, self discipline, hospitality, generosity, and strength (Bala, 2008).

The attainment of *doo*-ness through means and mechanisms of *iyuk* is the basis of all social status among the Kelabit: it represents an ideal that Kelabit individuals and collectively aim to attain and accumulate. It is the the images and ideals of *doo*-ness, and the interweaving processes between *doo*-ness and *iyuk* that have generated and sustained Kelabit modes of engagement with ideas, institutions and objects from the outside world. These externalities are adopted and co-opted by the Kelabit and given meanings, for example, as a means of providing a range of new options and systems for attaining and expressing social status, prestige and power in the Highlands. It is the dynamics between these that is relevant to the way in which Internet, computer, telephone and Very Small Aperture Terminals (VSATs) were received and adapted by the Kelabit in the Highlands and beyond. This is in spite of, or possibly as a response to the Kelabit insulation from much of the world; for instance, prior to World War II, little was known by outsiders of the Kelabits and their surroundings. They were self-sufficient: producing salt, planting rice and hunting and gathering jungle produce for food as main source of protein.

An ethno-historical analysis can establish how over the years the Kelabit forged connections with the rest of the world through a variety of strategies and traditions to attain *iyuk* and *doo*-ness. A clear example of this is how through the cultural activities of travelling far (*me ngerang mado*), the Kelabit came into the possession of prestige items, such as jars, beads and gongs. These were impossible to obtain locally in Central Borneo. Therefore those items that reached the highlands are considered important visible signs of prestige in the community (Saging, 1977; Talla, 1979; Janowski, 1991). Among these prestige items are the T'ang and Ming Chinese jars, locally known as *belanai ma'un* (ancient jars). These are prized as family heirlooms, particularly the150-pound ceramic jars with red dragon.

By traveling far, a person did not only accumulate prestige items but also knowledge. The experiences gained through traveling are considered knowledge, thus the Kelabit notion: *mado lawe, mula'nuk keli* (Far traveling increases one's understanding). As with other prestige objects, knowledge is a good source of high social standing in the longhouses (long structure built on stilts with common areas and separate family dwellings). This suggests that cultural practices of traveling far are important local practices and strategies for *iyuk* of status among the Kelabit; they are important means to incorporate objects and ideas from the outside world into Kelabit social system. Hence those who possessed these items are highly regarded in the community.

Kelabit *Iyuk*, *Doo*-ness and Nation-ness

At the same time as the Kelabit absorb objects, ideas and people into their social system, the Kelabit themselves have been integrated into the wider economic and political terrain. Most pertinent here is the formation of Malaysia in September 1963. Sarawak together with Sabah, Singapore and Malaya have formed a federation. Consequentially, the population on the Malaysian side of Borneo was granted Malaysian citizenship and its privileges. With the granting of this citizenship new forms of economic, political and social systems were introduced.

As noted by Anderson (1983) 'Nation-ness is the most universal legitimate value in the political life of our time' (p.12). This process inevitably did not only change how to attain *iyuk* and *doo*-ness but also the very notions of *iyuk* and *doo*-ness in the Kelabit Highlands. That is, what they constitute among the Kelabit in the contemporary world. Said differently, the Kelabit integration into Malaysia as a nation-state has transformed the meaning of *iyuk* and *doo*-ness within the community; increasingly the notions are linked with the Malaysian government's notion of "development" (Malay, *pembangunan*) which is seen as a means for individuals to attain and enjoy affluent and prestigious lifestyles whilst at the same time enabling the whole collective (in this case the Kelabit society) to command high standards of living and respect from others. This is revealed through Kelabit every-day discussions concerning their contemporary identity and standard of living as a group. These discussions often focus on how to attract and bring more development projects into the Highlands for *doo*-ness: big and small infrastructure, better roads, cars, good medical services and effective communication facilities.

In fact, there is a sense of communal pride in being considered a progressive and successful community. Although complex, there is consequently an overall general desire for "development" as promulgated by the Malaysian government as means for *iyuk* and *doo*-ness among rural and urban Kelabit. Seen in this light, e-Bario is just one of many projects being pursued by the Kelabit to promote "progress" in the Kelabit Highlands, partly as a strategy for gaining *doo*-ness and *iyuk* for the Kelabit as a whole.

It is this Kelabit contemporary desire for progress and development, which partly defined the Kelabit on-going engagement with e-Bario in the Kelabit Highlands. If in the past the Kelabit participated in travelling far in search of Chinese jars, beads and other valuable items as part of their strategies for advancement, in the contemporary world the Kelabit are eager to collaborate with the world of progress and development in order to attain better well being (*doo ulun*) in the Highlands.

In order to understand how exactly ICT as developmental tools have been used, or rather are used to increase the Kelabit's livelihood, the next section will highlight the appropriation of technologies for communication, and as means to position or reposition Kelabit interests and their identity as a group.

As described earlier, many Kelabit have left the Highlands for education and job opportunities. This has led to a highly mobile and geographically-dispersed community. As a result of their widespread diaspora the Kelabit are constantly looking for ways and strategies to ease communication between urban and rural Kelabit. It is out of this need that the Kelabit are using e-Bario as new ways and strategies to foster family relations and community connections. This is especially important for many older men and women in the Highlands who welcome the telephone especially as an improved means of communicating with their children living in the cities. The significance of this is made clear by Maren Talla who is 78 years old. He said, 'In the days before the telephone, I had to fly to and fro between Bario and Miri when I wanted to speak to my son and daughters, who currently are all living in Kuala Lumpur. It's a lot of money to fly down to Miri and Marudi just to speak with them. But now with the telephone, it is so much easier and cheaper. Although I can't see their faces, at least I can hear their voices. It is very satisfying to my soul when I hear them. I usually stop at the *Pasar* (market) to have something to eat and also to call my children on my way to my sheep ranch. It feels so good to be able to hear their voices on the phone; it makes me sleep well in the night. Listening to their voices on the phone calms me.'

The significance of e-Bario however goes beyond easing communication between rural and urban Kelabit for it also signifies that 'we [the Kelabit] are at par with the rest of the world and people.' Although many do not use the Internet in relation to daily activities such as farming and so forth, the presence of the new technologies in Bario is perceived not purely as a means of obtaining better quality information, connectedness and *iyuk*, but also as a symbol that the Kelabit are *doo* (progressive) in that they are not being left behind by others. These technologies are markers and signifiers that they are on a par with others in embracing worldwide shifts of perspective and influence. This is particularly significant in the context of Kelabit's present day marginal or even displaced position within the broader policies and discourse of the Malaysian state and ethnic framework of development.

To explore the situation in detail, the next part of this section will provide a brief overview of Malaysia's ethnic-oriented national development agenda under Malaysia's New Economic Policy (NEP or DEB for *Dasar Ekonomi Baru* in Malay) which was introduced in 1971 in response to race riots in Kuala Lumpur in 1969.

MALAYSIAN ETHNIC FRAMEWORK OF DEVELOPMENT

The Malaysian Ethnic Framework of Development under New Economic Policy (NEP) signifies a development pattern which is tilted towards distributional objectives, albeit along racial lines (Brosius, 2003; Hilley, 2001; King, 1999; Scott, 1985). Underlying the national quest for rapid economic growth is the desire to accelerate the process of restructuring Malaysian society to correct economic imbalance so as to reduce and eventually eliminate the identification of race and ethnicity with economic function (Second Malaysia Plan 1971-1975 provides a thorough outline of the aims and agendas of the policy). Embedded in the framework, however, is the requirement to identify persons based on their ethnic and religious affiliation for the purpose of resource and wealth distribution. As noted by Chandra (1986, p.33), ethnic and religious categories "carry deep meanings for people" in defining a person's existence and purpose especially in accessing political and economic resources in Malaysia.

What are the implications of the framework for the Kelabit, as one of the smallest ethnic groups in Sarawak? The Kelabit have to come to grips with their assimilation and participation within Malaysia's inter-ethnic disparities with regard access to key economic and political resources.

First of all, the Kelabit "peripheral situation" in relation to particular (Malay) political cultures is aggravated by the Highlands' physical distance from centres of power. Without numbers, constituencies, pressure groups or lobbies, and with their out-of-the-way location (Tsing 1993), there is a concern that the Kelabit are not given a hearing in the context of a national integration discourse, which places, as will be made clear later, the Malay-Muslim *bumiputera* at the top of the hierarchy.

Second, although article 153 (Kedit, 1989) guarantees the Kelabit as Bumiputera (lit. the sons of the soil) certain privileges under the New Economic Policy (NEP), the eminent position of Malay *adat istiadat* (customs and traditions) and Islamic religion has created a sense of hegemony and superiority on the part of the Malays over other groups in Malaysia. Consequentially, the prominence of Malay-ness in national discourse tends to benefit the Malays politically, socially and economically (Shamsul, 1986; Jomo, 1985). In the long run this framework has forced ethnic groups into a competitive relationship with each other, in which one group's advancement can mean the retardation of another group (Despres, 1975; Nagata, 1979).

Putting this differently, the NEP and ethnic framework of development as new and shifting political, economic and social contexts have created new form of *iyuk* competition, in which the Kelabit must engage competitively with other citizens who are not Kelabit for economic and political resources. This entails the Kelabit to compete with other ethnic groups for access to government financial support, government grants, development projects and schemes. All this has introduced a particular concern or desire among the Kelabit for new means to project their identity in relation to others in Malaysia and globally; hence constantly looking for strategies for collective political agency and to advance their social status within Malaysia's economic and political terrain.

It is partly due to this dynamic of economic competition that the Kelabit have appropriated e-Bario as a new means and strategy to strengthen and articulate their *iyuk* and *doo*-ness through what Miller and Slater describe as "dynamics of positioning," (2001:18). Dynamics of positioning is a term used to denote how people engage with the ways in which Internet media position them within networks that transcend their immediate location, placing them within wider flows of cultural, political, and economic resources.

A good example of this is how the Kelabit are currently using and transforming e-Bario as a forum and a stage to position and reposition their aspirations for cultural and political *iyuk* and recognition by others. This is reflected in the words of 80 years-old Balang Radu, who claimed that e-Bario has enabled further progress (*iyuk*) for those living in Bario by providing the means to forge connections with the rest of the world. He stated, 'With these new means of communications, our lives are made much easier, although we live isolated in the headwaters of Baram. We can now liaise with the outside world from our villages, including talking to our children in Kuala Lumpur, Kuching and throughout the world. This is progress (*iyuk*) for us. It has made our life easier and we are connected to the rest of the world in a new way. Therefore we are basically very-very pleased with its arrival. We are now on a par with the rest of the world.'

Balang Radu's remarks demonstrate that the new technologies are being incorporated into the Kelabit ongoing pursuit for mechanisms to position themselves within wider networks of interaction that transcend their isolated position in the Highlands. In this way the Kelabit can *continue* to be integrated within (and be part of) the space of global flow of technologies, skills, communication and information. As described in the beginning of this chapter, Kelabit society has long been connected to the outside world through their geographic mobility, and the dispersal of families. In tandem with their experiences, the Kelabit also see themselves as a part of the wider world of progress. Just as the cultural practices of travelling far, and the adoption of school and church have expanded their horizons, so too the Kelabits' contemporary acceptance of ICT like the telephones, the Internet, Very Small Aperture Terminals (VSATs) and computers in the Highlands is seen as an extension of their existing connections to the rest of the world.

This sense of achievement is important for the Kelabit for the specific reasons I have noted earlier. They are deeply concerned about their communal *doo*-ness or status and collective interests in relation to others, especially within Malaysia's multiracial setting. As I have suggested, one of the ways in which the Kelabit are engaging with this situation is by positioning themselves on the same level with others in their pursuit of progress and success. By their capacity to attract new ideas and technologies into their environment, and their ability to adopt, incorporate, master and recreate them, the Kelabit portray themselves as a successful and progressive people.

e-Bario in this sense can be perceived as having three-fold significance in Bario: it provides means for *iyuk* by making it easier to communicate with diasporic Kelabit; it serves as a strategy for the image management of Kelabit *doo*-ness, in terms of their prestige and social status both locally and on the larger stage of Malaysia and the expanding world environment. It is a marker of Kelabit success. At the same time, it has become a symbolic compensation and a new resource for their relative smallness in numbers, political marginalization within Malaysia's ethnic framework of development and the geographical isolation of the Highlands from centres of power.

This dynamics of positioning is revealing through the ways e-Bario has been integrated within the local political apparatus to become a versatile platform for the Kelabit to position and reposition their interests in relation to the far wider context of state and national development plans. The Internet, computers and software are becoming useful tools and means to form networks, to acquire new skills in the Kelabit Highlands and to position the Kelabit at the forefront of competition for economic and political resources in Malaysia.

A local person, whom I shall refer to as Robert, who returned to Bario on retirement, illustrates this situation. Besides making a living as a tourist guide, Robert is involved in a number of organizations at village level: as secretary to a political party, and as secretary to the development bureau of the Council for Village Protection and Development. In many ways Robert depends on the computing services provided at the telecentre both for his tourism activities and also for conducting research, gathering information and writing documents and reports, including a concise development proposal for the Kelabit Highlands to be submitted for consideration under the Ninth Malaysia Plan. It was in this context that he stated that the Internet gave him access to a mass of information and enabled him to communicate with relevant people and agencies, such as the policy makers, politicians and government officials: 'The Internet seems to reduce the amount of protocol one has to endure in order to get through to these development conveners.'

Robert's statement indicates that some Kelabit are turning to these technologies as means to strategize their actions in their encounters with ideas, intervention and people from the outside world. This is particularly important as new notions of development which include commercial logging and large-scale, futuristic development plans for the Highlands are currently being introduced and implemented in the Bario. For instance, in 2003, commercial logging as a form of development has been introduced in the Kelabit Highlands. This differing concept of development has begun to shift attention away from socio-economic development among the Kelabit to their legal rights and governance in relation to their land and cultural heritage in the Highlands. This has stimulated individuals and groups to speak up after many years of moving in tandem with state-initiated plans for development. This is because there are significant concerns about the potential impact of logging in the Highlands area. These include the effects on watersheds for wet rice cultivation in the area; the Kelabit dependence on the forest for jungle produce and wild game; and the growing ecotourism in the Kelabit Highlands. Numerous people provide guiding and lodging services for Malaysian and international tourists, many of whom are attracted by the opportunities for long-distance trekking. Seen in this light, demands for land for timber concessions are bound to come into conflict with Highlanders in competition for the same resources. This is due to the very nature of logging is in complete contradiction to the new types of tourism that the Sarawak Tourism Board and the Kelabit themselves want to attract.

Simultaneously, there is a feeling that the Kelabit are dealing with the limitations of available local institutions and practices for confronting the many problems that commercial logging and road building are generating and will continue to do so. One critical issue is the shifting notion of land ownership, which is seen as a steady alienation of the Kelabit from their heritage land, and if left unaddressed, could become a growing arena for political conflict at the village level.

All these social and political processes are beginning to shape Kelabit modes of engagement with ICT, and their outcomes in the Highlands. The use of the Internet, computers and telephone permits a form of political agency, especially as these new forms of intervention threaten to change the physical and cultural landscape of the Highlands. The new technologies inspire those in Bario to reach out to those that have left the Highlands, but still maintain a strong interest in the affairs of the village.

A good example of this is the use of community websites such as the Online Kelabit Society (OKS). As an online forum, the site features discussions on various issues which currently face the Kelabit. It is an on-line forum, and the discussions that take place within it, which allow for exchanges of ideas between members of the community both within Malaysia and beyond. Some topics or themes are the encroachment of commercial logging and the impact of development in Bario, mapping of Native Customary Land and cultural sites in the Kelabit Highlands, and the documentation of the Kelabit language, which are increasingly being managed via the Internet. A recent example of this is an Internet forum to revive the use of the Kelabit language among the younger generation. The initiative was launched by a Kelabit woman living in Miri, who is very concerned about the declining interest for and usage of the language among migrant Kelabit. As a network conducted on the Internet, the discussion list includes Kelabit who are living in Miri, Kuala Lumpur, Kuching, Bario, Bintulu and Singapore. The main concern is to find ways of documenting "extinct" Kelabit words, terms and phrases, while at the same time promoting the use of the language

All this points to the idea that the Internet has become a new means to maintain solidarity, within an increasingly stratified and occupationally mobile population, and in the face of new types of development intervention described. In fact, the significance of Online Kelabit Society, in reproducing and maintaining solidarity among the Kelabit has been likened to the traditional roles of *ruma'kadang* (the longhouse) by one of its regular users. This is because it provides space for the exchanges of ideas and advice, which are important elements of communal living in a longhouse. This suggests that ICT makes it possible for the Kelabit to form new networks and to reproduce effective organization and actions. At the same time, the presence of ICT facilitates a greater agency and capacity for political engagement to question, assess and debate these developments, and to form links with other agencies which might be useful. The various technologies available at the telecentre, for instance desk tops, associated software and the Internet, are currently being used to strategize the Kelabit position in their encounters with commercial logging activities in the Highlands. Examples of this are the documentation of oral histories and the recording of images relating to cultural and historical sites found in the Highlands, as well as the marking of their Global Positioning System (GPS) points. All these are uploaded into a Geographic Information System (GIS) database at the telecentre, to allow for the construction of a land-use history in the form of a digital map, and spatial and temporal analyses of past land use in the region. These in turn are useful historical and legal documents in negotiations with agencies involved in conservation and logging.

In so many ways, the telecentre nowadays has become more than a venue to provide equal access for new technologies in the Highlands. It has increasingly become a place and forum for the Kelabit to present and manage other "development" issues currently facing them in Bario. This trend was made evident through a recent conversation with the local manager, in which he said that, 'e-Bario is not just about ICT anymore. We are also into introducing and managing the implementation of solar power in Bario and have bought a printing and laminating machine for the Centre. So, now people in Bario can print their photographs very easily. We produce the same quality as the shops in town, but at a cheaper rate for our people.' Furthermore, he continued that 'e-Bario has now become the secretariat for all sorts of events and activities in the Kelabit Highlands. Both the church and Council of Elders use the centre to organize their religious and administrative activities.' At the time I spoke to the manager, the Centre was organizing the World Wildlife Fund "Heart of Borneo" Project's yearly symposium in Bario and also for the annual Kelabit Highlands Food and Cultural Festival. Put simply, ongoing negotiations and explorations are taking place to make e-Bario significant and relevant to the people in the Kelabit Highlands beyond the imagined practical outcomes of the initiative, and far beyond the original intentions of the project proposal.

CONCLUSION

In conclusion, what can we learn from e-Bario especially with regards to ICT for community development and its effect at the grass roots level? Experiences in e-Bario made it clear that the introduction of information communication technologies has been mediated and reconfigured by webs of social relations and the intricate interplay of social, political and cultural conditions specific to the Kelabit Highlands. As a result, the social and economic effects of e-Bario unfolded through countless open-ended strategic and everyday decisions made by the Kelabit themselves, who actively consume, apply and make use of objects, ideas and services in the Highlands. As shown in this chapter, one crucial factor conditioning the effects of the project was the Kelabit's own desire for, and expectations of, "development" and "progress."

All this suggests that real-life situations can change the purpose of technologies, and the ways in which they are used may differ greatly from what had been envisaged at the outset. Placed within local social processes and circumstances, the visions of outside policy-makers for introducing ICT as tools for social and economic development may differ markedly from the actual realities of their use and effectiveness in different political and economic settings. As drivers and developmental tools for the creation of a knowledge-based society in Malaysia, the technologies in Bario have not necessarily heralded a new form of society. Rather, they have been partly integrated with or subordinated to existing practices, internal values and socio-political arrangements in the community. Their continued use and adaptation has also provided for new forums of dialogue and communication, allowing a sense of communal identity to be rekindled. In turn, it is within these social processes that the computers, Internet and telephone have been given meaning, and their application modified and developed within the community's social context and in a wider political and economic terrain.

This social shaping of use, and the simultaneous modification of social and political processes facilitated by or inspired by engagements with ICT suggests that it is in the local circumstances that ICT is engaged with, interpreted, represented and woven into the fabric of daily life of those communities within the area. The technologies should not, therefore, be viewed as separate and independent entities, but rather as objects that gain effect, meaning and relevance through the ways in which they are adopted and become part of the Kelabit social and political life.

As we can see the Kelabit negotiate what value to attribute to the Internet, computers and telephones, and how to apply these technologies to their own political, social and economic circumstances. All this resonates closely with Norman Long's transformative process of planned development, which he describes as 'constantly reshaped by its own internal organization, cultural and political dynamics and by specific conditions it encounters and itself creates, including the responses and strategies of local groups who may struggle to define and defend their own social spaces, cultural boundaries and positions within the wider power field' (2001, p.72).

The presence and use of ICT in Bario facilitate, inspire and modify existing Kelabit social practices, strategies and actions in their on-going engagement with development. This is particularly apparent in their engagement with commercial logging as a new industry in the area. It is an example of local empowerment, whereby the use of ICT has facilitated greater agency for political engagement in the face of this shifting notion of development. The new technologies are seen to increase the Kelabit's opportunities and abilities to make choices and to translate them into desired actions and outcomes. As a direct result, e-Bario has been recreated as a new platform to manage the interface of development in the Kelabit Highlands. In short, the presence of the Internet and computers as technologies of communication and information shape, color and influence the Kelabit response to their current circumstances.

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This work was previously published in Information Communication Technologies for Human Services Education and Delivery: Concepts and Cases, edited by J. Martin; L. Hawkins, pp. 201-214, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 3.3
In Search of Social Television

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ABSTRACT

This chapter provides an introduction to and overview of social television, in an attempt to find the real meaning of the term. It explores the history and current state of social television, looks at a number of examples of Social TV systems and their features, compares different definitions of the term, and outlines dimensions of design that have been used to organize the topic. The author argues that historically the notion of social television is intimately bound up with television itself, and that the two remain difficult to separate even today. The convergence of content and communication to create social media is turning Social TV into a reality and in the process turning television into what it was originally intended to be.

DOI: 10.4018/978-1-60566-656-3.ch001

INTRODUCTION

The term "social television," or "Social TV," is not new, but over the last few years it has acquired a specific technical meaning. It is used to refer to a variety of experimental systems that claim to support social experiences for television viewers, and to the research into such experiences. This book testifies to the brisk activity going on in this area of study.

To understand what all the research is about, we should first understand more precisely what Social TV is. That is the question explored in this chapter. It is investigated from a number of perspectives. First, we look at the history of social experiences for the TV, a history that stretches back much further than usually acknowledged. We will see that it has its roots in the very earliest inspirations for television itself, and has been a persistent motif of science fiction and a recurring ambition of developers ever since. Then, examples of modern Social TV systems of different types are presented, drawing attention to the range of disparate experiences supported and the overlap with other topics. At the same time, a set of typical features is identified; features which include sharing of TV presence information, support for shared experiences, freeform communication, and the publication of TV viewing data.

With social television examples from the idea's inception to the present thus catalogued, we examine the various attempts to offer a definition of the field. These are shown to follow one of two forms, and the limitations of both are discussed. Finally, we look at theoretical models and taxonomies that lay down the important dimensions of the social television space. Using these dimensions, different Social TV experiences can be characterized.

Even after a comprehensive review of the topic from all these different angles, a precise and straightforward statement of what social television is remains difficult to articulate. However, the search shows that such uncertainties are inherent to the field, and by the end of this chapter the reasons for the vagueness should be clear. Furthermore, a consideration of these reasons suggests that the future adoption and assimilation of Social TV is likely.

HISTORY

It is difficult, if not impossible, to establish where the concept of social television first originated. In one form or another it predates television itself. In the late nineteenth century, long before video and communication technologies crystallized into their familiar modern forms, science fiction writers such as Albert Robida dreamt up extraordinary devices like the all-purpose *telephonoscope*; television, videoconference terminal and proto-Internet browser all in one screen. Truly a converged technology! Among its many functions, the telephonoscope allowed audiences to experience theatrical performances in their homes and share the experience with other viewers as if sitting in the same theater:

"So, one can applaud?" asked Barnabette.

"Of course!" Mr. Ponto replied. "Home viewers can also offer their own [applause]. Here, let me connect out to the theater. You may applaud, if you wish."

"So," a laughing Barbe inquired, "we could also send out boos if we wished to?"

"Definitely not!" answered Mr. Ponto. "That's forbidden! You understand that if expressions of disapproval were permitted, any practical joker could disturb the shows from their own armchairs."

"But then," Barbe continued, "home viewers who find the play boring are not entitled to let it be known? That's quite unpleasant; one must repress one's feelings and keep them to oneself."

"Absolutely not, you silly girl. The home viewer may boo to his heart's content whenever a play bores him, but he must make sure to shut off the connection to the theater. Thus he can express his bad mood without causing any disturbance to the theater." (Robida, 1882/2004, pp. 55–56)

Social television-like technologies, particularly variations on video telephony, went on to become a staple of science fiction. In *Nineteen Eighty-Four*, George Orwell provides an especially sinister example:

The voice came from an oblong metal plaque like a dulled mirror which formed part of the surface of the right-hand wall. The instrument (the telescreen, it was called) could be dimmed, but there was no way of shutting it off completely. […] The telescreen received and transmitted simultaneously. Any sound that Winston made, above the level of a very low whisper, would be picked up by it, moreover, so long as he remained within the field of vision which the metal plaque commanded, he could be seen as well as heard. (Orwell, 1949/1990)

Although the function of the telescreen is primarily monitoring, in the novel it is also occasionally used for communication and interactive content. At the time of the book's writing in 1948, video links were already in use, and by 1956 AT&T had created the first experimental prototype of PicturePhone, their famous videophone system (AT&T, 2008). Although years of user tests were not encouraging, PicturePhone was finally commercialized in 1970. It was a market failure, the first of many to come for video telephony (Noll, 1992).

This form of video telephony, which did not involve television content, falls outside social television as it is now generally understood. Of course, it had always been possible to socialize around the TV set, or communicate about TV content via other means (such as by telephone). After the listener/viewer call-in program format made the jump from radio to television in the 1960s (Newcomb, 1997), a small number of viewers could even join the broadcast from their own homes, in an early form of interactive programming.

Prestel, a videotex system (a type of early computer network initially accessed on TV terminals) from the UK Post Office/British Telecommunications that was launched in 1979 and remained in operation until 1994, introduced a form of email between users. However, neither this nor later videotex features such as bulletin boards and multi-player games were integrated with viewing TV content, and the services were frequently accessed from dedicated terminals rather than on the TV.

The first system to offer something akin to a remote social television experience appears instead to have been Spacephone, launched in 1980 by the US TV-maker Zenith. Spacephone was a feature offered on a number of high-end TV models which allowed users to talk on the telephone through their TV set, using the TV speakers and a built-in microphone as a speakerphone ("Zenith Electronics," 2008). Users could answer the phone and place calls with their remote control, and watch television while talking. However, the TV audio was muted during calls. Nevertheless, two Spacephone users talking to each other over the system would have experienced a simple version of social television. Unfortunately, Spacephone was not a success, and a faltering Zenith discontinued the feature in the mid-eighties (Perry, 1988).

A few years later, in 1988, a comedy show that would exert considerable influence on social television premiered on a local cable station in Minnesota (Cornell & Henry, 2002). *Mystery Science Theater 3000* (MST3K) involved a janitor marooned in space, watching old movies with his robot friends, and ridiculing them in order to preserve his sanity. MST3K's instantly recognizable visual format, showing the cast in silhouette sitting in front of the movie screen, has inspired several Social TV systems.

Social television finally started to gain traction around the turn of the century. Over a period of about two years, starting in 2000, SMS TV Chat was launched in many countries in Europe, becoming a big (and very profitable) hit. SMS TV Chat is essentially a chat room where all the text is displayed on the television as part of the broadcast. Participants write to the chat room by sending text messages from their cell phones. There are a number of different program formats. Sometimes the chat takes up the whole screen, so that there is no other TV content. Sometimes an unrelated program runs in the background or in a part of the screen. And sometimes a fully interactive live program is built around the chat (Beyer, Enli, Maasø, & Ytreberg, 2007). Especially this third case undeniably creates a social experience around the television content. However, the fact that the conversation is displayed as part of the broadcast severely constrains the type of communication and contact that is possible. All utterances are public, and the volume of messages and the possibility of delay can restrict an individual's ability to get a word in, or for groups of people to meaningfully converse (Zelenkauskaite & Herring, 2008).

Also in 2000, America On-Line (AOL) launched AOLTV, a line of retail set-top boxes to compete with Microsoft's WebTV. Like WebTV, it allowed users to surf the web on their television, but more importantly to read email, instant message (IM) and chat in chat rooms while watching TV on the same screen (Hill, 2001). AOLTV did not integrate television context with the IM presence information or provide ways for users to send links to TV content, but otherwise the box offered a near fully-fledged social television experience. AOLTV went off the market in 2002, but the chat features remain part of many Interactive TV services (Hu, 2003).

Soon afterwards, the research community started exploring social television in earnest, starting with Abreu, Almeida and Branco's (2001) description of 2BeOn. This activity continues up to the present. However, while a number of corporate research labs (including groups at Alcatel-Lucent, Microsoft, Google, PARC, Motorola, AT&T and Siemens) have published about Social TV prototypes and concepts, or even announced systems, as of late 2008 none of these have actually been launched.

At the same time, social sharing of video is becoming a reality online. YouTube[1] and other video sites have long offered the ability to share links to videos and leave comments as a form of asynchronous communication. Netflix[2] shares viewing history, ratings, comments and reviews of DVDs and online videos with a user's contacts and the wider community through Netflix Buddies. Now synchronous viewing and communication (via text, voice or video chat) are part of sites such as YouTube Streams,[3] Lycos Cinema[4] and Wi-Fi TV.[5] BuddyTV[6] offers a "TVj" feature to arrange similar sessions around TV shows, but does not provide the program itself: participants have to access it separately. Asynchronous communication is also becoming more advanced, with the ability to attach comments to particular playback positions in the video stream, so-called *deep tagging*, widely available (Click TV,[7] VeoTag,[8] ReviewTube,[9] InnerToob,[10] etc.), and several sites offering media-rich annotations and enhancements such as speech bubbles, graphics and animations (BubblePly,[11] Vidavee Graffiti[12]).

While video sites are moving into live chat, IM clients are starting to offer co-viewing of video. Zync is being integrated into Yahoo! Messenger (Shamma, Bastéa-Forte, Joubert, & Liu, 2008), and Microsoft is adding Messenger TV to their MSN Messenger[13] client. Both provide similar functionality, namely the ability for people in a chat session to watch an online video clip in near-synchronization. Finally, the internet TV application Joost[14] includes IM and "Channel Chat" plugins, where the latter is a public chat room associated with each Joost TV channel. (Given the dot-com industry's notorious turbulence, it is very likely that other sites and services will have complemented or replaced many of the ones listed above by the time this sees print.)

In some ways, history is coming full circle. Early on, as Robida's ideas became reality, parts of the telephonoscope split and diverged into different devices and services. Over the next hundred years, efforts to bring them together led to many different innovations, but a genuinely social kind of television remained science fiction. Now the technologies that have been separate for so long are converging again, and we are getting close to realizing the original thought in whole. However, currently available solutions still fall short of a comprehensive and seamless experience. They are limited in the types of content and the types of communication they support. In some systems, users have to coordinate multiple separate devices, and many do not share the video context or TV presence with other users, so that even if the communication *is* integrated with the media playback in a single device or application, the two activities remain essentially separate. For a fully integrated social television experience, we have to look to prototype systems in the research community.

EXAMPLES

Although the idea has a long history, social television has only recently come to be recognized as a distinct research topic within the field of interactive television (iTV). The best way to convey what Social TV means today may be by example—or, rather, multiple examples. There are many to choose from in the literature. Those that have been described in some detail include 2BeOn, from the University of Aveiro (Abreu et al., 2001; Abreu & Almeida, 2008), AmigoTV, from Alcatel (now Alcatel-Lucent) (Coppens, Trappeniers, & Godon, 2004; Coppens, Vanparijs, & Handekyen, 2005); Media Center Buddies, from Microsoft Labs (Regan & Todd, 2004a; 2004b); and ConnecTV, from TNO (Boertjes, 2007; Boertjes, Klok, & Schultz, 2008).

However, there is one particular example that is especially close at hand: At Motorola we have over the last few years developed a series of social television prototypes, collectively known as STV, for use in lab and field trials (Harboe, Massey, Metcalf, Wheatley, & Romano, 2008a; Harboe et al., 2008b). The design goal throughout development has been to allow a small group of friends or relatives to share a feeling of contact or togetherness while watching TV. In the current version, STV3, the key elements are:

- **Television presence** information through a buddy list and ambient display.
- Support for setting up **shared viewing experiences** through program suggestions and the ability to join what someone is watching.
- **Freeform communication** through text chat and group voice calls.
- Awareness of **viewing habits** and preferences, provided by viewing history lists and integration of viewing information into the electronic programming guide (EPG) grid.

In the selection and type of features, STV3 closely resembles a number of other social television systems. 2BeOn, AmigoTV, Media Center Buddies and ConnecTV all incorporate more or less the same capabilities. (The exception is the ambient display, which is apparently unique to STV.) However, in other systems there are some variant solutions to the same problems, as well as additional features not included in this particular prototype.

While STV3 supports creating shared viewing sessions through the presence information, the ability to join what a buddy is watching, and suggestions, some other systems take a more direct approach. ConnecTV has a "follow-friend" mode that switches channels automatically whenever a buddy does. Goldenberg (2007) and the Living@Room team (Ghittino, Iatrino, Modeo, & Ricchiuti, 2007) both propose a "shared remote control" paradigm where users who are watching together remotely all can take control of the joint content stream, pausing or rewinding everybody's TVs at the same time. The IM video player Zync uses a similar shared playback control (Shamma, Bastea-Forte, Joubert, & Liu, 2008). Coates (2005) suggests a type of voting system or game to resolve disputes over what to watch.

One feature not included in STV3 is video communication, to allow participants who are watching together to actually see each other. Video is the basis for Reflexion (Agamanolis, 2008), and is included in AmigoTV (Coppens et al., 2005) and Web Zync (Shamma et al., 2008), as well as in many social television concepts (Ghittino et al., 2007; Coates, 2005; Gross, Fetter, & Paul-Stueve, 2008).

In Telebuddies, the social interaction takes place within a multiplayer quiz game that is part of an interactive TV show (Luyten, Thys, Huypens, & Coninx, 2006). Creating content-related activities like games, wagers or fantasy sports around communication opens up many new possibilities for television-based socializing.

The increasing prominence of non–live-broadcast content, such as programs recorded on Digital Video Recorders (DVRs) or streamed on-demand from the web, has led to many proposals for ways in which users can interact around content asynchronously. A widespread idea is to record a first user's interactions as a kind of "commentary track" (whether in the form of voice, text, or non-verbal annotations such as emoticons), and play it back later for other users, synchronized to the content (Fink, Covell, & Baluja, 2006; Ducheneaut, Moore, Oehlberg, Thornton, & Nickell, 2008). This concept is implemented in CollaboraTV (Harrison & Amento, 2007; Nathan et al., 2008).

When the recorded interactions and annotations become sufficiently complex and powerful, it makes sense to consider them as a form of end-user enrichment of the TV content (Cesar et al., 2008). Such enhancements may include virtual edits, links to related content, freehand drawings or "scribbles" on top of the video, metadata tags, as well as the basic voice, text and graphical comments. It may even take the form of user-supplied closed captions and translations.

From such end-user enrichment, it is only a short step to user-generated content (Alliez, 2008) and community television (Vasconcelos, Fava, Kampf, Schilling, & Furtado, 2007; Obrist, Beck, Kepplinger, Bernhaupt, & Tscheligi, 2008). This in turn leads naturally to integration with blogs and social networks (Mantzari & Vrechopoulos, 2007; Baca & Holtzman, 2008), and to open forums where strangers meet and interact (as opposed to the fairly closed buddy lists for connecting family and friends presupposed by many other Social TV systems), described by Hess (2007). Beyond all these examples, social television bleeds over into iTV in general, as well as into telepresence, video telephony, any kind of content sharing, multiplayer games, online social networks, and collaborative filtering, among other things.

The examples listed above, although they encompass systems that support quite different experiences, seem to have something in common, when taken as a whole. Exactly what that characteristic is is more difficult to answer. The great variety of social television features and the indistinct boundaries of Social TV as a research area raise the question: How can we tell what is and what isn't Social TV?

DEFINITIONS

There have been many attempts to define social television. On reviewing the literature, it turns out that these efforts can be grouped under two definitions, one narrow and one broad, with the same researchers often using one or the other depending on the context (Table 1).

The broad definition defines "social television" as *any* technology that supports social practices associated with TV. Current social practices include things like talking about upcoming TV shows, watching TV together (at home, or in public places like a bar), and talking about TV programs after the fact.

This classification is comprehensive, but it makes the potential scope of the topic staggeringly broad. Most things in life have a social dimension, and television-related information is more or less ubiquitous in the modern world. Is a tabloid magazine, filled with gossip about television stars and a source of much potential

Table 1. The two types of definitions of social television found in the literature

Social Television Definitions	
Narrow	**Broad**
Communication technologies that create a remote, shared experience of watching TV together	***Any technology that supports social practices associated with television***
Using communication technology to connect TV viewers, in order to create remotely shared experiences around TV content. (Harboe et al., 2008b) *An audio-video system which allows distant viewers to communicate with each other using several interpersonal communication modalities, such as open audio channel, instant messaging, emoticons, etc*. (Chorianopolous, 2007) *Integration of television and computer technology to support sociable, computer-mediated group viewing experiences. […] Design for distributed, shared television viewing*. (Ducheneaut et al., 2008) *Video services that integrate other communication services like voice, chat, context awareness, and peer ratings to support a shared TV experience with one's peer groups*. (Klym & Montpetit, 2008) *Providing two or more remote TV consumers with a joint TV watching and communication experience*. (Schatz, Wagner, Egger, & Jordan, 2007)	*Interactive TV (iTV) systems that support the sociable aspects of TV viewing. This includes improvements to collocated interaction*. (Harboe et al., 2008a) *Technological support for the social practices that surround TV viewing*. (Chorianopolous, 2007) *Leveraging […] computing integration to remove the barriers to sociable interaction around video content*. (Ducheneaut et al., 2008) *Provide groups of TV spectators with technical support for collocated and geographically distributed TV watching and social interaction*. (Gross et al., 2008) *Communication and social interactions—remote or co-located—in a TV-watching context, or related to a TV experience; and technology that supports these communications and interactions.* (Geerts, Harboe, & Massey, 2007)

small talk, then a social television technology? It would seem so, especially if integrated somehow into an interactive TV system.

The other, narrow definition avoids this issue. Simply put, it states that "social television" describes systems that create an experience somehow "like" watching TV together, even though viewers are physically remote from each other. This is achieved by integrating communication technologies (such as voice communication or text chat) with the TV.

This categorization covers many aspects of the social television examples listed in the previous section, but not all of them. For example, it would not seem to include the ability to send a recommendation of a program you *just watched* to a friend, yet that kind of functionality is part of several Social TV systems. More importantly, it leaves out whole categories of related systems and features that have been envisioned but not systematically explored, like the ability for two people sitting next to each other on the couch watching a quiz show to participate and compete against each other.

Another ambiguity, shared by both definitions, is what is meant by "television." In addition to live broadcasts, many other types of content are available or accessible on television sets, including video-on-demand (VOD), internet video, and other user-generated content. Some of these media types are clearly relevant to social television. Sharing a home movie between two TVs is arguably a social television experience. Sharing a photo album may also qualify. At the same time, it is becoming possible to watch TV on other devices, such as cell phones and mp3 players. So maybe sharing a home movie between two phones is another example of social television? But sharing photos between two cell phones can hardly qualify, or the term is diluted beyond reason!

Perhaps these difficulties have less to do with shortcomings of the definitions than they are simply reflections of a world in transition, where the boundaries between traditional media types and communication services are blurring. Social TV is just one *part* of the research on content plus communication, which also encompasses social music, social photos, and more. Ultimately, the most important dimension of a user's social media experience is probably not whether or not it is classified specifically as "social television".

DIMENSIONS

By now, it should be evident that the social television space encompasses many radically different experiences. In order to bring them into some kind of organization, several researchers have put forward dimensions of design for social television.

In the analysis of Coppens et al. (2004), a social television experience consists of a mix of three basic components: personal content (including personal favorites and personally recommended content), rich communication (including all the modalities already discussed: text, voice, video and graphical messages), and community support (presence, invitations, scheduling, and support for social networking). While this is a serviceable description of the AmigoTV system, the distinction between the categories is not always clear. Program suggestions, for example, could arguably fit in any of the three.

Ducheneaut et al. (2008) divide TV-related sociability into direct and indirect forms. Direct sociability is the socializing that takes place during or just before and after the television experience, while indirect sociability refers to socializing about the content *apart* from the actual experience of it (such as when talking about an upcoming program or something that has been watched previously). This is an important distinction, but remote communication, and especially asynchronous interaction, confuse the matter, since one of the people socializing may be in the middle of the television experience while the other is not.

Chorianopoulos (2007) uses the well-established CSCW time-space matrix (Baecker, Grudin, Buxton, & Greenberg, 1995) to describe television sociability in two dimensions: synchronous—asynchronous communication and collocated—distant presence. The resulting quadrants correspond to four scenarios that could benefit from social television systems. The most valuable contribution of this model is probably to identify interesting, non-obvious potential use-cases for Social TV, such as supporting people watching at the same place at different times. However, it should be recognized that in practice, both dimensions have more than two states. Text chat, for example, has aspects of both synchronous and asynchronous communication (Voida, Newstetter, & Mynatt, 2002), and the ability to record and play back interaction sequences synchronized to the content, found in systems like CollaboraTV, mimics certain characteristics of a synchronous experience in an asynchronous communication situation (Harrison & Amento, 2007). Along the space axis, social television has an important category of nearly-collocated communication: between people watching on different TVs in the same household.

Hess (2007) identifies seven aspects of community building for Social TV systems that bring people together. Of these, group size may be the most generally relevant, making a distinction between one-to-one communication and interaction in larger groups. Because Hess's focus is on a "Find-a-Friend" scenario, he assumes an open, public forum, where participants would mostly have weak-tie relationships, and does not consider more closed and close-knit groups of friends and family who have strong ties to each other.

The most extensive taxonomy of social television is due to Schatz et al. (2007). They define six dimensions of the design space for mobile social television, incorporating a number of the axes used by others: synchronous—asynchronous, verbal—non-verbal, integrated with—separate from the content, one-to-one—one-to-many, push—pull, and high bandwidth—low bandwidth. All of these dimensions are equally applicable to non-mobile social television. The degree to which the communication is integrated with the content (allowing people to communicate *via* the content, as when sending suggestions, sharing ratings, or adding tags, annotations or other enhancements) is an especially important factor not identified in the other models.

Gross et al. (2008) divide social television functionality into three components: group TV watching, presence info and communication, and recommendations. To this, they add social, spatial and temporal dimensions that generally correspond to those outlined above, and mention the possibility of group adaptive interfaces. On this basis they put forth a model of design dimensions.

In summary, theoretical models of social television have proposed a number of different dimensions of design. For the most part the models complement each other and can be used together. Many of the dimensions are simply aspects of communication technologies and online social networks in general. However, the integration with TV content does give rise to new dimensions that define the relationship between the communication and the content.

CONCLUSION

Like the topic itself, the search for social television remains a work in progress. Our ability to delineate it, either in terms of history, by example, through definition or by analysis of its characteristic dimensions, is limited by its variety, its interconnectedness with other social experiences, and its ongoing development. Yet if a definitive description is still elusive, the idea itself appears on the verge of finally being realized on a grand scale.

Whether or not any of the prototype systems mentioned above ever make it to market (and several of them are ready to take that step), it seems a near certainty that some sort of communication, probably text chat, will soon be easily available alongside the viewing of TV content. Online, a variety of social experiences around video and television content are emerging simply from the convergence of internet and video.

Ironically, just as convergence is turning Social TV into reality, it may also be rendering the notion obsolete. Without a clear distinction between a TV screen and other screens and between television programming and other content, and with communication and content sharing available ubiquitously, social television as a separate concept might no longer make sense. When first conceived of, Social TV was not thought of as distinct from the idea that would become television. As communication and video experiences are integrated in modern-day telephonoscopes, perhaps the ability to cheer along with an audience spread out all over the world will soon be commonplace—and disconnecting before booing just good manners.

ACKNOWLEDGMENT

I would like to thank the many people who have contributed to my thinking on social television, including fellow Social TV researchers, workshop participants, and Motorola coworkers. I also particularly wish to thank Elaine Huang, Joe Tullio, Ashley Novak and Noel Massey for their help revising the manuscript for this chapter.

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ENDNOTES

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[2] http://www.netflix.com/
[3] http://www.youtube.com/streams_main
[4] http://cinema.lycos.com/
[5] http://www.wi-fitv.com/
[6] http://www.buddytv.com/
[7] http://www.click.tv/
[8] http://www.veotag.com/
[9] http://www.joeberkovitz.com/reviewtube/
[10] http://www.innertoob.com/
[11] http://www.bubbleply.com/
[12] http://graffiti.vidavee.com/
[13] http://messengertv.msn.com/
[14] http://www.joost.com/

This work was previously published in Social Interactive Television: Immersive Shared Experiences and Perspectives, edited by P. Cesar; D. Geerts; K. Chorianopoulos, pp. 1-13, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.4
Asynchronous Communication
Fostering Social Interaction with CollaboraTV

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ABSTRACT

With the advent of digital video recorders and video-on-demand services, the way in which we consume media is undergoing a fundamental change. People today are less likely to watch shows at the same time, let alone the same place. As a result, television viewing which was once a social activity has been reduced to a passive, isolated experience. CollaboraTV was designed to address this new mode of television viewing by directly supporting asynchronous communication. We demonstrated its ability to support this communal viewing experience through a lab study and a month-long field study. Our studies show that users understand and appreciate the utility of asynchronous interaction, are enthusiastic about CollaboraTV's engaging social communication primitives and value implicit show recommendations from friends. Our results both provide a compelling demonstration of a social television system and raise new challenges for social television communication modalities.

DOI: 10.4018/978-1-60566-656-3.ch012

INTRODUCTION

Television is undeniably a major component of modern society. In the United States, it is not only the dominant media activity, but is also considered the most exciting and influential media type (FCC 2006; Putnam 2000; TBA 2006). Despite increasing competition from the internet, television usage has been steadily increasing, and is now at it's highest level since viewing data was first collected, a 50% increase since the 1950s, and a 12% increase from 1996. The average person watches 4.5 hours of programming a day, with the average household tuned in for more than 8 hours (FCC 2006; Putnam 2000). This consumes almost half of people's total leisure time (BLS 2006; Putnam 2000).

Given the significant place that television holds, our research focuses on understanding the social aspects of television viewing – especially in today's age of social behavior-altering technological advances – and the utility of social television systems for meeting the new challenges that such advances bring about.

Declined Social Interactions Around Television

Television was once championed as the "electronic hearth" which would bring people together (Tichi 1991). Indeed, television shows provide a common experience, often affording even total strangers a social connection on which to initiate conversation. This effect blossomed in the 1950s, when two-thirds of all Americans tuned in to watch "I Love Lucy" (Putnam 2000). However, a fundamental shift in how we consume media is degrading such social interactions significantly – an increasing number of people are no longer watching television shows as they broadcast. Instead, users are favoring non-live media sources, such as Digital Video Recorders (DVRs), Video-On-Demand services (e.g. Apple's iTunes Video Store), and even rented physical media (e.g. DVDs via Netflix). To complicate matters further, televisions are outnumbering people in the average home; less than a fifth of households have a single television (Fairbank 1995; AP 2006). This is leading to a decline in ability for people to interact and is eroding once strong social ties. People are increasingly watching TV without their families, with some studies suggesting at least half of Americans usually watch alone (Putnam 2000). However, all indications point towards a lack of ability to communicate, not a lack of desire.

The "Water-Cooler Effect": A Thing of the Past?

Television shows often act as a conversation starter, enabling the "water-cooler effect" (Putnam 2000), where groups congregate and discuss a television show, automatically assuming everyone in the group has seen it. For example, co-workers could discuss a show from the previous night at work the following day. However, this effect is heavily dependent on a property of live television: shows have a fixed broadcast time. This means that after a show has aired, everyone who wanted to see it, must have watched it (or missed it). DVRs enable people to watch shows days, weeks, and even years after they first air. This trend towards asynchronous viewing, although not omnipresent today, is becoming a dominant media consumption mode. DVRs are already found in 20% of American homes (Leichtman 2007) and worldwide adoption is predicted to reach 250 million users by 2011 (ABI 2006). On-demand commercial video downloads are also booming, jumping 255% from 2005 to 2006 (NPD 2006). Similarly, Netflix, the most popular DVD rental company, has experienced nearly 50% growth in subscribers annually since 2002 (Netflix 2006).

What does asynchronous viewing mean for water cooler talk? Many people will not have watched the most recently aired episode by the following day. In fact, some people may be multiple episodes or even seasons behind. This makes conversing about a show considerably more problematic. If a group of friends meet and talk about the latest episode, those who have not seen it are left out. It is even possible that some may avoid the conversation entirely, fearing that yet-to-be-seen episodes will be spoiled. Equally likely is that people will moderate their conversations in order to prevent revealing spoilers to friends that are one or more episodes behind. However, this hampers the exchange of important and interesting details that were revealed in recent episodes. Moreover, by the time lagging people do catch up, and want to discuss the show, it is likely others will have forgotten important details or simply have lost interest, substantially degrading the quality of interaction.

Unprecedented Level of Program Choice

Television viewers today can easily be overwhelmed by the number of channels as well as programs. Gone are the days when one could flip through a 40 page TV guide and decide on what to watch. Given the plethora of content today, the task of finding something relevant to watch has become very difficult. As a result, viewers often resort to randomly scanning multiple channels ('channel surfing') to find a show of interest. Digital TV content providers have tried to respond to this information overload problem in a few ways. Electronic program guides, which are little more than digital forms of their paper predecessors, still require viewers to sift through a multitude of static choices. Vendors also provide basic search capabilities along with TV programming service, but again the task of searching for the illusive "good" show rests on the viewer. Despite the availability of technology aids, viewers still prefer channel surfing as a method to select what to watch, often expressing considerable dislike for on-screen program guides (Taylor 2003). DVR systems, like the TiVO, even automatically record shows that it thinks the user will like. But the quality of such system-recommended shows is questionable (Zaslow 2002).

To address these concerns, a new communication paradigm for television is needed, one that captures users' comments during and immediately after watching a show. This is when the material is fresh and engaging, and peoples' commentary rich and plentiful. This content then needs to be saved – the enthusiasm and detail preserved – and shared with users who watch the content at a later time to recreate the experience of watching together. Also, the social nature of such a system involving groups of people who often watch shows together can be exploited to tackle the problem of content overload by using the viewing habits of friends as recommendations. CollaboraTV achieves all this using a unique set of communication primitives and visualization techniques.

Our efforts to address the aforementioned issues are organized around 3 research questions (RQs):

- **RQ1.** Does CollaboraTV provide users a sense of social presence? Does it enrich the viewing experience?
- **RQ2.** How well does CollaboraTV support the task of asynchronous television viewing?
- **RQ3.** Can friend networks present in social television systems be leveraged to help users choose what to watch?

The remainder of the chapter is organized as follows. We first survey related work, illustrating how we build on or advance it. We then describe the CollaboraTV system, highlighting distinctive features that appreciably affect usage. The heart of the paper describes a lab study followed by a month-long deployment of CollaboraTV to support social interactions while consuming video content; we focus on how our results answer our three research questions. Finally, we discuss the implications of our results for future design and research.

RELATED WORK

Social Television Systems

Television-based communication has been the focus of substantial research. Many of the ideas in CollaboraTV are extensions of successful elements in previously developed systems. However, CollaboraTV distinguishes itself in several significant ways.

Xerox PARC's SocialTV (Oehlberg 2006) envisioned the use of a shared audio channel, where groups of users could interact verbally. The project also introduced the idea of a movie theater-themed visualization scheme for user presence. Indeed, CollaboraTV's virtual audience is a direct descendant of this concept. However, unlike avatars in SocialTV, CollaboraTV's are dynamic and used as a conduit for communication (comments, gestures and emoticons).

AmigoTV represents one of the earliest efforts in this domain (Coppens 2004). Like SocialTV and CollaboraTV, avatars are used to visualize user presence. The system offers a series of faces as avatars, and allows users to select a demeanor (e.g. happy face, angry face). This simple mechanism allows avatars to operate on an additional dimension: emotion. Users can also generate shared video effects, for example a flaming ball whizzing across the screen. Like SocialTV, AmigoTV allows users to communicate via speech.

ConnecTV is a tightly integrated instant messaging and television application (Boertjes 2007). From a user's perspective, friends are placed into one of three groups: "watching this channel", "watching another channel", and "not watching". In addition to being able to chat with friends that are watching the same show, the system also allows messages to be sent to friends watching different shows. The latter serves as an invitation for that user to switch channels and join the friend. These invitations have the ability to operate in an asynchronous way. If a user is not available when the invitation is sent, it will be saved until that user comes online. Once logged in, the invitation is shown, and the user can start watching the associated content asynchronously from the originating friend. Media Center Buddies, system developed by Microsoft, is similar (Regan 2004).

The Telebuddies system (Luyten 2006) promotes communication amongst synchronous viewers using a series of events incorporated into the media stream. The authors offer a quiz example, where users are formed into groups and compete. A text-based chat interface is provided to allow users to deliberate.

Unfortunately, evaluation of social television applications has been fairly limited (Geerts 2006, Harboe 2007, Boertjes 2007). There has been a significant amount of work evaluating the use of ambient displays to convey TV watching status (Harboe 2008). Although there has been considerable investigation of particular social television elements (Geerts 2006; Harboe 2007; Weisz 2007), comprehensive field studies that cover the usability, impact, and potential adoption of full systems are limited. Currently, these systems do not distinctly support asynchronous communication. With a clear trend towards on-demand media consumption, systems that do not support this form of communication have significantly diminished value. In these regards, CollaboraTV is unique.

Avatars

The benefit of avatars in communication systems has been widely researched (Diederiks 2003; Persson 2003; Salem 2000; Smith 2000). The use of animated characters in television has also been investigated (Chorianopoulos 2006). Television is traditionally watched in groups, which makes avatars an obvious technique to simulate presence. Avatars humanize remote users, or in the case of CollaboraTV, potentially teletemporal (literally meaning far in time) as well. Moreover, avatars have been shown to be ideal for non-textual communication; emotions, gestures and postures offer a universal dimension of expression that people find familiar and natural.

SYSTEM DESCRIPTION

CollaboraTV was designed from the ground up to support synchronous and asynchronous viewers in a unified interface. The resulting system allows communication in and between these two viewing modes, providing an unprecedented level of interaction potential. Additionally, CollaboraTV provides a suite of novel features that leverages existing user behavior to further enhance the social experience.

Temporally-Linked Annotations

Our initial prototype version of CollaboraTV allows users to create text comments while watching a show. The text content is attached to the media stream at the corresponding time index. When other users encounter this point in the show, the comment is displayed on screen for several seconds.

This annotation method inherently supports asynchronous communication. Previously generated comments will be shown to later viewers as they watch the show. Although the mechanism is simple, the effect is great – past users appear to make comments as if they were watching in parallel with you. In a synchronous situation, when one or more users are concurrent, comments are shown immediately to all group members because the comment is attached to the show at the point everyone is presently viewing. This allows people to chat (live) like they would with an instant messaging client. Additionally, because these (chat) comments are attached temporally to the media, subsequent viewers will see the conversation unfold in "real-time" even though the conversation took place in the past.

This communication scheme has several important qualities. Foremost, synchronous user groups can communicate without hindrance while simultaneously interacting with asynchronous commentary. Secondly, lone viewers who would otherwise see no communication are exposed to a wealth of previous interaction. This may motivate them to participate in the conversation knowing that subsequent viewers will see their remarks. Lastly, as more users watch and comment, the richer the dialog becomes for later viewers.

CollaboraTV supports a second type of temporally-linked annotation: the interest point. Like comments, interest points are attached to the media stream at the time index they were created. However, instead of containing text, interest points are used to indicate a positive or negative reaction to a show's content (e.g. a particularly funny joke or exciting action scene). Users are free to associate the polar nature of this feature however they see fit (e.g. thrilling/dull, witty/cheesy, and suspenseful/predictable).

Virtual Audience

The most prominent feature of the CollaboraTV user interface is the virtual audience. A series of avatars are used to visualize both current and past viewers (i.e. synchronous and asynchronous users respectively). The effect of a movie theater, where people are seated and shown as silhouettes against the content, is used. The simple black figures are unobtrusive, immediately recognizable, and work well at a variety of scales. Each avatar is named and has a static seating position throughout the show. A "watching live" label is displayed below avatars that represent synchronous viewers. Figure 1 shows a screenshot of the initial prototype version of CollaboraTV.

In addition to embodying concurrent and tele-temporal viewers, the virtual audience is used as the primary communication conduit. Temporally-linked comments are shown in translucent, comic-book-like speech bubbles, which are rendered above the source user's avatar. In addition, avatars raise and lower their arms to make thumbs up/down gestures. These correspond to user-generated positive and negative interest points.

The virtual audience is a critical component of the CollaboraTV communication strategy. Because user actions are coupled with a personal avatar, one that is seen by friends and family, pro-

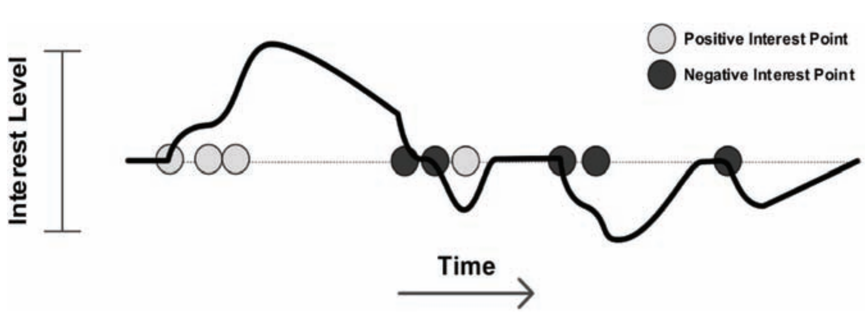
Figure 1. The CollaboraTV prototype interface with all panes active. A) Information about current show. B) Alternative, chat-room-like visualization (inset, used only in lab study). C) Interest profile visualization. D) Progress bar that displays the position in the media stream. E) Virtual Audience. Panels A, C and D fade away after a preset period of inactivity.

viding commentary and interest feedback becomes an outlet for expression and not just data entry.

Buddies, Sharing and Privacy

A user may consider their comments and interest points personal, and thus only wish to share them with friends and family. To achieve this, CollaboraTV employs a simple social network in order to determine how user-content is shared. Specifically, a unidirectional subscription model is used. If comments, emoticons and interest points are to be exchanged between two users, they must explicitly befriend each other by adding the other to their buddy list. This would be most typical among friends and families, who want bi-directional communication. However, there are some instances where unidirectional communication is valuable. For example, it would be possible to watch a television program with one of the show's actors. This would be achieved by subscribing to that user. However, because the subscription is only one-way, the user would not appear in the actor's virtual audience.

Figure 2. A set of discrete interest points is used to form a continuous interest profile.



Interest Profiles

Although temporally-linked comments, emoticons and interest points are primarily used for communication purposes, their location, frequency and content can be leveraged for other purposes. Interest profiles are a notable example. These are created by interpolating a continuous interest level from a series of interest points. Data from a single user or group of users can be used. Because positive and negative interest is assumed to be transient, the interest level slowly decays to a nominal level. (Figure 2)

These data of how a viewer's interest level swings between positive and negative over the time period of a TV show may be interesting to viewers. In response, the feature is exposed graphically in the CollaboraTV user interface. While a show is watched, two interest profiles are calculated: one for all previous viewers and one for the current user. The two interest profiles are shown together in Figure 1. This helps visualize the difference between these two profiles, displaying the magnitude of disagreement between the user and the group. It was thought that highlighting sections of agreement and disagreement may spark additional discussion, increasing social interaction.

Interface Design

The CTV GUI consists of the following 5 elements:

1. **Buddy Information (View/Join):** A list of buddies of a user along with an indication of whether or not the buddy is currently viewing CollaboraTV. A user has the ability to 'join in' on a buddy, who may already be watching a show, and start watching at the same point in the show as the buddy. Thus a user can catch-up with a buddy who may not be too far along into a show.
2. **Program Guide:** A listing of all available shows in the CollaboraTV system, along with show descriptions. Shows viewed by buddies of a user are marked in the program guide along with any collected social usage data. The program guide also has a list of shows that have been viewed by a user's buddies, as well as a list of popular shows across all users of the CollaboraTV system.
3. **Virtual Audience:** Discussed previously.
4. **Progress Bar:** Displays the current position in the media stream. The temporal locations of annotations – comments, interest points and emoticons – are denoted using icons on the progress bar (Figure 1). When the show progresses to an annotation as seen on the progress bar, the avatar corresponding to the user who made the annotation is animated to display a comment bubble, thumbs up/ thumbs down gesture or emoticon on its face.
5. **Interest Profile Visualization:** Discussed previously. Users have the option to move to particular points on the interest profile timeline and begin watching the show at the chosen point of interest.

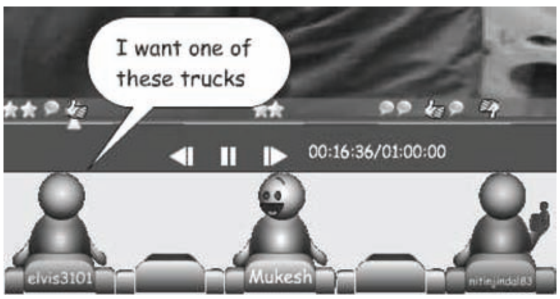
System Architecture

CollaboraTV uses a client-server architecture. The prototype client was built using Java and provides the GUI functionalities described previously to access available content, launch programming, and control playback (Harrison 2007). The prototype uses MythTV, an open source media center application with DVR capability, for recording and playing shows and accessing show information for its program guide.

EXPERIMENT: LAB STUDY

Our first study was a lab based study of the initial CollaboraTV system (Figure 3). In addition to the research questions listed above, we also wanted to see how users could communicate asynchronously

Figure 3. A partial virtual audience from a live user's perspective. Other avatars represent past viewers. Note the speech bubbles (comments), thumbs up and thumbs down avatar gestures (interest points) and the avatar emoticons (emotions). These annotations are also temporally displayed on the progress bar seen above the virtual avatars.



and what types of interactions would arise while using the CollaboraTV system. We were also interested in seeing if our virtual audience interface could provide a better sense of presence and help to elicit more interactions between users.

Experimental Setup

In this study, users were seated in a room with a large rear-projection screen. A wireless (Bluetooth) keyboard was used for entering text annotations. For all other functionally, a wireless (radio frequency) remote control was provided. A labeled color printout of the remote control was provided for reference. Twenty-three televisions shows were available for users to watch. These varied in content and genre. Advertisements were removed, and clips shortened to approximately seven minutes in length. We kept the amount of content low to help ensure overlap between users.

Before the study began, the authors watched each show and generated some preliminary comments and interest points. Thus, no less than two avatars (three including participant's avatar) were present in the virtual audience. This was deemed necessary to engage people in the asynchronous technology and help them better evaluate if comments left in the past were interesting and whether they would respond to comments knowing previous users may never see them.

In order to investigate whether the virtual audience increased user participation, an alternative commentary interface was created. This was modeled after a generic chat-room-like application. Comments were listed sequentially in a vertical orientation, prefixed with user names with no audience display.

Comments and interest points created by users, persisted between sessions. This meant that avatars in the virtual audience represented real people (in this case, colleagues). Additionally, users understood that future study participants would see their avatar's comments and interest points. This provided the necessary social context to engage users. It was thought that if users knew their comments were to be deleted once they finished, there would be no motivation to communicate. Also, this exposed participants to a variety of people, commentary, commentary styles, and audience sizes.

Participants

Thirty-two participants (24 male and 8 female, with a mean age of approximately 42) volunteered for a small food reward. Participants were recruited from a large corporate research lab using an email campaign. All but one participant watched television on a regular basis.

Procedure

Experimental conditions were balanced across participants to remove any order effects. Users were first shown a short video providing an overview of CollaboraTV. This was followed by a 10-minute, hands-on walkthrough, which familiarized participants with the system and its features.

Following the tutorial, participants were asked to select and start a show of their choosing. Based on the participant's experimental condition, either the virtual audience or the chat-room-like visualization was enabled. Users then watched the show, generating comments and interest points as they saw fit. After the first show had finished, users were asked to select a new program to watch. This time, the other comment visualization method was used. For the third (and final) clip, users watched a common show, ensuring overlap with other participants.

After the final show concluded, users answered an online survey eliciting feedback about the system and their perceptions about asynchronous communication. The survey used a Likert-style one to five scale to determine user's level of agreement to questions about CollboraTV. Each trial took approximately one hour to complete.

RESULTS: LAB STUDY

Overall reaction was positive. Users understood and appreciated the value of asynchronous communication immediately. When asked if CollaboraTV made watching television more engaging and enjoyable, over half of participants agreed or strongly agreed (m=3.58, sd=1.09). The ability to create comments was popular, with 76% of participants agreeing or strongly agreeing the ability made television viewing more fun (m=3.87, sd=1.05).

Asynchronous Communication and the Virtual Audience

The virtual audience appears to be an effective and engaging visualization. User participation was significantly greater when compared against the alternative, chat-room-like visualization ($p<.05$). On average, users generated 21% more interest points and 17% more comments when the virtual audience was enabled. This was further reinforced by survey results, which indicated that two-thirds of participants agreed or strongly agreed that they preferred the virtual audience (m=3.97, sd=0.87). A follow up question asked users to consider an alternative interface where the virtual audience was present, but comments were decoupled from (i.e. not associated with) particular avatars. Responses were overwhelmingly negative (m=2.15, sd=1.06).

The virtual audience's ability to support both synchronous and asynchronous viewers was also popular. Users had overall negative option when asked to consider a virtual audience that only displayed synchronous users (m=2.12, sd=0.89). Equally negative was the reaction to a virtual audience that only showed past viewers (m=2.09, sd=.91). Also, a pair of questions asked participants to consider two systems, one where their comments and interest points were only shown to synchronous viewers, and the other where their comments and interest points were shown to both synchronous and later (asynchronous) viewers. Users strongly favored participation in the system that supported both communication modalities (m=3.09, sd=1.07 vs. m=3.94, sd=0.83).

System Redesign

The lab study was useful in helping us evaluate the initial system. However, it is difficult, in a lab setting, to see how users might integrate this technology into their daily viewing habits and determine the true value of asynchronous communication while watching television. Since our prototype system was not very portable, because of numerous hardware constraints, we decided to re-implement CollaboraTV to run within a web browser. This would allow users access to the system from their homes and help us to reach a wider audience.

The new version of CollaboraTV uses a client built in Adobe Flex. A central JBoss server in coordination with a Flash Media Server serves out video content to the clients, and coordinates the communication between multiple clients. A central MySQL server provides a common data store for user generated data (annotations, buddy lists, show ratings) as well as show related data.

Based on user comments from the lab study, we made a few changes to the client interface. Most of these changes were required to make the interface more mouse friendly. The prototype was controlled through a remote device, but the new web version, needed to support the mouse. Besides text comments and interest points, CollaboraTV now allows users to temporally link emotion icons or emoticons to the media stream. Users can express their feelings at the time of watching a show by selecting from a set of emoticons that represent common expressions (happy, sad, angry etc.) Along with text comments and interests points, emoticons provide CollaboraTV users with a rich set of primitives that help digitally recreate the communal viewing experience. Emoticons are seen as corresponding animations of the avatars. For example, when a user selects the 'happy' icon, the user's avatar turns around and displays a smile on its face. All actions are smoothly animated. These subtle effects enhance the perceived interactivity. Figure 1 provides an example of each of these items.

EXPERIMENT: FIELD TRIAL

In order to gauge the true utility of CollaboraTV, we conducted a field study to investigate the usefulness of CollaboraTV to support the communal viewing experience. Participants accessed and used CollaboraTV from their personal computers, interacting with their television buddies freely and naturally over the duration of the study. Such an open and natural design preempted the need to simulate the experience of watching programming remotely with other users of the system, and also gave users sufficient time to form an opinion about the system.

Participants

The participants were recruited using a mailing campaign directed at students who had interned at a large corporate research. The summer interns presented an interesting group to recruit from as they had interacted with each during their internship period. They often stayed in the same summer housing, traveled to work together, had lunch together as well as socialized during many events for summer interns. Thus, new friendships were made and new cliques formed. After the summer internship, the interns returned to their home towns, within and outside the US. This group had an important property that made it ideal for our study – cliques of friends who were now geographically separated. The presence of cliques within the potential participant pool was vital, as CollaboraTV depends on the notion of buddies. We used a survey to find participants amongst this group of interns and their friends who regularly watched television. 16 qualified subjects participated (14 male and 2 female, with a mean age of approximately 25). Their backgrounds were mainly in IT.

Procedure

Participants used CollaboraTV for 4 weeks. They completed a pre-study survey about their TV viewing habits and selected a group of buddies with whom they would like to watch shows on CollaboraTV. Participants could either choose buddies from the list of interns or invite other friends. Following the initial survey, we invited each participant to view a short online video providing an overview of CollaboraTV. At the end of the study period, we conducted another online survey where participants informed us of their experiences with CollaboraTV.

Participants viewed streaming video from the CollaboraTV server using a web browser with the Adobe Flash plug-in installed. Once logged in to the system, they could select from a list of

37 shows (600 episodes total) across 17 genres. The list of shows to be recorded was based on a listing of the highest rated shows across different genres on a popular TV show rating website. During the course of the study, participants could request shows to be added to the system. They could also modify their buddy list, and make annotations while they watched a show.

We told participants to use CollaboraTV just as they wanted: they could watch any show of their choice, add or remove anybody to their buddy list and use any system feature. To ensure minimal usage levels, we asked participants to view at least 2 shows. We offered a modest incentive: a randomly selected user who participated at the minimum level received a $50 gift certificate. 70% of the subjects met the requirement.

Experimental Design

To test the effect of CollaboraTV's social features in providing users' a sense of social presence (RQ1), we asked users to create a buddy list and observed the interactions that took place between buddies. These buddies were in most cases other interns with whom participants had fostered friendships over the last year as a result of a joint summer internship experience. In other cases, participants invited a family member or a friend to be their CollaboraTV buddy. Annotations made by participants while watching a show were persisted and shown to their buddies. Users understood that their buddies would see their avatar's annotations and this provided the necessary social context to engage users. Besides observing the logs of annotations made by users, we asked about their experiences of using the social features of CollaboraTV while watching shows with their buddies.

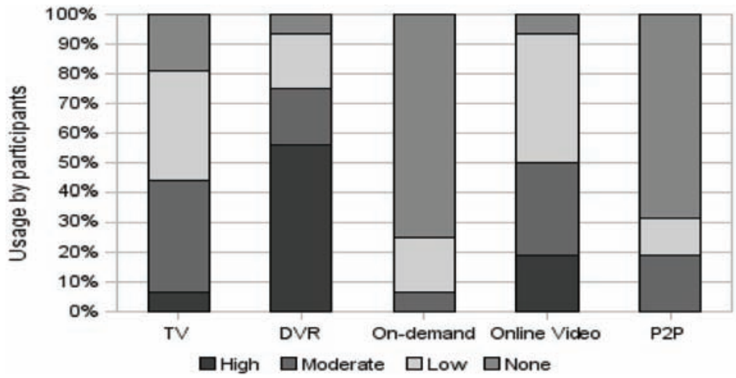
Numerous existing social television systems have explored the dynamics of synchronous communication. To better understand the potential of asynchronous communication, one of CollaboraTV's most distinctive features, our study focused on this mode of interaction (RQ2). We asked users to watch specific shows with a buddy(s) in a time-shifted manner. A new episode of a show found in the viewing history of a user or buddy was chosen. Participants were asked to view the chosen show, or alternately a show of their choice, and were given a week to complete this task.

Digital television services today pose a significant content selection problem. Rather than taking the algorithmic route such as recommender systems, CollaboraTV employs a simple yet powerful mechanism. Social Influence Theory tells us that when we do not know what to do, we often times do as others do. CollaboraTV aids such behavior via certain interface features. Users can view a list of shows that their buddies have been watching called PopularShows(Buddies). Also available is another list called PopularShows(All) that anonymously displays names of shows that have been recently viewed by any system user, not only buddies. Shows recently viewed by buddies are indicated in the program guide. To learn if friend networks present in social television systems could be leveraged to help users choose what to watch (RQ3), we observed usage logs for instances when users selected a show displayed under either PopularShows(Buddies) or PopularShows(All). We also asked survey questions to find out if participants found these lists useful.

RESULTS: FIELD TRIAL

At the start of the study, participants completed a survey that gave us sufficient background regarding their familiarity with different video viewing technologies and their attitudes towards television viewing. Given their IT background, almost all participants reported themselves as expert computer users, with high weekly computer usage. On the question of television expertise and usage, almost all of the participants had used televisions for more than 10 years, with 75% viewing between 1-3 hours per day.

Figure 4. Amount of usage of different video-related technologies



We also asked questions about familiarity and usage of DVR technology, to which 56% of participants said they use it often, while 37.5% of users had either heard of it or used it a few times. We felt that the familiarity with DVR technology would lend itself nicely to the asynchronous viewing mode in CollaboraTV. Only 3 participants had used online social television systems before. Figure 4 shows usage levels of some popular video-related technologies.

With this background about participants, we now address the core of our results, which are organized around our 3 research questions. We begin with RQ1, describing how participants felt about the social features of CollaboraTV. We follow by identifying opportunities for improving the communication primitives based on participant feedback, and then address RQ2, which focuses on asynchronous viewing. At this point, we explore the related issue of privacy in social television systems, before finally looking at a possible solution to the content selection problem described in RQ3.

RQ1. Does CollaboraTV provide users a sense of social presence and enrich the viewing experience? We asked participants questions to understand if they even valued the experience of watching with others in the first place. 81% indicated that they watched television with family or friends, and said that watching with others was more fun than watching alone. 19% also added that watching programs/films that elicit strong emotions with friends or family helped bring them closer together. These responses encouraged us to believe that participants would use and value the social annotation primitives of CollaboraTV at the onset of the study.

Annotation Activity

During the period of the study, we maintained logs of all the annotations made by the participants with the intention of using annotation activity as a measure of success of CollaboraTV in enriching the viewing experience. In all, participants created 213 annotations, an average of 14 per person (min: 0; max: 72; std: 22.5). 137 (64%) were text comments, 24 (11%) were interest points, and 52 (25%) were expressions. The difference in usage of the 3 types of annotations could be because of the ease of use and expressiveness of text chat. In many cases, viewers used chat-style emoticons embedded in their text comments.

Chat Content

After the study was complete, we assigned each of the participants' 137 messages to one of 6 categories. We adopted the classification scheme used by Weisz (2007). A reliability check was

Table 1. Examples of chat in each coding category

Category	Example chat (original form)	% chat
Television Show	"does she leave him there or something?" "that's dakota fanning indeed" "Colbert took the book apart"	34.3
Evaluations	"oh man . . . bad driver" "if this wasn't already planned, this dude's the funniest astronaut out there" "nice choice of music"	8
Personal	"I want to sit next to you" "do you like Chandler?" "I'm hungry"	18.9
System	"it works fine even with limited bandwidth" "they should cut out all commercials" "test . . . "	16.8
Laughter	":D", "hehehe", "lol" and many variations thereof "I've seen this show too many times:)"	18.9 solo 5.1 mixed
Greetings & partings	"hi", "hey", "bye" and many variations thereof "I'm out of here"	2.2

performed between two independent coders, with an inter-rater reliability of 83% after two iterations. Each line of chat was coded under one of these categories -- show content, evaluations of the show, personal topics, laughter, system-related comments and greetings/partings. Laughter, which was often embedded in text comments, was coded separately as either occurring by itself or co-occurring with text. A breakup of the chat content is shown in Table 1.

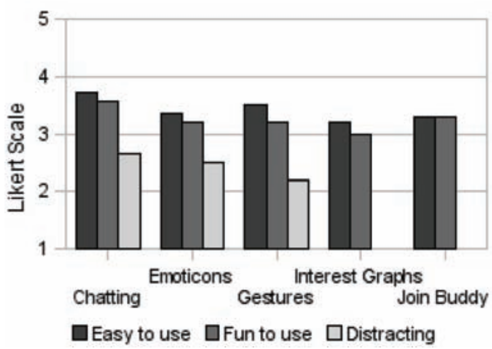
Our results were similar to those reported by Weisz (2007). A significant amount of chat was about the show content as well as personal interactions triggered by the content. For example, a participant said, "do you like Chandler? Would you date him?", to which a buddy said, "haha prob not, he's too much like my first bf" while watching an episode of a popular sitcom. Laughter in the form of "hehehe", "lol", ":)", ":D" etc. occurred very frequently, with users often mixing it in with chat, but more often occurring by itself. Close to 20% of chat consisted of solely laughter. This is roughly the same as the number of times the emoticon representing 'laugh' was used during the study. More over, the high usage of chat-style emoticons such as ":D", ":)" could explain why emoticons were not directly used as much. The chat-style emoticons are quicker to create and users are already familiar with them.

Attitude Towards Text Chat and Other Social Interaction Features

In the final survey, participants were asked if they liked the social interaction mechanisms that CollaboraTV offered such as text comments, emoticons and interest points. More than half the participants agreed or strongly agreed that CollaboraTV is fun to use (m=3.57, sd=0.65), while 71% agreed or strongly agreed that the system is easy to use (m=3.71, sd=0.73). Participants for the most part (57.1%) had no trouble learning to use the system (m=3.64, sd=0.84). When asked if the system was useful to them, 85.7% responded affirmatively (m=3, sd=0.55), saying in 78.5% of the cases that it supported what they wanted to do to a large extent (m=3.07, sd=0.73).

Participants liked the movie theater seating effect of avatars and expressed the desire for interactions between proximately seated avatars. They were not very enthusiastic about the possibility of customizing their avatars.

Figure 5. Evaluation of CollaboraTV's social features by participants, on a 1 to 5 Likert-scale



We asked participants to evaluate each of the social interaction features on the dimensions of how fun and easy they were to use. Given that viewing annotations made by others via their avatars may be considered as distracting, we also asked users if this was the case in their experiences with CollaboraTV. Figure 5 shows the responses of participants.

Note that viewing an interest graph or joining a buddy in viewing a show are activities with no direct external factors vying for the users immediate attention, unlike animated avatars. In the particular scenario of the distractions caused by chatting and viewing others comments, 64% of participants were ambivalent about creating text comments, responding with a 'neither agree or disagree' while close to half were undecided about their attitude towards viewing others comments while viewing television. Likewise, 50% of the participants were undecided about how distracting the virtual audience as a whole was. This is despite the fact that more than half the users found chatting to be a fun activity. This confirms what researchers have reported in the past about chatting while consuming video being fun as well as distracting simultaneously (Weisz 2007). To accommodate such users, it would be worthwhile to investigate alternative visualization schemes, in particular ones with smaller visual footprints. These could be offered as alternative visualization modes in a future CollaboraTV version.

Overall Activity Level

CollaboraTV had a collection of close to 600 episodes from 37 shows in 17 popular genres during the study, which were updated based on requests from participants. Despite this large and flexible selection, the positive survey responses/ general feedback to the social features, CollaboraTV experienced only low to moderate levels of activity. On average, participants viewed 4 shows and created 14 annotations. Several factors could be used to explain this paradox. One obvious reason could be the lack of critical mass. As one characteristic participant said: "very few people [online]; the more people and friends there are the better the experience". We could solve this by providing users a robust invitation mechanism.

A reason for low number of annotations could be the common habit of viewers carrying out some other task in parallel to watching television. 68% (m=3.75, sd=0.93) admitted to normally doing something else along with watching television, explaining that they seldom solely watch television. Another reason could be the current input modalities of CollaboraTV, where users are expected to use their keyboard to make annotations. We discuss alternate unobtrusive temporal annotations that could remedy this in our 'Future Work'.

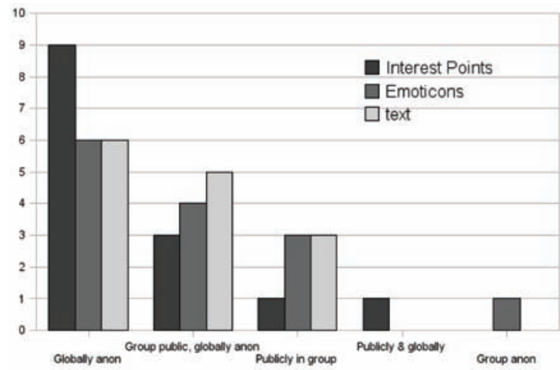
In the pre-study survey, 4 participants had indicated a preference to watch television alone, as they felt watching with others was distracting. At the end of study, we checked to see if their opinion had changed as a result of using a social television system first hand. 3 of these 4 users, who had earlier strongly agreed that watching programs with others is distracting, admitted that the virtual audience was not distracting while watching a show. All 4 were ambivalent when judging if the CollaboraTV experience with its virtual audience was more engaging and enjoyable compared to traditional TV. Finally, one of the 4 now strongly agreed that the ability to join shows and watch in parallel with other users with a virtual audience is compelling. These changes in opinion, though minor, serve as encouragement to us.

On the whole, over half of the participants agreed (m=3.21, sd=0.89) that when compared to traditional TV, the experience of viewing in the company of a virtual audience is more engaging and enjoyable. Also, participants said the ability to join shows and watch in parallel with other users was compelling (m=3.29, sd=0.83). In both cases, 35.7% agreed or strongly agreed.

RQ2. How well does CollaboraTV support the task of asynchronous television viewing? The asynchronous viewing capability of CollaboraTV is meant to help preserve interactions like the "water cooler conversations" that build social capital. But before studying the utility of this capability, we wanted to learn if participants valued "water cooler conversations". We verified this by asking users questions regarding the social role of television in their day-to-day lives. 75% (m=4, sd=0.73) strongly agreed that watching the same programs as friends or family provided them with common ground for conversations. Additionally in 19% (m=2.75, sd=0.86) of the cases they explained that watching programs that elicit strong emotions with friends or family brings them closer together.

Next we asked participants how frequently they (a) used conversations about programs/films as conversation starters (b) used examples from programs/films to illustrate points in conversations with others, (c) used conversations about programs/films as a way to clarify values and opinions to others. In response 37.5% (m=2.69, sd=1.2) admitted to (a), 37.5% (m=2.69, sd=1.2) said they often employed (b) and 18.8% (m=2.44, sd=1.03) said they clarified their values as in (c).

Figure 6. User preferences for sharing of different types of annotations



Sharing and Privacy

Any system that encourages social interaction in the form users sharing their annotations would have to address the privacy concerns of users. In CollaboraTV, the privacy of all annotation types - comments, interest points and emoticons - is handled in the same manner. At the onset, it was unclear if users placed different levels of sensitivity on these items. In the final survey, users were asked how they would prefer their different annotations to be shared. The results in Figure 6 indicate that users generally consider comments and emoticons to be more personal than interest points. When queried about the granularity of control desired in sharing comments, 57% preferred a global program setting that applies to all shows. Show or episode level granularity did not appeal to participants.

The most striking observation however, is that participants favor anonymously sharing their annotations globally, irrespective of the type of annotation, versus any other scheme of sharing. They even prefer to share annotations anonymously, over publicly sharing within their friend group. A strong bias towards anonymous sharing schemes is visible in Figure 6. However, this is not a blind bias, as participants also seem to care about sharing their comments with as many people as possible This can be seen in their preference of the ‘anonymous global’ scheme over the ‘publicly within group, anonymously globally’ scheme or even the ‘anonymously within group only’ which would seem the most conservative of the schemes. Participants seem to desire striking a balance between their privacy and benefit to others, by wanting to enrich the viewing experiences of others with their anonymous comments. The willingness of users to consider the social good and share bodes well for a system such as ours.

RQ3. Can friend networks present in social television systems be leveraged to help users choose what to watch? At the start of our study we had asked participants questions about how they plan (if at all) what they watched on television. 55% strongly disagreed when asked if they planned ahead on what to watch (m=2.63, sd=1.15). While users claimed to tune in to watch a specific show often (62%, m=3.63, sd=1.02), they also still explained that they watched programs/ films when it is convenient, rather than to see something specific for the majority of the time (56%, m=3.38, sd=0.96).

So when users do find a convenient time to watch some television in general, how do they decide on what to watch? Participants said that they mostly browse channels until they find something interesting to watch (51%, m=3.38, sd=0.96). This reiterates the popularity of the ’channel surfing’ behavior as reported in previous research such as Taylor (2003) that studied how TV users select a show to watch. Based on these responses, and using the categorization described by Logan (1995), we found 25% of participants to be “watchers” or those who know exactly what they want to watch, and 50% to be “grazers” or those who generally channel surf.

Close to 90% of our participants watch only low to moderate amounts of television weekly. This minimal television viewing, coupled with the ad hoc “grazer” habits described earlier, could mean that users would likely not want to waste their precious viewing time channel surfing. CollaboraTV employs a simple, yet powerful method to help users select a show to watch quickly. Users can view two lists -- PopularShows(Buddies) and PopularShows(All) -- which are lists of shows that have been recently viewed by buddies or all system users respectively. The idea here is that when users are having trouble deciding which show to watch, they can turn to what their like-minded friends have been watching recently, or optionally pick a show that a lot of system users seem to be watching lately. This show recommendation technique is based on the theory of social influences.

We asked participants if their viewing choices were influenced by those around them. More than half the participants said that they watched video content recommended by family, friends or colleagues (m=3.19, sd=0.75). Further, a fair number of them admitted to having watched content that others had been talking about or were the current media buzz (m=2.9, sd=0.57). These responses give credence to our recommendation technique.

At the end of the study, we asked users if they found the PopularShow() lists useful. 57% (m=3.71, sd=0.73) strongly agreed that the ability to see what others in their buddy group have been watching i.e. PopularShows(Buddies), was useful. In contrast, only 42% found the PopularShows(All) list useful. Despite responding positively towards the utility of the PopularShow() lists, observing our usage logs revealed low usage in terms of users actually clicking on shows in these two lists. This could be because the lists are not very accessible in their current location inside the program guide. To make the recommendation method using these lists more effective, future versions of CollaboraTV will have a splash screen similar to those found in popular social networking site. Recent activity traces of buddies will be displayed, which in turn would encourage users to explore and interact more with the system. 62% of participants also said that they already share video content today(e.g. by sending a friend a link to a website). Such explicit behavior will also be supported allowing users to send and receive show recommendations.

As another approach to solving the show selection problem, we can use interest profile data for collaborative filtering based recommendation. Most contemporary systems rely on an overall rating (e.g. two thumbs up, five stars). Interest profiles, on the other hand, provide essentially a scene-level granularity. For some content, even finer grained feedback may be available, for example, the individual jokes and gags in a sitcom. With this level of detail and personalization (e.g. user liked this joke, but not this one), the accuracy of recommendations could be exceptional.

DISCUSSION AND FUTURE WORK

In our studies, we have taken a first step towards creating social television systems that support both synchronous and asynchronous viewing modes. Further, we have demonstrated the importance and utility of a rich set of communication primitives in recreating the social experience of viewing television with others, while also illustrating the value of receiving recommendations implicitly from other users of the system. We now discuss the future implications of our work.

Alternate Temporal Annotations

To provide us with future direction, we asked study participants to consider 3 alternative annotation categories (1) illustrations, where users could draw something on the screen, (2) audio, where users could record short voice annotations, and (3) video, where users could attach a video clip of themselves. 52% voted for voice-based annotations, while 32% showed interest in option (1). Video annotations did not seem to resonate with respondents, which could be due to the overhead of maintaining a presentable countenance while watching television and loss of privacy in general.

Integration with Social Networking Sites

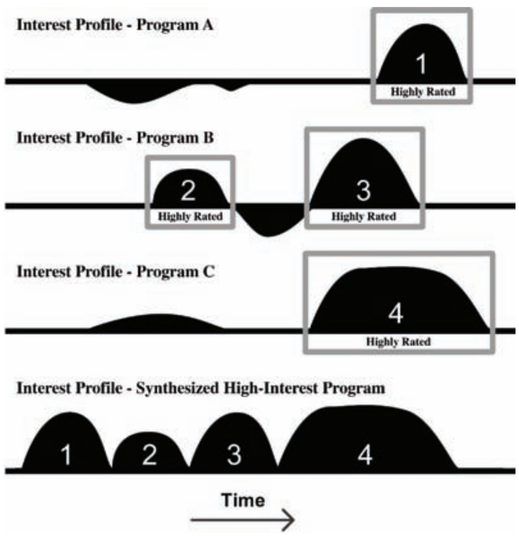
In answering RQ3, we explored the potential of exploiting buddy networks within CollaboraTV for the purpose of making implicit show recommendations. The next logical step would be to tie CollaboraTV to popular social networking websites such as Facebook or MySpace that have open APIs for developers. We are currently working on a Social EPG which integrates a social network, recommender engine, and social usage data into an EPG. It can display a visualization of shows that a user has been watching recently, allowing their buddies to discuss the show or even follow a link back to CollaboraTV to view a show that everyone is talking about.

Show Highlights

Interest profiles can be used in several powerful ways. We are currently working on features that exploit this social usage data. One application for the data is an interest-based media seek feature. Most media navigation controls provide the ability to skip forward and backward using a fixed-time step. However, by taking advantage of interest profile data, it is possible to provide a skip feature that advanced users to the next section that was highly rated by previous viewers. Consider if this feature was available for a soccer game. The portions of high interest (as rated by previous users) are likely to be intense periods of game play, shots on goal, and actual goals. Using the interest-based seek feature, one could progressively advance through the game, seeing only the most highly rated sections.

Another example is a feature that collapses programming down to a fixed time. For example, a user could ask the system to collapse a baseball game down to only the most exciting (i.e. highly

Figure 7. Highly rated sections from three programs are identified and synthesized into a new program.



rated) hits. This would be achieved by identifying the highest rated sections of the game, removing these clips, and then reassembling them into a new (and shorter) program. This feature could also be applied to a genre of programs, for example, news, where the most highly rated stories and interviews of the day would be pulled out and synthesized into a custom news program (Figure 7).

Show Recommenders

From our survey, 64% of users were willing to share their annotations with a show recommendation system (m=3.57, sd=1.28) to receive personal recommendations, while 57% were comfortable with sharing their annotations for the purpose of providing recommendations to other system users. Because this implicitly collected data provides a rich representation of a user's experience while watching video, we are exploring recommendation techniques based on user annotations. Implicit user feedback in the form of annotations can be used as a good substitute for explicit ratings. Such a method would do away with the issue of scarcity of ratings that many collaborative filtering-based recommender systems face and hopefully provide additional data to help in forming better user clusters for generating recommendations.

Limitations and Learnings

While having a set of participants who are geographically spread across the world provided an ideal setup for testing CollaboraTV, this was not without its shortcomings. Delivering instructions via email and following up with participants who we cannot meet face-to-face can be quite challenging. We believe that it would be more fruitful to have a set of users who we can meet in person at the beginning and the end of the period of study to learn first hand about their experiences with the system. Online surveys lack the ability to explore serendipitous questions and conversations that are possible with meetings.

We chose an open ended model of running our experiment to observe realistic interactions and use cases that are hard to capture in manufactured lab settings. However, we came to realize that in order to study interesting user behaviors (e.g. synchronous and asynchronous modes of communication), we would have to engage with participants with specific tasks geared towards these behaviors. It is important to balance the freedom of using the system as one wishes with specific tasks and events.

CONCLUSION

CollaboraTV allows people to interact in a synchronous, asynchronous, and mixed television-viewing situation. This unique ability offers users an unparalleled way to communicate, and ultimately reconnect with friends, family and colleagues. The lab study and comprehensive field study have yielded results that show the virtual audience was successful in engaging users and humanizing people who were remote or teletemporal. Users are enthusiastic about asynchronous communication and found value in receiving implicit show recommendations from their friends. Overall, we believe CollaboraTV achieves our goal of bringing people closer together, making the ever present "electronic hearth" social again.

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This work was previously published in Social Interactive Television: Immersive Shared Experiences and Perspectives, edited by P. Cesar; D. Geerts; K. Chorianopoulos, pp. 1-13, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.5
Examining the Roles of Mobility in Social TV

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ABSTRACT

Mobile TVs have been available for many years, without ever becoming very popular. Moreover, the first wave of research has been mostly concerned with technology and standards, which are necessary to ensure interoperability and market acceptance. Although, there has been a significant body of computer supported co-operative work (CSCW) and mobile human-computer interaction (HCI) research findings, there is limited investigation in the context of leisure activities, such as TV. In this chapter, the author proposes three concepts that drive the main paths for research and practice in mobile and social TV: (1) Mobile TV as a content format, (2) Mobile TV as user behavior and (3) Mobile TV as interaction terminal. Further research should elaborate on these three concepts and highlight the cultural impact of mobile TV.

DOI: 10.4018/978-1-60566-656-3.ch014

INTRODUCTION

One explanation for the slow diffusion of interactive TV (ITV) in the information society is that the difference between the broadcast and the telecommunications mentality has imposed an artificial distinction between content distribution and interpersonal communication. As a result, content has to be distributed and consumed through broadband, unidirectional and inflexible TV channels and interpersonal communication takes place over low-bandwidth bidirectional channels. However, the convergence of the telecommunication and content distribution platforms could be beneficial for viewers, as well as the commercial TV stakeholders. In addition, new devices and new types of content facilitate the emergence of novel consumer behaviors. In this article, we explore the interplay of these three concepts (device, content, behavior) in the context of mobile and social TV

TV content gradually finds its way through Internet and mobile platforms. Besides triple-play services, which offer integrated access to voice, content and data services, there are opportunities for new services enabled by the mobile infrastructure. Indeed, the convergence of broadcast, mobile and data platforms has offered many opportunities for integrated content and communication services, which we refer to as 'Social TV'. We define social TV as a socio-technical system that involves more than one user and networked audiovisual devices.

Previous definitions were focused only on the technological aspects and ignored the fact that even traditional TV is inherently social. For example, viewers compete mentally with quiz show participants, or between co-located groups. Moreover, viewers react emotionally to TV content, they record and share TV content with friends and discuss about shows either in real-time, or afterwards. In this context, it is necessary to not only pay attention to usability issues, but also to sociability. Indeed, ethnographic and survey studies have documented the social uses of TV (Duchenaut et al 2008, Lee and Lee 1995), but they have not described the user requirements of applications that facilitate the social uses of TV. For this purpose, we explore the related academic literature, we identify the user interface requirements of those computer mediated communication applications that enhance the social dimension of TV.

The rest of the article is structured as follows. We begin with an analysis of the social uses of mobile TV. In Section 3, we outline the multiple roles of mobility in Social TV. Finally, we describe the implication of such systems for practice and future research.

SOCIAL AND TECHNOLOGICAL ASPECTS OF MOBILE TV

This section explores the social and technological dimensions of TV and other related audiovisual media. In addition, we present a brief overview of technological support for TV sociability.

Social Value of TV

Although TV has been blamed for the reduction of social interaction within the family and the local community, there is a significant body of previous research that considers TV as a social medium, because it provides opportunities for shared experiences and group viewing. In particular, mobile phone applications that support sociability within families or distant groups might enhance the attractiveness of ITV as a leisure activity. This section draws on interdisciplinary literature and empirical research in order to raise the main research issues of the multiple roles of mobility within Social TV.

Despite the many criticisms on the quality of TV content and on the passive nature of the watching activity, the social uses of TV have been documented in acclaimed research (Gauntlett and Hill 1999, Kubey and Csikszentmihalyi 1990). It has also been established that viewers have adapted TV in many ways to meet their everyday life needs (Lee and Lee 1995, Rubin 1983). The findings of these works frame a set of opportunities for the design of social communication services in mobile TV.

The majority of previous research on ITV has over-emphasized the benefit of increased choice of content and of the interactivity with content. Instead, a worthwhile effort would be the fulfillment of seamless communication over, or about televised content. Such services could support human connectedness (Agamanolis 2006) over a distance (e.g. synchronous communication over a TV program between diasporic households), or enhancement of the shared experience that comes with TV co-viewing. For this reason, we explore an integrated view of the interpersonal communication together with the shared experience of mass communication.

There is a growing academic interest on Social TV systems, which consist of technological solutions for integrated interpersonal communication and content distribution. Although, there has been a significant body of computer supported co-operative work (CSCW) research on supporting interaction among geographically distributed co-workers, there is limited investigation in the context of leisure activities, such as TV. Similarly, research on interpersonal communication in the human-computer interaction (HCI) field has regarded video-mediated communication at work (Veinott et al. 1999). As a matter of fact, there is not much knowledge on designing applications for leisure or informal content enriched communication.

Cross Media Infrastructure

In the past, TV content in the living room has been provided either by broadcast, or optical discs. A basic ITV system includes a set-top box (STB) that decodes the signal and provides processing and storage capabilities that enable interactive applications. Nevertheless, the disagreement on a common open middleware platform has been an obstacle for the development of sophisticated interactive applications that are independent from the STB hardware. On the other hand, there is agreement over the specifications for the digital video broadcasting (DVB-S/C/T/H specifications satellite, cable, terrestrial, mobile). Furthermore, TV content can be efficiently distributed over peer-to-peer (P2P) networks. In this way, the variety of video content has been increasing with the support of new internet technologies, which allow new ways of distributing video (e.g. broadband connected TV set-top-boxes). Thus, ITV applications are neither limited to the traditional TV device and broadcast delivery, nor to the typical channels of satellite, cable, and digital terrestrial networks. Alternative and complementary devices and distribution methods should be considered, such as mobile phones (mobile DTV).

Social TV builds upon the convergence between different technological infrastructure, such as broadcasting, telecommunication, and internet. The convergence has been realized in different forms. On the one hand, Internet content may be accessed through television web browsers, or linked to ITV programs (e.g. interactive advertisements). Communication applications such as messaging, chatting, or voting during certain programs (quizzes, contests etc.) strengthen viewer's loyalty to the specific program. However, Internet access via television may disrupt current viewing patterns. Besides user interaction, at the network-level, internet connection facilitates video transfer over P2P networks. Moreover, the distribution of TV content over IP-based platforms, known as IPTV (Internet protocol TV), provides additional opportunities for the delivery of a wide variety of TV programming. In addition, 3G mobile networks could be used to distribute and control TV content.

Related Research in the HCI and CSCW Fields

One of the first approaches for a closer integration between TV content and social communication was the "Inhabited TV" research effort (Craven et al. 2000), which developed a collaborative virtual environment, where viewers could interact with other viewers or virtual objects. In this case, viewers were watching TV within the virtual environment and not within physical space. Thus, the TV experience was extended by enabling social interaction among participants and increased interaction with content. In an Inhabited TV application, the television becomes an actor and a part of a group interaction within a virtual online world.

There are various approaches to integrate social communication features into TV, such as chat, IM and email. There has been particular commercial interest on integrating the SMS into TV. Indeed, SMS TV is very popular, which is based on the familiarity with SMS and the availability of the technical infrastructure. Besides SMS services, there is a growing body of research and development, which is presented next.

Coppens et al. (2005) have reported the development of a 'Social TV' system, but their description focuses on the technical details, the features and the potential of the system for end-users. The 'Amigo TV' system provides a technological platform for integrating content delivery, communities, and interpersonal communication (Coppens et al. 2005). In addition, the content of the broadcasts can be personalized by sharing personal photos and home videos. Amigo TV supports online user meetings and buddy lists. Interpersonal communication is based on voice, text, and video formats, as well as animated avatars.

Regan & Todd (2004) describe a system for messaging over TV content. The Media Centre Buddies system integrated TV technology into an instant messaging application. The main aim was to allow multiple users to log into an instant messaging client that was running next to a TV channel.

User Generated and Distributed Content

TV content production has been regarded as a one-way activity that begins with the professional TV producers and editors and ends with post-production at the broadcast station.

As a matter of fact, television viewers have long been considered passive receivers of content, but a new generation of computer literate TV viewers has been accustomed to make and share edits of video content online. Furthermore, the wide-availability of video capture (e.g. in mobile phones, photo cameras) and easy-to-use video editing software (standard in many desktop computer operating systems), opens up additional opportunities for wider distribution of home made content (e.g. through peer-to-peer, portable video players, etc). User generated content and social communication about media content has been also proposed by Resnick (2001), who suggested that interactions could create productive resources, which he refers to as socio-technical capital. This capital may consist of artifacts created from the interactions or relationships and practices developed through repeated social interactions. Such capital can enable future social interactions.

Mobile media players transform the traditionally solitary media consumption into a social experience. Mobile and wireless technology open up opportunities for new interesting social practices, where media consumption and sharing can take place in a variety of social, physical and temporal contexts. Advanced mobile phones are equipped with digital cameras, multimedia processing and multiple mobile communication technologies (such as short or long-range, low or high-bandwidth). Since a mobile phone remains constantly with the user, it could potential store a large amount of details about social interactions. Then, search and sharing of media content could benefit from this social dimension of smart phones: the user could share audiovisual content with those related (in terms of place or terms of social proximity) without investing effort on selecting these people. TunA (Agamanolis 2006) is one example of a mobile application where users can tune in to eavesdrop on the playlists of nearby users and listen to the same music in a synchronized way.

Content Enriched Interpersonal Communication

Social TV systems offer one or more computer mediated communication features, which are closely integrated with the TV watching experience. Computer mediated interpersonal communication over distance, or over time could employ various communication modalities such as: (1) audio, (2) text, (3) video, (4), photos and (5) non-verbal cues (e.g. emoticons, avatars). We refer to integrated content and communication services as 'content enriched communication.' Content enriched communication over a distance refers to two types of sociability: (1) synchronous, when viewers get together and watch the same show at the same time and (2) asynchronous, when viewers interact after the show has already been seen by each one, independently and at different times. Communication between spectators is realized at two levels: (1) direct communication, such as chat or instant messaging and (2) indirect communication, such as cooperating in a team to win a quiz. In brief, there are four basic scenarios of Social TV (Chorianopoulos and Lekakos 2008):

- **Synchronous viewing over a distance:** This is probably the most interesting scenario, because the requirement it poses is to recreate the experience of co-located group viewing, when the viewers are located in two or more distant places. For example, distant viewers should be able to watch together popular social TV content, such as sports, quiz shows, series, reality shows. A good starting point is to consider ways to disclose presence and status of viewers, to continue with support for multiple interpersonal communication modalities (non-verbal most notably), and to summarize the social experience with automated highlight production, which could motivate further discussion and social bonding between the distant viewers.
- **Asynchronous viewing over a distance:** This a feasible scenario if we consider that distance viewers might have very different time-schedules, patterns of daily life activities, or even live in distant time zones. Then, the probability of synchronous co-viewing is rather limited. In this case, a Social TV system could record and share shows and viewing habits with the members of the social circle. In addition, a Social TV system should allow annotation of content and recording of interactions, such as pausing, skipping, replaying and content browsing. In this way, each time a particular TV program is accessed keeps a trace, which is exploited at the next access, in order to personalize the content and most notably to provide a motivation for asynchronous communication. This could be rather subtle, such as visual annotation of the content highlights, or could be more explicit such as audio and text comments.
- **Asynchronous viewing at the same place:** The main motivation for the development of Social TV systems is based on the need to bridge the distance between social circles of people, but there is also the case that co-located groups of people do not manage to meet as often as they wish for a social TV night. A subset of the functionality that was described in the previous case might be the most appropriate here.
- In addition to the above, Social TV designers should consider the traditional TV watching scenario, where a group of viewers gathers in the same place to enjoy a favorite TV program. Although this is a case that content enriched communication is least needed, there might worthwhile benefits in employing a Social TV system. In all cases, designers should consider extended functionality for user generated content. For example, the ability to upload personal music, photos and videos might be used to achieve communication through content. In particular, the automated production of personal TV channels that keep track of individual life streams captured with a mobile device (e.g. music, photos, personal videos) could be multiplexed with broadcast TV watching behavior. Indeed,

> Kubey and Csikszentmihalyi (1990) have found that everyday life experience is correlated with TV watching behavior. Thus, interpersonal communication could start with a screen displaying media use of each party during the past few days or hours. In practice, this scenario is rather feasible to implement, because the respective services have been very popular (e.g. YouTube, MySpace, Flickr)

Although mobile and social TV is thought to be suitable for the distant and synchronous communication scenario, there are several other opportunities. For example, multiple mobile terminals could be employed at the same place to control content on a shared big-screen. Moreover, user generated mobile TV content could be posted online and latter-on be annotated by other mobile TV users, when triggered by a particular location or other condition.

MULTIPLE ROLES OF MOBILITY

In this section, we propose three main directions of mobile TV research, and we offer suggestions for future research and market developments. Besides TV watching on-the-move, mobile TV has significant potential, both as a personal TV set and as a tool to establish a closer interaction with the television programs (e.g., TV voting).

Mobile TV as a Content Format

Digital mobile TV systems have been designed to complement mobile networks with broadcast and multicast capabilities for spectrum-efficient delivery of multimedia services on mobile devices in both outdoor and indoor environments. In particular, the DVB-H standard is based on the widely deployed series of DVB standards (DVB-S/C/T) and includes enhancements for mobile terminals, such as reduced power consumption and reception while on the move. Although the technical standards are suitable for mobile TV reception, it is clear that mobile TV prospects should be examined not as an alternative but as a complementary service to traditional living-room TV. This is because the perceived quality of TV on a mobile phone and the solitary experience are not the favored mode of watching TV, at least with regard to popular living-room content formats (e.g. TV series, sports).

For some time television has been the only major media format that has been missing from mobile phones. Technological advancements in wireless broadband (e.g. WiFi, 3G, 4G, DVB-H) and multimedia mobile terminals (e.g. multimedia mobile phones) have made a reality the reception of digital TV on the move. The distribution of TV content to mobile devices over broadband wireless raises the issue of video quality. Video quality depends on many aspects of the video encoding systems, such as bit rate and algorithms that model human perception of video on small screens. Most of the research on the effect of screen sizes in the field of consumer electronics has examined the impact of increasing the image size in the viewer's visual field by means of large physical displays or projection areas. The results show that larger image sizes are more arousing, better remembered, and generally preferred to smaller ones (Reeves et al. 1999).

There are many services that aim to provide users with audiovisual content while on the move. Although many of these services sound appealing, the end-users' subjectively perceived quality is an important factor for their success. The properties of video quality have many similarities between the different application domains (e.g. internet, broadcast), but the characteristics of mobile devices define a special set of constrains. The biggest differences to other application domains are the limited bandwidth, which leads to high-level requirements of compression and the limitations of the mobile devices such as display size, power resources, processing capabilities and memory. In addition, the wireless transmission of the content is error prone. Accordingly, the production of video under these special requirements should regard the possible distortions in the subjectively perceived quality (Knoche et al 2008). For this reason, subjective quality evaluation tests during product development are necessary, in order to ensure acceptable quality of service. In particular, the subjective quality of service for mobile TV depends on the perceived audio-visual quality of the consumed content and the interaction through which the user has to go to access it (e.g. the delay between selecting content and start of play).

Further research in mobile TV should investigate authoring tools that enable automatic post-production of video that is targeted for viewing on the move. Currently, mobile service providers encode and deliver existing broadcast material and interactive applications without additional editing, because it is more cost-effective than re-editing. Future research should improve on intelligent cropping mechanisms that present only a part of the original shot. On the application side, cross-media multimedia authoring tools should consider the diversity of screen formats and sizes in mobile devices. Besides content adaptation, further research should investigate the uses of user generated content and provide templates that facilitate creation and distribution (sharing) of end-user content.

Mobile TV as User Behavior

Early studies on user behavior and mobile TV systems have indicated short watching sessions (Södergård 2003), which are suitable for particular TV genres, such as news and sports highlights, and music videos. More recent research by the same group (VTT, Finland), has tracked the evolution of mobile TV usage (Oksman et al. 2007). They have identified that in mobile TV there is no prime time, only 'prime place', such as while commuting.

In contrast to living-room TV sets, which are shared displays for audiovisual content, mobile phones are natively social devices. Since their introduction, users have learned to use them as social connectivity tools, with voice-calls and text messages as basic functions. Therefore, the mobile TV user behavior might be shaped by established practices of interpersonal communications over a distance. Indeed, researchers have identified that for some users mobile TV might be a rather personal activity (Cui et al. 2007). In particular, they have identified that mobile TV is employed to privately watch content, at places and situations that are not socially appropriate for TV watching (e.g., business meeting, school lectures). They have also reported that mobile TV is also employed at home, when other TV sets are employed for different programs than the ones preferred by the mobile TV users.

Mobility means that content consumption takes place in various dynamic mobile contexts e.g. on the go, in the bus or at work, a direct contrast to the static embeddedness of living-room TV. Mobility thus means limited attention spans, but with increased user readiness for interruptions and interaction. Furthermore, mobile displays are considerably smaller than living-room screens. The consequence of these contextual factors is that static TV is superior in creating immersive, passive media experiences. Mobile TV might never be able to lull people in the same way as high definition television, but on the other hand it allows for more interactive and intimate experiences. Although there is a significant body of research on sharing content such as photos and music through desktop and mobile media, there is not much research on video sharing and content enriched communication through mobile devices (Schatz et al. 2007). Therefore, further research should consider the practices of sharing user generated video content.

Mobile TV as Interaction Terminal

Mobile phones include some kind of standard and familiar input and output facility. The most common input device on a mobile phone is a simple numeric keypad, a few function keys and navigation keys. In short, in terms of input capabilities, a mobile phone is very similar to a common TV remote control. Some contemporary phones have removed the numeric keypad in favor of a larger touch screen, which might dynamically render a numeric keypad or many any other input arrangements depending on the application. Moreover, mobile phones feature media rich output capabilities, such as full-color high-resolution (in comparison to size) screens and audio support. As a matter of fact, the output capabilities of contemporary mobile phones are equal or better to early TV sets. In addition to user input and output devices, mobile phones have several data networking capacities. Text messages are a common standard in mobile phones and they have been successfully exploited by TV channel operators as voting and chatting input devices.

The use of the input and output facilities of mobile phones as alternative communication channels for TV programs (e.g. voting, chatting, TV on the move) has been a straightforward and expected development. Cesar et al. (2007) has explored the use of mobile multimedia touch screens to augment the living room TV experience. They have demonstrated that besides remote control, personal mobile terminals could provide additional content, as well as annotation of content. Mobile TV broadcasts transmit content to all mobile terminals within the footprint of a base-station, which is relatively narrow when compared with terrestrial broadcasts. The presence of multiple base-stations is the main advantage of mobile broadcasting, because the content could be personalized to fit both the terminal and the context of use (e.g., time of the day, geographic location).

CONCLUSION

Mobile and Social TV applications could be feasibly offered through triple play infrastructures, which combine content delivery, voice, and data services. In this way, the network operator can provide interaction between the TV viewers on TV channels using an interactive broadband link. Triple-play services have been introduced on the assumption that telecommunication, content and data services could be delivered over the same technological infrastructure thanks to the convergence of the respective technological platforms. Although the convergence of previously distinct technological platforms is a significant benefit both for consumers and service providers, there are also additional benefits from a closer integration of platforms at the user-level. Content providers could be benefited by metered communication services, while telecom providers could be benefited by content distribution. In both cases, the users could gain access to intuitive content enriched communication.

In addition, mobile DTV infrastructure offers many opportunities for converged personal communication and content services. In particular, the availability of broadband wireless technology is rather suitable for the delivery of content enriched communication services (e.g. active content sharing, synchronous co-viewing or asynchronous notifications over a distance, discussion and annotations about shared content). Wireless network operators have invested in broadband licenses and infrastructures, but most of the services offered are only video communication, or only video on demand. The introduction of content enriched communication services is a worthwhile direction, because it offers an excellent balance between the basic need of users to communicate with a mobile device and the need of network providers for increased revenue by added value broadband services, such as mass media content distribution.

In summary, multimedia phones are essential elements of the next generation of Social TV services. They are established social connectivity providers, personal media interfaces, content capture and sharing tools, and thus complement stationary interactive TV setups very well. The proposition of mobile TV has a major difference with the analog predecessor. Most notably, it has the potential to offer localized and interactive programs and not just the same broadcasts as seen in living-room TV. In conclusion, while counter-intuitive to many, the activities that happen during television watching can be a very sociable. Therefore, the ultimate objective is to develop technological support and content for the social practices that surround mobile TV viewing, while retaining the centrality of TV as a leisure pursuit.

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This work was previously published in Social Interactive Television: Immersive Shared Experiences and Perspectives, edited by P. Cesar; D. Geerts; K. Chorianopoulos, pp. 244-253, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.6

From 2BeOn Results to New Media Challenges for Social (i)TV

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ABSTRACT

This chapter focuses on traditional and emergent challenges for the Social (i)TV area focusing on explaining the development and evaluation of one of the first Social iTV prototypes and looking at the challenges new media is introducing to this research field. The authors begin by explaining the conceptualization, development and evaluation process of the 2BeOn system and continue with the most important results from it's evaluation with a particular focus on the results that can be important when developing any Social iTV platform. In the last part of the chapter recent developments in the broadcast of TV and Audiovisual content, namely considering the Internet as a medium, are addressed. In this scope authors propose a categorization of emergent online distribution platforms along with a set of social activities users perform on those platforms. Taking in consideration some of the challenges surrounding the presented scenario the chapter ends with the conceptualization of UMCA, a system that could increase social interaction activities performed during the consumption of online AV/TV content.

DOI: 10.4018/978-1-60566-656-3.ch013

SOCIAL (I)TV: PROGRESSES AND CHALLENGES

Interactive television platforms that promote services aimed to support socialization practices around TV viewing, acting as a kind of "social glue" (Light, 2004), are at the core of Social (i)TV research (Harboe, 2007). Despite the introduction of the first iTV systems with real time communication services being considerably recent, it is interesting to notice that a considerable amount of research as been done in this area. Since the year 2000, with AOLTV being the first commercial iTV system integrating an Instant Messaging service (Kawamoto, 2000), there have been a number of iTV conceptual models, prototypes and systems that enriched this concept adding user awareness in relation to what others are watching. This type of presence/information, besides enabling a feeling of togetherness, opens up several interaction possibilities among users of an established social network: a user can alert his buddies to something interesting that is on air or simply peep at what others are watching and start a conversation based on a common TV content, no matter their geographical location. In this context, numerous developments have emerged, such as: 2BeOn—University of Aveiro (Abreu, 2002); Reality IM—Accenture Labs (Chuah, 2002); Amigo TV—Alcatel (Coppens, 2004); Social TV—PARC (Kharif, 2005), Social Software - described by Coates (2005); ConnecTV—TNO (Boertjes, 2007); CollaboraTV—AT&T (Harrison, 2007); Find-A-Friend - University of Siegen (Heß, 2007); Living@room—CSP (Andrea, 2007).

However, even with this considerable number of prototypes, applications and related research, there are still a lot of open questions, being Social (i)TV far from a fully explored area. In the following sections, and based on the experience gained with the 2BeOn prototype, some answers to the following topics are addressed:

1. Considering the different sociability practices promoted by television viewing, what are the communication, presence and content sharing services for a suitable mediation of those activities in an iTV system?
2. As the interface design of a Social iTV application is a central piece to achieve its' proposes, what are the fundamental issues in this domain?
3. How to evaluate a Social iTV application in order to find out if there is a correlation between users' digital literacy and: (a) learning curve; (b) the suitability of the application to support and promote interaction between viewers allowing an increase of the communication frequency; (c) the users' wish to make use of such an application.

Taking into account the ever-increasing sociability practices that arise from the current use of AV (audiovisual) distribution platforms (for both PC and mobile based devices), this chapter also focuses on the techno-social context in which users are currently sharing AV content and interacting through it.

THE 2BEON SYSTEM

The 2BeOn system was conceptualized, prototyped and evaluated with one main goal: to support and promote interaction between viewers, enabling an increase of communication and sociability practices (Abreu, 2007). Users involved in the evaluation of the prototype were not restricted to members of an existent social network (e.g. friends or family members), since viewers that did not know each other but that were in tune with the same TV content were also considered.

As stated by Gray (1992) *"A very important part of the pleasure of television serials is to gossip about them the following day."* (Gauntlett, 1999, p.128). In this context and in parallel with its main goal, 2BeOn aims to capitalize the TV ability to induce conversations, strengthen sociability practices and enable a new form of TV enjoyment in a virtual, nevertheless collective, viewing environment.

Conceptualization Process

The conceptualization process of this application was based on a theoretical framework[1] (mainly centred on sciences and technologies of communication) in order to define a set of functional requirements needed to support viewers' social practices. These include commenting, criticizing or gossiping about TV content, in real time or after the broadcast (Dahlgren, 1995); warning someone of a TV program being broadcasted; or sharing AV content. At this stage of the development process, a central issue was the identification of these typical communication practices around TV content and the evidence of emergent transmedia and multitasking behaviours, like using PC mediated communication services while watching TV (Lafrance, 2005; Oumard, 2008).

Design Guide Principles

The aforementioned theoretical contextualization also reflected about behavioural aspects of viewers (the main users of the application); visualization patterns; and television's technical constraints, in order to supply relevant inputs to establish a suitable set of Design Guide Principles (DGP) for iTV interfaces. These DGPs (21 in total), which were applied in the development of the prototype, can be arranged in the following 3 categories based on their impact at:

- Functional level (based on behavioural factors, such as attention levels to the TV set, predisposition for interaction and social contexts of visualization).
- Graphic design.
- Interaction design.

Main Features

Awareness about user status and channel viewed is of great importance to enable a feeling of togetherness and to promote interaction between known viewers. The role of such presence mechanism is even more important in the current scenario of TV audience fragmentation and ever-increasing individual TV consumption. As sustained by Chuah (2002), this kind of information can have the ability to change the motivation for the selection of TV programs, it being based not only on their content but also on the social context surrounding it.

One necessary feature of these awareness systems is the possibility of guaranteeing users' privacy. When the user does not want others to be informed about the current TV channel he is watching, he can simply "block" that particular channel. In this situation the users' status changes automatically to "busy"—the same status when he is performing other tasks, like instant messaging, reading messages or managing his social network. The portability of personal information was also guaranteed allowing users to login in the application wherever they were.

The support of informal interaction between known users was based on 3 services:

1. ClipEmail used for sending short alerts
2. IM designed to support longer real time conversations[2]
3. TVPR (TV Program Recommendation).

Communication between unknown viewers and identification of matching telly profiles was also considered, since occasional conversations about TV also occur between unfamiliar people and affinities might emerge among unknown viewers sharing the same type of TV consumption. For these purposes a TVChat service (whereas chat rooms are in sync with TV zapping) was implemented and a search tool for matched television profiles was conceptualized.

These features have been grouped into 4 sections of the system:

- FriendsOn - buddy list and access to IM, ClipEmail, TVPR and Email services;
- MsgOn - management of incoming messages while offline or busy;
- ChannelsOn - management of channels and access to the TVChat service;
    - + FriendsOn - management of the social network.

Figure 1. 2BeOn main menu (left) / zoom of FriendsOn interface—start of an IM communication (right)

The Development Process

Since the beginning of this research it became clear that it would be necessary to outline a strategy for demonstrating the sociability concept of the application to a group of pilot users, in order to try and test its functionality and interface approach and to determine its acceptability level. This is the global goal of a high-fidelity prototype (Chorianopoulos, 2004).

The prototype development was carried out based both on a functional and a technical dimension (Strauss, 1997), targeted at fulfilling the identified functional requirements.

The functional dimension comprised the design of the graphical and interaction user interface, which was assisted by the achieved set of DGPs (based on behavioural, technical and usability factors) and interaction storyboards. The main communication strategies, choice of colours, fonts, iconography, spatial distribution and other graphical elements of the interface were also defined at this stage.

Some of the solutions that were applied, based on a sample of DGPs, are shortly described here, since they can be of value for the development

Figure 2. automatic dimensioning of the IM interface: normal size (left) / expanded field text (right).

of other iTV applications (for details please see Figure 1 and Figure 2).

Considering DGPs with impact at the functional level, it is necessary that the application is set to:

- *Different levels of users' attention to TV program*—it is important to consider the situations in which the user, consciously or not, reduces its level of attention to television programs. Adopted solutions:
    a. sound alerts were incorporated to catch the user's attention to special events.
    b. based on the user's typing frequency, when using the IM service, the interface (with an embedded layout) is dynamically dimensioned. This way, as the typing frequency increases, the text field expands and the TV area shrinks and vice-versa.
- *Predisposition for interaction*—the application must be designed so that users don't feel forced to interact and perform tasks (Peng, C., 2002) allowing the interaction to occur only when wanted. Adopted solutions:
    a. any communication by instant messaging is preceded by an invitation. Thus, the user can easily refuse the beginning of an interaction.
    b. if the user does not login he can watch regular TV, that is, without any interactivity. If logged on he can define himself as being offline, simply by pressing a dedicated key on the remote.
- *Different social contexts of visualization (individual or in group)*—in a situation where the user is not alone in the room there are several factors to consider. It is required to ensure privacy (for example, preventing that messages addressed to him are viewed by all) and it is also required that his interactions do not mix with other elements being watched. Regan (2004) also addressed this problem from another perspective. Adopted solutions:
    a. a family/group account was implemented so that the user can login with a contact list based on people known to all elements of the group.
    b. conceptualized, yet not fully implemented, was a feature that allowed the user to choose to have his messages directly displayed on the TV set or, for example, to be redirected to his mobile phone. This solution fits in the secondary screen approach, which has been used in a number of different iTV prototypes, more than a decade ago, as described by Cesar (2008).

Regarding some of the DGPs that influence graphic design, the interface must be designed in order to:

- *Avoid irrelevant information*—given the limitation on the amount of information that can be displayed on a standard definition TV set, it is advisable to limit the maximum number of selectable icons that are available at the same time on the screen. Adopted solutions:
    a. limitation of the number of icons in each screen to a maximum of 4, which also allowed to trigger them through the chromatic shortcuts of the remote.
    b. use of colour codes to differentiate users status (online and offline) and privacy of channels (active and blocked channels).
- *Give primacy to television programs*—it is essential to preserve, as much as possible, the integrity of television content in order to guarantee traditional television experience. Thus, the interface must be designed and positioned to obstruct as less television images as possible. Adopted solutions:

a. positioning of the logo and interaction menus in the right upper corner of the screen.
b. vertical placement of menus.
c. use of overlaid and embedded interface layouts.
d. automatic scalability of the IM interface.

Finally, there are DGPs with impact at the interaction design level, pointing out that the application needs to fit to:

- *User interaction adapted to television*—it is not accurate to assume that users of iTV platforms have high digital literacy, so interaction with TV should avoid typical PC navigation/interaction patterns, like drop-down menus and vertical scroll of pages (Gawlinski, 2003). Adopted solutions: The initial purpose of using a remote control acting like a mouse was quickly abandoned and replaced with:
  a. chromatic keys—shortcut buttons to activate screen icons matching the same colour.
  b. standard orthogonal cursor—the selection area activates, for a brief period of 2 seconds, on screen labels linked to each icon.
  c. reserved keys for some special features.
- *Optimization of the navigation experience*—by reducing the number of steps needed to perform a particular action and keeping the response time below one second. Adopted solutions:
  a. prediction and anticipation of the next interaction.
  b. automatic sorting of contacts and channels lists, based on the frequency of communication with each of the contacts and viewed channels.

As far as the technical dimension is concerned (which addresses the design of the hardware and software architecture that supports the required features), its development was assisted by block diagrams of the architectural modules and flowcharts correlated with the interaction storyboards. The prototype was not based on a commercial middleware; instead, Macromedia Director was used with PC clients (running as Set Top Boxes) connected to regular TV sets via VGA to PAL adaptors. Two components or plug-ins were essential: BuddyAPI (which allowed the control of the TV tuner application) and WinShapper (used for the definition of transparent areas supporting both overlaid and embedded interfaces). For more details on other technical solutions please refer to Abreu (2002).

The Evaluation Process

At the time the 2BeOn prototype was developed, published iTV evaluation methodologies were very scarce and mainly based on traditional usability engineering concepts and methods (Chorianopoulos, 2004). With the growing number of available Social iTV solutions, there is an increasing need to understand how these systems should be evaluated, both from a technical point of view and HCI and Social Sciences perspectives. In this scope and despite current publications like Chorianopoulos (2006) it is believed that the methodology used for the evaluation of 2BeOn can still be a relevant contribution to this area.

The goal of the 2BeOn evaluation phase went beyond simple usability tests. Actually, it was aimed to enable regular users with an adequate level of hands on experience with the system, so that it would be possible to extract a wide set of results. This purpose meant, therefore, a set of 3 goals that the evaluation was intended to attain, namely:

1. Validate the usability of the prototype, to check if the various functional solutions were

suitable and if they ensured a straightforward use of the system. This goal was mainly centred on the verification of the proper operation of the DGPs in order to analyse potential correlations between demonstrations of dissatisfaction from evaluators and technical implementation errors.
2. Evaluate the conceptual model of the system and the suitability of its functional solutions. This second goal implied the validation of the various hypotheses that sustained the main functional requirements. It also aimed to identify the user's level of interest regarding future use of such an application.
3. Synthesise a number of opinions and suggestions, raised by the use of the prototype, to enable future improvements.

Considering these goals, the evaluation process was structured in three distinctive, but complementary, phases (each with its purpose, method and tools)—see Table 1 and Figure 3.

Evaluation Results

1st Goal: Usability of the Prototype

The validation of proper use of the DGPs was made from the analysis of results gathered by different combinations of the aforementioned instruments (tools) for data collection. Exemplifying, the solutions adopted to face *different levels of users' attention to TV programs* were verified by two questions on the final questionnaire, one in the interview and through the observation tables.

Only two minor problems related with two DGPs were detected. These are here described to show their importance on the usability of the prototype. They regard the solutions adopted to:

- Face different levels of users' attention to TV program—the volume of the sound alert linked with the incoming messages was to low, so some of the received messages were not immediately detected.
- Guarantee the consistency of the interface—a mismatch in the colour of the exit icon in two services resulted in an inconsistency and consequently in some interaction errors.

Correlation Between Users' Digital Literacy and the Usability/Learning Curve

Considering the mean time spent by each group at each of the 3 evaluation sessions and the mean number of uses of the "back" key, it was possible to observe: (Figure 4)

- An evidence of a correlation between digital literacy and ease of use in a first contact with the prototype (users of the EXP group took less time).
- A stabilization of the learning curve as sessions progress - evaluators with different levels of digital literacy tend to have, after some practice, identical levels of ease of use of the prototype.

2nd Goal: (a) Validation of the System's Conceptual Model

Based mainly on the analysis of the final questionnaire and the interview it was possible to conclude that all the research hypotheses that sustained the main functional requirements proved to be valid.

2nd Goal: (b) Achievement of the Main Objective

This refers to the evaluation of the suitability of the application's features in supporting and promoting interaction between viewers, enabling an increase of communication and sociability practices. It was

Table 1. Evaluation process

Phase 1	
Purpose:	to characterize a broad range of potential users (TV viewing habits and dynamics of communication around television) enabling the selection of three groups of non-expert evaluators with different levels of digital literacy. This allowed the application of a causal-comparative methodology with a non-probabilistic sample.
Method:	quantitative and qualitative analysis of the gathered data.
Tools:	questionnaire, enabling the selection of 3 groups of 5 evaluators with the following levels of digital literacy: low (first year students attending the course of Pre-School Teachers) - EdI; average (2nd year students attending the course of New Communication Technologies) - NTC; high (professionals in the area of information and communication technologies) - EXP.
Phase 2 (this phase occurred in two stages)	
Stage1 (3 non-consecutive sessions for each group of evaluators)	
Purpose:	to supply a substantial and uniform knowledge of the prototype (through the interaction with a remote moderator performing a series of tasks presented by a local assistant) and to test usability analysing the evolution of evaluators' performance (learning curve), throughout hands on sessions (Preece, 2002).
Method:	Journaled Sessions (Hom, 1998).
Tools:	internal mechanism for the registration of the evaluators' interactions; synchronized recording (video - what was happening on the screen; audio - evaluator's verbalizations during the evaluation of the prototype); opinion screen (that appears at the end of the session, inviting the evaluator to write down his opinions); and direct observation (using observation tables filled in by a local assistant).
Stage2 (at the end of the 3rd session)	
Purpose:	to allow free use of the prototype, in a close simulation of a real environment; verify the sort of actions and reactions that evaluators (who already knew the prototype) assumed in these conditions.
Method:	this stage started with a small set of interactions to integrate all evaluators in a similar situation. From then on the moderator remotely promoted the use of the application and evaluators did not have to follow a script of tasks. The assistant examined the type of problems evaluators faced.
Tools:	the tools for data collection were the same used in the first stage of this evaluation phase.
Phase 3	
Purpose:	to check the opinion of evaluators on qualitative factors of usability, suggestions and their level of interest regarding a future use of the application.
Tools:	final questionnaire and interview.

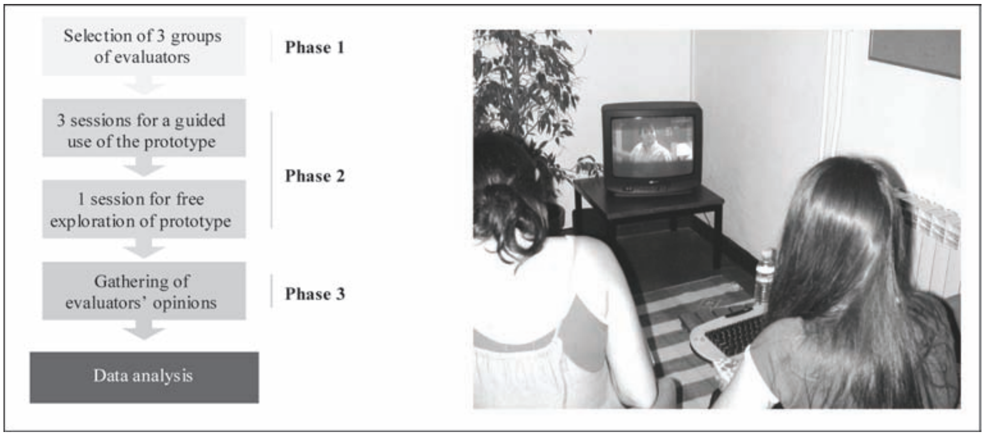
possible to conclude that:

- Information of presence (status and TV channel) acts as a catalyst of communication - most users agreed that, having this type of information from their contacts (in the FriendsOn section), they would have a higher propensity to start a conversation. This can be either encouraged by the fact that users detect they are watching the same channel of the person to be contacted, or by the need to alert about something they find interesting. (Figure 5)

Some evaluators said this type of awareness also gave them a feeling of comfort and togetherness, stating, for example, that:

"it creates proximity..."—Evaluator NTC-C;

Figure 3. 2BeOn evaluation phases (left) / hands-on sessions during phase 2 (right)



"Maybe comfort in knowing that a person is not alone (…) know that there is someone there who is in the same situation"—Evaluator EdI-E.

- IM and TVChat were the services users found to be more suitable to support interpersonal communication (classified as "high" support). ClipEmails and the feature for sending TVPRs were classified as "middle" support. (Figure 6)
- IM and TVChat use was also considered to be very compatible with television reception with minor intrusion on the attention to the TV program.

"I can monitor both (communication and television) perfectly"—Evaluator EdI-E.

- Users were also asked to predict the level of distraction to TV reception if voice communication was used instead of text messages. It is important to notice that on average they all said that text communication was less distractive than voice would be and only one of the evaluators agreed with a future integration of voice communication in the system. (Figure 7)
- Most evaluators, when asked if they would speak more about TV content with a Social iTV application like 2BeOn, answered that

Figure 4. The progress of the average time spent per session

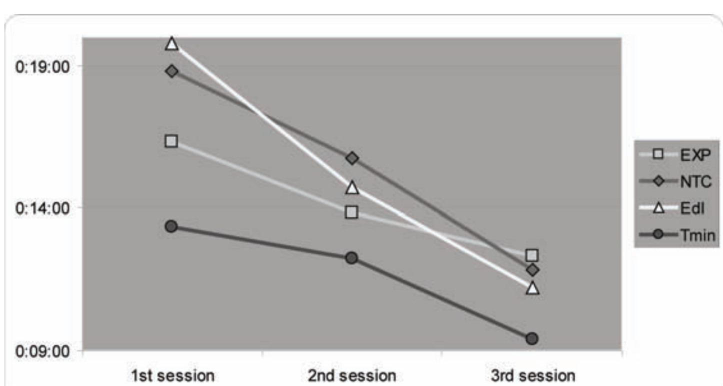
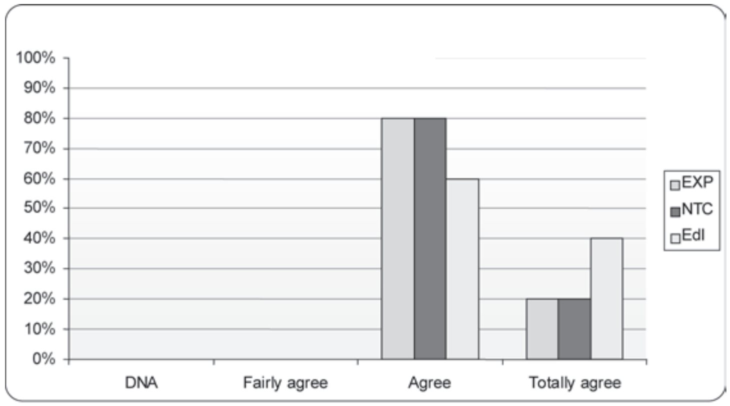


Figure 5. Influence of the information in section FriendsOn as a catalyst of conversations



they would do it up to four times more than without such an application. (Figure 8)

- Regarding the user's level of interest concerning a future use of such an application, very positive answers were given. 80% of the evaluators of NTC and 60% of the evaluators of the groups EXP and EdI expressed having "great interest". Comparing the answers given before and after the use of the prototype, a relevant change in opinion was observed, with an increase of 40% in the option "high interest". (Figure 9)

Correlation between Users' Digital Literacy and the Suitability of the Application to Support and Promote Interactions and to Increase Communication Frequency

Regarding the suitability of the various communication services there were no significant differences between different groups of evaluators. However, considering the predicted increase of conversations expected by having an application like 2BeOn, the evaluators with the lowest digital literacy where the ones that predicted higher increases.

Figure 6. Classification of interpersonal communication support by various services

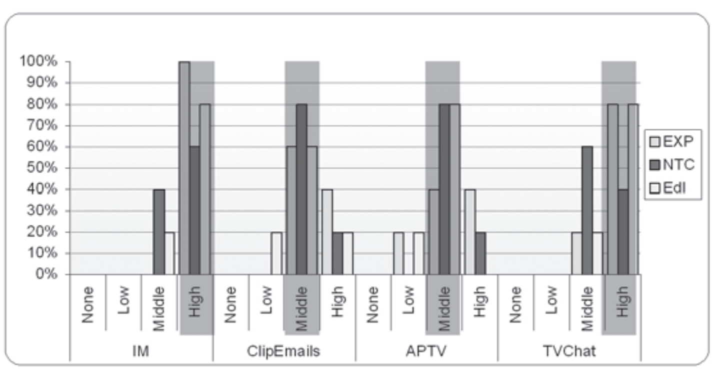


Figure 7. Prediction of distraction on the attention to the TV program if voice was used instead of text communication

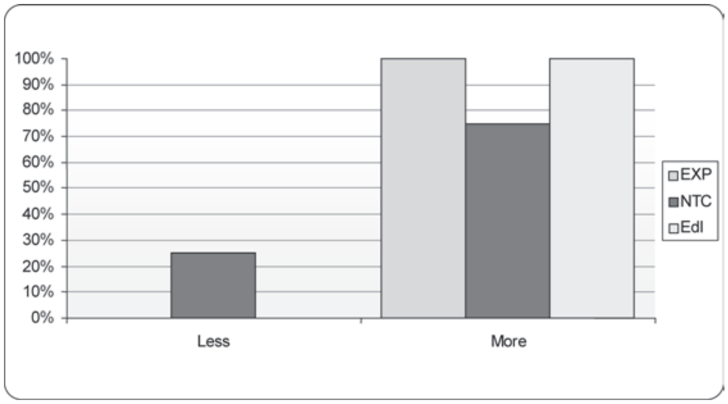


Figure 8. Prediction of the increase in conversations about TV content using 2BeOn

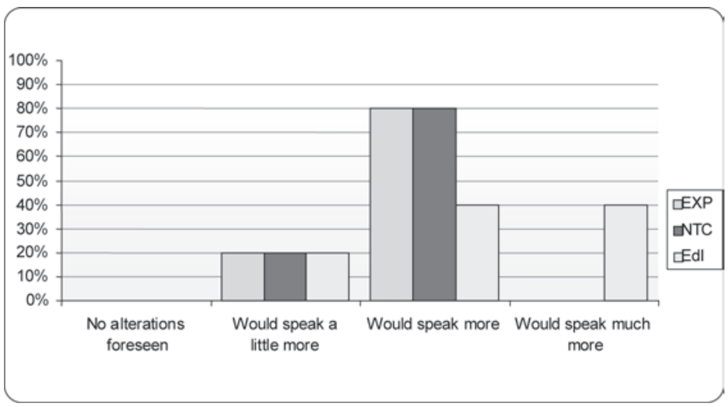
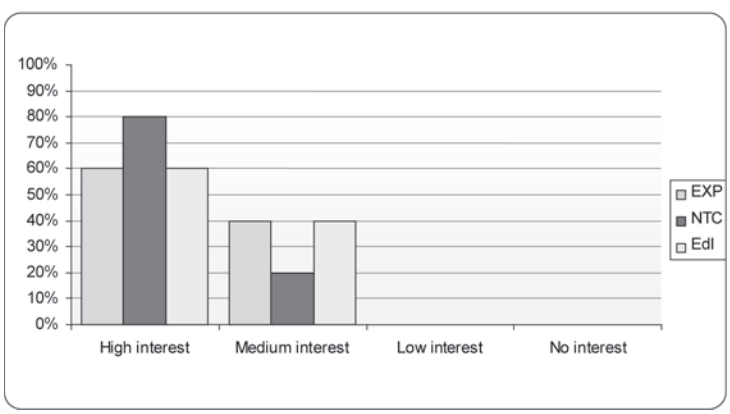


Figure 9. Level of interest, shown after the use of the prototype, in an application like 2BeOn



Correlation between Users' Digital Literacy and the Users' Wish to Use Such an Application

The results gathered allow predicting that, regarding the evaluators involved in the evaluation process (that are, within certain limits, a reflection of a generation between 19 to 31 years), there is a considerable interest in using this kind of Social iTV applications. However, no differences were detected between evaluators of different groups (with different levels of digital literacy).

NEW BEHAVIOURS AND PLATFORMS FOR SOCIAL (I)TV

The results from the 2BeOn evaluation along with results from other similar research projects show that users are willing to talk about the TV content they consume, and are ready to do it while they watch it. But before (a possible) widespread penetration of these kind of social features in iTV platforms occurs, users are already socializing, in large scale, using PC based AV distribution platforms or using other communication tools in parallel (like IM in PCs) while watching Webcasts or regular TV. Leurdijk (2007) and Lafrance (2005) refer not only to the ability of young people to multitask but also to consume different types of media simultaneously. Oumard et al (2008), in their ethnographic study, also concluded that "*Internet video consumption is already strongly integrated in social communication*".

In this part of the chapter a description of these emergent scenarios, its tools and levels of sociability are described and a proposal for increasing social interaction around multiplatform distributed AV content is presented.

Where Users are Watching TV Content?

The online developments in Audiovisual (AV) distribution have been fast and diverse, mainly after the YouTube boom in 2006 and 2007.

Today, we can find multiple formats of platforms that broadcast AV content and promote different levels of participation for users. Some of the available platforms can be classified under the following categories:

- **You Tube like and User Generated Content (UGC) distribution platforms:** The YouTube like platforms are very popular and have been widely used for individual upload (UGC). But these platforms are also used for creating institutional, well planned and full budget broadcast channels, as it can be verified by the U.S. presidential campaign and the candidates' channels created in YouTube[3]. The media consumption in these platforms is very significant, as 75% of Internet users in the U.S. watched, in May 2007, more than 2,5h a month of online video (Lipsman, 2007). A report from Pew Internet shows that 27% watch videos from You Tube, 11% from Yahoo Videos and 6% from MySpace (Madden, 2007);
- **Stream+peer-to-peer platforms:** Joost is probably the most well known service of this category of TV distribution platforms. Using a combination of streaming video server and a peer-to-peer architecture, these platforms allow good video quality providing some popular (traditional) TV channels to be viewed in the computer along with some social and communication features. Babelgum and Zatoo are other important examples;
- **Online TV with UGC platforms:** Broadcasting powered by Internet platforms is no longer an exclusive of traditional media channels. Current Tv, Mogulus and Veoh TV, just to name a few, propose different online TV channels with some own production but mainly allowing users to contribute with their shows. These platforms are distinct from the You Tube like platforms by selecting the content to

go online and presenting it in a pre-ordered playlist;

- **Online AV content archives and stores:** One example of a popular online music and video store is iTunes, being BBC iPlayer another important platform;
- **Other:** Other platforms with specific characteristics allow users to have easy access to AV content. Examples are SopCast and TV Ants (peer-to-peer TV channels streaming applications) or Messenger TV (like other IM applications with A/V support it allows users to share and watch a video while commenting on it. Examples of these tools are later described in this chapter).

What About Social AV/TV Features?

Some of the platforms described in the previous topic were not originally designed with support for collaborative social media consumption. However, with the emergence of Web 2.0, many of these platforms have been upgraded with awareness, collaborative and communication features that support a set of social activities. These activities include:

- **Rating:** Classifying the video content quality and helping other users decide to watch it or not. The classification can be completed with comments associated with a video or channel. 13% of video consumers do this (Madden, 2007);
- **Forwarding:** Recommending a video content or TV channel to friends by sending the URL via email. This activity is very popular as 57% of video consumers on the Web share recommendations with others (Madden, 2007). As stated by Oumard (2008) some users even bookmark videos for future recommendation, engaging in chat/IM sessions around the video content;
- **Embedding:** An indirect recommendation feature by promoting the re-broadcasting of a video content in a blog or other platform;
- **IM or Chatting:** Some platforms allow users to chat with others watching the same channel or video content. Joost also allows users to talk to friends even if they are not tuned in the same channel;
- **Collaborative production:** The users' participation related to a TV channel or video content is not limited to the discussion or recommendation about content produced by others. The user can now be an active part in the production process. Current TV, Mogulus and other platforms allow users to create their own collaborative channel or send their programmes to be broadcast (if accepted) in the official channels.

These examples from Mogulus show that users can easily create their own channels using regular webcams and feeding them with the collaboration of others around the world. Al Gore, co-founder of Current TV, stated that they are trying to open the television business in order for viewers to be able to do television (Ribeiro, 2007).

Figure 10. The set of Joost widgets available for interacting with content and other users

Figure 11. The home-page of Mogulus showing some of the collaborative channels available (left) and the online editing tool (right).

As a Pew Internet (Lenhart, 2007) report states, "*The posting of content does not happen in a vacuum. Content is posted so that it might be seen by an audience (...). And often that audience responds to the content posted online, making the content as much about interaction with others as it is about sharing with them*" (p. 15). The same report confirms that Internet users that share their own content online (39% of online teens) are more active communicators. (Figure 10 and Figure 11)

Challenges

These data concerning the use of new AV distribution platforms and the social activities of a "new" Internet generation of users bring out a new set of challenges when referring to Social (i)TV or, in a broader analysis, to social practices surrounding AV content:

- It is harder to have a specific content at a specific time as a common referential to viewers;
- Each platform offers its own social features, usually not compatible with each other;
- Users can have similar AV content consumption but watch it in different platforms and terminals (PC, TV, mobile, …);
- Users are now content (co)producers, searching for new ways to interact or influence content. As Leurdijk (2007) refers "*broadcasters' endeavours could also lead to highly valued new services for a general audience, (…) to new and fruitful exchanges between professional and amateur programme makers (content producers)*" (p. 94).

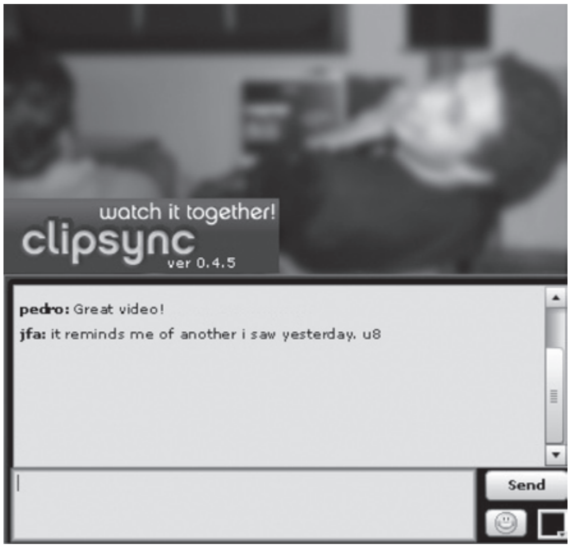
These challenges have restricted the Social AV/TV support in web based platforms to asynchronous tools. Users comment, forward, rate or discuss a video content in an asynchronous way precisely because they can watch the same content in any platform at any time. But what about synchronous Social AV/TV features? Platforms like Joost and a new set of applications are now offering some interesting features.

Tools for Supporting Synchronous Social AV/TV Activities

Recent developments have revealed some tools that promote Social AV/TV features for PC based users, such as the ability of different users to watch the same video collaboratively.

Some of the most relevant applications include:

Figure 12. The ClipSync interface[4].



- YouTube Streams (http://www.youtube.com/streams_main)—this feature from You Tube allows users to create rooms with their selection of videos (from YouTube of course), share these rooms with others and chat about them. It does not allow synchronization between users but allows different levels of participation such as the ability to add videos to the room;
- You Tube—Active Sharing—this feature allows users to know who is also seeing the same You Tube video. It does not provide features to manage a list of buddies or synchronous communication features to interact with other users.
- ClipSync (http://www.clipsync.com/)—this Flash based tool also allows creating and hosting rooms/sessions with video playlists (from different sources) and chat about them, but it adds some important features. It allows the synchronization of playback with the participants in the session and allows the integration of Skype friends lists; (Figure 12)
- Messenger Zinc—a plug-in for the Yahoo IM service, introduced in 2007. This plug-in provides the ability to integrate a video player in the IM application allowing to share a video from popular video sites (like YouTube) for collaborative and synchronized viewing with others (Shamma, 2008);
- Microsoft Messenger TV—this new feature from Microsoft, introduced in May 2008, is part of the company's efforts to promote social video, using, in this case, the Windows Live messenger. It allows

Figure 13. Microsoft Messenger TV—a social video tool[5]

users to watch videos together from the MSN video service and chat about them. (Figure 13)

THE USER MEDIA CONSUMPTION AWARENESS SYSTEM (UMCA)

If all AV viewers had Joost, a Social iTV platform like 2BeOn, host the same room/session in a social video tool or all had a compatible iTV system, it would be easy to conceive that one could check what one's friends were watching and interact with them based on that referential.

But in online video platforms, considering their huge numbers and diversity[6], it is hard to track what your friends are watching and promote instant interaction based on this. Messenger TV or Zinc allow users to share an AV consumption session but this feature depends on the initiative of the user to share each new video he decides to watch collaboratively.

Taking into account this constraint, in this final section of the chapter, a proposal for a general conceptualization for a new system, the User Media Consumption Awareness system, is presented. The proposed system could allow users to know (at any time and independently of the platforms used) what their friends are watching, allowing them to chat or to make recommendations based on that information.

Figure 14. An example of the Peeko Chat in action

Technical and Functional Model

Peeko Chat[7] for Firefox browsers is an example of a plug-in that tracks users in the same page and allows them to chat instantly. There is no content evaluation or correlation in this system, just URL tracking. Two or more users visiting the same domain can interact by chat. (Figure 14)

The proposed *User Media Consumption Awareness* (UMCA) system extends the features of this type of browser chat, like Peeko, and of tools like ClipSync or Messenger Zync by allowing to:

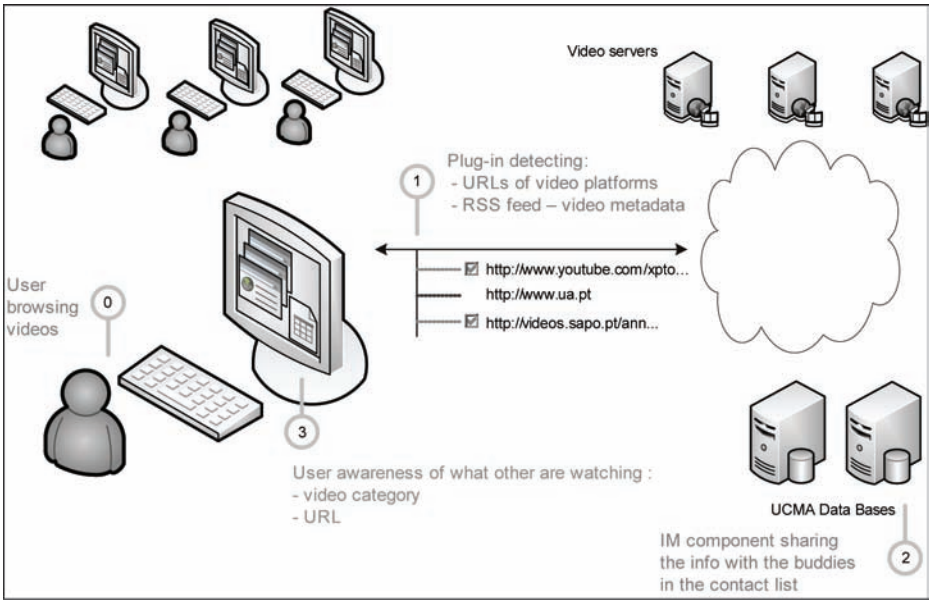
- Track which video content or channel each user is watching and categorize it according to associated metadata (for example by examining an RSS feed and the tags associated with the video/channel)
- Keep a buddy list, like in a common IM service, allowing users to build their own network of friends and to get information about their instant AV content consumption[8]
- Give users a set of collaborative features that include an IM platform and a recommendation system.

System Configuration Proposal

For it to be successful, this kind of system should be simple and fully integrated in the operating system, like a regular IM tool is. It should act like an add-on to any browser. ClipSync, for example, allows some collaborative features but demands the use of a proprietary application to watch the videos.

The proposal for the UMCA system, as shown in Figure 15, should include the following components:

Figure 15. Conceptual model of UMCA system



1. One component, acting as a plug-in for the browsers, detects in real time the URLs visited by the user and compares it with a list of popular video server sites. This list is permanently updated in the UMCA server. The structure of each new site is analysed to maximize compatibility of the sniffer component. If the user is visiting a site, classified as a video site, the component can read the RSS feed related to the page to read the meta information associated with the video. The information provided by the feed allows the component to define the video being watched, the URL and related meta information.
2. Another component, close to an IM service, shares the information from the video with the buddies in the contact list. The user can define the level of privacy wanted for each video site or for each category of videos.
3. Users can know, in real time, which videos others are watching, their categories and URLs. Tools for video recommendation and synchronous text chat are also provided.

Another component of the system aggregates all the information to allow ranking buddies according to their video consumption, identifying the categories of preferred content (ex. Sports, news …) and creating individual profiles for each user[9]. Finally, another component, derived from the previous one, defines a set of automatic recommendations based on buddies' video consumption. After watching any new video this tool can present the user with a contextual recommendation (received from UMCA) of other related videos, as in the following example:

- *User A just finished watching a video of a Cristiano Ronaldo goal in MSN videos;*
- *UMCA alerts the user with a list of related videos his buddies have watched (similar to Amazon's recommendation system). Ex. "User B watched "Manchester United—Euro champion" in You Tube; User C watched "Top ten goals" in Meta Café".*

The widespread use of a tool like UMCA could contribute to support social activities around online AV/TV consumption. Apart from having participatory viewers contributing with their own content, they could be more active in sharing videos, influencing others' choices and specially talking about what they are watching. This tool could have, potentially, the ability to recover to AV/TV online consumption some of the habits and behaviours we could experience with television decades ago.

CONCLUSION AND FUTURE WORK

Social (i)TV is a very relevant and wide-ranging field. Some of the platforms mentioned in this chapter try to promote social activities around TV consumption, but the transversal adoption of these activities is still in its early phases. The results from the evaluation of Social iTV systems, like 2BeOn, have shown the willingness of viewers to interact with their friends/colleagues while watching TV. Users want to talk about TV content and iTV providers are now alert to this reality and are trying to promote new ways of doing it.

In parallel, the proliferation of AV/TV online distribution platforms (PC, TV or mobile based) with consequent changes in the video consumption habits has added important new challenges to the Social AV/TV field. In the existing scenario, content distribution ranges from regular broadcasters to a set of websites and applications making it harder for synchronous interaction activities. The users no longer share a unique platform and a unique terminal, the TV set.

Although in its early stages of specification, the proposal for the User Media Consumption Awareness system presents a range of technical, design and interaction research concerns and challenges. It is expected that the UMCA system may trigger this research field further in searching for a new Social AV/TV add-on for online video distribution. Yet further software development is needed in order to have a prototype available for the validation of this proposal with real users.

Therefore the authors believe that in parallel with the development of social features for traditional iTV platforms that are currently taking advantage of the new IPTV infrastructures, important steps must also be done in online AV/TV platforms, since it is expected that these will enhance the potential for social interaction practices around AV online content.

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ENDNOTES

1 The impact of television in the social interaction among televiewers has been researched for many years. J. Klapper (1960) quoted by McQuail (1993); Katz, Gurevitch and Hassem (1973) quoted by Fiske (1990); and Wolton (1997) are only a few of the authors that reflected upon this subject.

2 In recent years, authors like Geerts (2006) and Weisz (2007) have studied the pros and cons of using textual versus voice communication. At the time the 2BeOn prototype was developed, IM sounded more compatible and less disturbing for TV reception than voice communication, despite the existence of a buddy list that helped an initiator of a communication to judge when the recipient was apparently available, enabling a minor number of interruptions (Nardi, 2000). As discussed in the "evaluation process" section this hint was corroborated by the participants during the evaluation phase.

3 E.g.: The Barack Obama channel: http://www.youtube.com/user/BarackObamadotcom Retrieved May 23, 2008.

4 Source: http://www.masternewmedia.org/pt/video_televisao_pela_internet/producao-video/videos-on-line-sincronizados-remotamente-assista-a-qualquer-video-em-sincronia-com-qualquer-pessoa-atraves-da-internet-conheca-melhores-ferramentas-20070527.htm . Retrieved May 23, 2008.

5 Source: http://arstechnica.com/news.ars/post/20080512-first-look-microsoft-enters-social-video-with-messenger-tv.html Retrieved May 23, 2008.

6 For an extensive list of online video platforms please visit http://www.everybodygoto.com/2007/05/21/the-ultimate-online-video-list/ Retrieved May 23, 2008.

7 For more information visit: http://peekko.com/HomePage.html Retrieved May 23, 2008.

8 Windows Live Messenger from Microsoft allows users to share information about the music they are listening on their computers. However, this feature relies only on the media player information. The new Messenger TV allows sharing video consumption but only if consumed from MSN video archives.

9 Oumard (2008), regarding the promotion of interpersonal communication around video content, also refers to the importance of keeping a public personal video profile of the watched videos attached to an IM application.

This work was previously published in Social Interactive Television: Immersive Shared Experiences and Perspectives, edited by P. Cesar, D. Geerts, and K. Chorianopoulos, pp. 222-242, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.7
Evaluating the Effectiveness of Social Visualization Within Virtual Communities

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ABSTRACT

Participation and system usage is crucial for virtual communities to develop and sustain. However, many communities report very low participation rates of members. Finding and studying strategies for fostering participation in virtual communities is therefore a growing field of research and different approaches for strengthening participation in virtual communities exist – among them social visualization. While many tools for visualizing social interactions have been developed, not much empirical evidence about their actual effectiveness exists. To find out more about the effectiveness of social visualization on the participation rate (number of logins, forum posts, personal messages, and chat posts) the authors conducted an empirical study within CyberMentor – a virtual community for high school girls interested in science and technology. In their sample of N=231 girls the authors did not find a significant difference between the number of logins in the phases before and after the introduction of the visualization tool. The number of forum post, chat posts and personal messages however increased significantly after the incorporation of the visualization tool. Long-term effects were found for one-to-many communication technologies (forum, chat), but not for personal messages (one-to-one)

DOI: 10.4018/978-1-60566-340-1.ch008

INTRODUCTION

In this chapter we present results of an empirical study about visualizing usage behaviour of community members within CyberMentor – a virtual community for girls who are interested in science, technology, engineering, and mathematics (STEM). We conducted a timeline study and divided the ten months duration of our study (September 2006 till June 2007) in four phases: starting phase (month 1 and 2), consolidation phase (month 3), short-term effect phase (month 4 and 5), and long-term effect phase (month 6 through 10). The visualization tool (CyberCircle) we developed was incorporated into the platform after the consolidation phase. To find out if social visualization has an effect on the users' participation behaviour we compared community members participation rates (number of logins, forum posts, personal messages, and chat posts) of the consolidation phase with average participation rates of the short- and the long-term phase.

We will start with some background information about virtual communities in general, the technology acceptance model which serves as our theoretical background, and social visualization. The chapter focuses on virtual communities or online communities in general rather than on virtual communities of practice. The virtual community described in this chapter offers great opportunities for formal and informal learning though, which will be discussed later. Since virtual communities and virtual communities of practice are extensively covered in other chapters, we will not go into detail concerning this topic. As background of our own work we chose the technology acceptance model which will be described before defining and showing examples of social visualization. An overview of evaluation approaches of visualization techniques within communities shows that only little evidence of the effects of social visualization within virtual communities exists (e.g. concerning the participation rate). Next, we describe the aim of our research and the hypotheses concerning the effects of social visualization on participation. In the method section we will present the virtual community (CyberMentor) that we used as a research tool for our study. We also describe the community platform, and the social visualization tool (CyberCircle) we developed. After a description of the subjects, research design, and measurement variables, we present the results of our study and discuss them. We conclude our chapter by naming some limitations of our study and making suggestions for future research and practice.

BACKGROUND

Virtual Communities

In the research literature a wide variety of definitions on virtual communities exists, which range from technical to people-centred. Lazar and Preece (2002) define virtual communities as "a set of users who communicate using computer-mediated communication and have common interests, shared goals, and shared resources" (p. 128). Preece (2000) identifies key elements of virtual communities: (1) people, who interact as they strive to satisfy their own needs, (2) shared purpose, such as a common interest or need that provides a reason for the community, (3) policies, that guide peoples interaction, and (4) computer systems, to support social interaction and facilitate a sense of togetherness. Virtual communities encourage research of different disciplines (e.g. computer science, psychology, sociology, anthropology, etc.) and one finds various methods for studying and answering research questions about virtual communities. One important research field deals with investigating usage behaviour of community members. Reasons for joining an online community are examined (e.g. Ridings & Gefen, 2004) as well as reasons for lurking (reading but not posting) (Katz, 1998; Nonnecke & Preece, 2001; Preece, Nonnecke, & Andrews, 2004). A growing body of research examines strategies and mechanisms to foster participation and contribution in virtual communities based on theories from social psychology (e.g. Cheshire, 2007; Cheshire

& Antin, 2008; Harper et al., 2007; Ling et al., 2005; Rafaeli, Raban, & Ravid, 2007; Rashid et al., 2006). Harper et al. (2007) for example conducted field experiments involving members of an online movie recommendation community (MovieLens) and studied effects of personalized invitation messages designed to encourage users to visit or contribute to the forum. They found that personalized invitations led to an increase in participation (reading and posting). Cheshire & Antin (2008) examined the effects of various feedback mechanisms on repeated contributions. The types of feedback they examined were "Gratitude" for providing a contribution, a "Historical Reminder" on one's entire contribution record, and the "Relative Ranking" on one's contributions compared to others (p. 712). The authors report significant impacts of all three feedback mechanisms on repeated contributions of users. Techniques of visualizing social interaction within the community platform offer another approach for strengthening participation in virtual communities. Our research focuses on that approach. Before we give a short overview over some main ideas and findings in the field of social visualization, we describe the technology acceptance model (TAM) (Davis, 1989, 1993; Davis, Bagozzi, & Warshaw, 1989) and its successor TAM2 (Venkatesh & Davis, 2000) on which our assumptions concerning social visualizations are based on.

Technology Acceptance Model

Besides other models of technology acceptance (for an overview see Venkatesh, Morris, Davis, & Davis, 2003), the technology acceptance model TAM (Davis, 1989, 1993; Davis et al., 1989) and its successor TAM2 (Venkatesh & Davis, 2000) are influential models to explain and predict system usage behaviour. The technology acceptance model (TAM) is theoretically based on the Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975). According to the TRA behaviour is directly influenced by the intention to perform a behaviour. The intention in turn is influenced by the attitude towards the behaviour and the subjective norm concerning the behaviour. Attitude stands for "an individual's positive or negative feelings (evaluative affect) about performing the target behaviour" (Fishbein & Ajzen, 1975, p. 216). Subjective norm is defined as a "person's perception that most people who are important to him think he should or should not perform the behaviour in question" (Fishbein & Ajzen, 1975, p. 302). The theory states that people perform the anticipated behaviour if they a) judge the behaviour as positive and b) believe that important others do so too. The TAM, proposed by Davis (1989) adapts the TRA to the field of Information Systems. Two new constructs, perceived usefulness and perceived ease of use are introduced in the TAM. Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320); perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). In the TAM those two constructs are seen as determinants of an individual's attitude towards using an application.

The subjective norm component is not included in the first version of TAM. However, research conducted on the influence of subjective norms on intention led to mixed results. While some researchers found significant effects of subjective norm on behavioural intentions (Cheung, Lee, & Chen, 2002; Igbaria, Zinatelli, Cragg, & Cavaye, 1997; Riemenschneider, Harrison, & Mykytyn, 2003; Taylor & Todd, 1995), others found no significant effects (Lau, Yen, & Chau, 2001; Mathieson, 1991; Roberts & Henderson, 2000). Although Davis, Bagozzi, & Warshaw (1989) also found no significant effect of subjective norm on intentions they highlighted the need for more research to find out more about "the conditions and mechanism governing the impact of social influences on usage behaviour" (1989, p. 999). In a further study Venkatesh & Davis (2000) hypothesized that subjective norm would influence perceived usefulness and usage intention if system use is mandatory. They found that subjective norm indeed exerts a significant direct effect on usage intentions for mandatory systems. Further on, subjective norm influenced usage behaviour via perceived usefulness (Venkatesh & Davis, 2000). Venkathesh & Davis (2000) summarized their new findings in a follow-up model called TAM2 including subjective norm into the model.

With the aim of examining the convergence or divergence of published research results Schepers & Wetzels (2007) conducted a quantitative meta-analysis with 63 studies in which TAM/TAM2 had been assessed empirically. Besides confirming the original TAM relationships (significance of perceived usefulness and perceived ease of use towards attitude and behavioural intention to use) via correlation analysis and structural equation modelling, the authors examined the influence of subjective norm. Correlations between subjective norm and behavioural intention were tested in 22 studies. They found that in most studies (19), subjective norm is directly and significantly related to users' intention to use a system. According to the research reviewed, one possibility to strengthen the subjective norm component and thereby the system usage is to make the social group salient to the users. Important here seem to be perceptions of group distinction (e.g. Henri Tajfel & Turner, 1986) which lead to higher commitment towards the own group, as well as an increased ambition to strengthen in-group identity through participation. Although Michinov, Michinov & Toczek-Capelle mention that in computer based environments "nonverbal and paralinguistic cues may prevent the development of a sense of belonging among group members who are geographically distant from one another" (2004, p. 28), they concede that the social identity theory (H. Tajfel, 1978) contradicts this assumption by providing an alternative perspective. In their view identification with an online group becomes possible when the salience of the group is enhanced. This enhancement of salience of a group could be achieved by social visualization techniques. Visualizing additional information – for example usage behaviour of community members – makes the platform a less anonymous place. Utz (1999) conducted a study about MUDs (Multi-User Dungeons) and found out that users with a higher identifiability showed a higher orientation towards collectivist norms than users who were less identifiable. Therefore we assume that visualizing social interactions (and thereby making community members more identifiable) has a positive influence on the subjective norm and thus on the usage behaviour. Before presenting our aim of research we define social visualisation, show some examples and discuss first findings concerning social visualization and its influence on participation rates.

Social Visualization

Erickson (2003) defines social visualization as 'a visual (or sonic or other perceptual) representation of information from which the presence, activities, and other characteristics of members of a social collectivity may be inferred, and, by extension, can provide the basis for making inferences about the activities and characteristics of the group as a whole' (p. 846). In the literature one can find different operationalizations of social visualization within virtual communities (e.g. Bouras, Igglesis, Kapoulas, & Tsiatsos, 2005; Bradner, Kellogg, & Erickson, 1998, 1999; Erickson, Halverson, Kellogg, Laff, & Wolf, 2002; Erickson & Kellogg, 2000; Erickson & Laff, 2001; Erickson et al., 1999; Lee, Girgensohn, & Zhang, 2004; Perry & Donath, 2004; Sun, 2004; Sun & Vassileva, 2006; Vassileva & Sun, 2007; Xiong & Donath, 1999). They all visualize "hidden" information about users and usage behaviour. Erickson et al. (2002) believe 'that such systems – by supporting mutual awareness and accountability – will make it easier for people to carry on coherent discussions; to observe and imitate others' actions; to engage in peer pressure; to create, notice, and conform to social conventions; and to engage in other forms of collective interaction' (p. 40). They developed a communication tool called Babble (Bradner et al., 1998, 1999; Erickson, 2003; Erickson et al., 2002; Erickson & Kellogg, 2000; Erickson & Laff, 2001; Erickson et al., 1999) which allows synchronous and asynchronous multi-channel text chat. The Babble system provides a social proxy, "a minimalist visualization of people and their activities" (Erickson et al., 2002, p. 40) called Cookie, which visualizes cues about the presence, number and ways of participation in the online environment. Participants are represented as coloured dots within the Cookie. The distance of the person's dot to the circle's centre indicates how recently that person had either "spoken" (typed a command) or "listened" (scrolled or clicked on the interface). A second social proxy within the Babble system, the Timeline, represents each user as a row. When logged on to Babble, users leave a line, and when "speaking" in the chat, they leave a vertical mark to the line. That way other users can see when people were online and when they were involved in conversations. For this social visualization no detailed evaluation but rather user experiences are reported and summarized as "in general, users report that the social proxy is engaging and informative" (Erickson et al., 2002, p. 41).

Another early visualization approach, the PeopleGarden, was developed by Xiong and Donath (1999). The PeopleGarden is a message board community that visualizes users' posting histories. Each user is represented as a flower. The height of the flower shows the length of membership. The number and colour of the flowers' petals indicate the number of messages sent and how recent they are. Also for this approach no empirical evaluation was conducted; instead the authors summarized the users' informal feedback and conclude that users prefer realistic encodings.

Lee et al. (2004) developed two social browsers (People and eTree) for two different community Web sites - CHIplace and Portkey. CHIplace (see also Girgensohn & Lee, 2002) was developed for the ACM CHI 2002 conference to extend interactions among people. The Portkey Web community was developed for summer interns at IBM TJ Watson Research Center to enable them to exchange with others and develop social networks. The CHIplace People browser provides a community map of the site members' different roles. Each user is represented as a dot and grouped with others who are having similar roles. Related clusters of member dots are closer together than unrelated ones. The own user dot appears in red and one can easily see the own position within the community. By clicking on a dot one can open the person's profile page. For the eTree visualization within the Portkey community Lee et al. (2004) used an ecosystem metaphor consisting of the different parts of a tree.

Forums are represented as branches; threads are mapped in form of leaves. The colour of the leaves indicates the age of the posts. The community members are represented as coloured circles placed around the tree. The circle's colouring tells the user's role (intern or IBM authors) and its distance from the tree shows how active the user participates. The Portkey eTree was introduced shortly before the end of the interns' stay and the authors could only collect informal feedback about the metaphor. They reported that many people found the visualization attractive and that they liked the ability to view the growth and evolution of the discussions.

A main concern that came up was privacy. For the CHIplace People browser, usage data was collected and reported. The announcement of the People browser caused an overall usage spike. However, the percentage of sessions in which the People browser was used decreased from 35 percent in the announcement week to about six percent after eleven weeks. Lee et al. (2004) concluded that user feedback and comments provided strong support of the value of the two browsers and suggested "further studies to examine how such techniques can alter people's participation and behaviour in Web communities" (p. 75).

A more recent version of a visualization tool was developed by Sun and Vassileva (2006). They developed a paper sharing online community called Comtella. Within this community each user is represented as a star. The size of it indicates the users' participation level (number of shared links to papers). Based on the activity level each user is assigned to one of four levels, restricting the "best" 10% to the top level, 36% to the second level and 27% to the two lowest levels. The authors evaluated their visualization tool within an online class of students (N = 35) over a period of three months and reported increases in participation after their social visualization tool was incorporated into the platform after 6 weeks usage. However the methodology is not described exactly and no statistical test is mentioned. In a further study of Vassileva and Sun (2007), students (N = 32) were divided in two groups showing the visualization to each group half of the time (about 5 weeks to each group). However, as one group was more active independent of working or not working with the tool, the authors' initial hypothesis that the visualization would motivate the subjects to participate more actively could not be confirmed.

AIM OF RESEARCH

Social visualization tools that display hidden information about members' interactions have been developed and deployed within several virtual communities. While many researchers hope to increase participation and interaction of community members with the help of social visualization, not much empirical evidence exists. Only few evaluation results are reported in the literature and too many shortcomings exist to suppose that social visualization leads to an increase in participation. In our research we want to evaluate the effectiveness of social visualization on the participation rate of virtual community members. As most studies concerning participation in virtual communities study short-time effects, we will differentiate between short-term effects and long-term effects. We also distinguish between various participation criterions like (1) the number of logins into the platform, (2) the number of posts to the discussion forum, (3) the number of personal messages sent to other community members, and (4) the number of chat messages.

Based on findings by (1) Hartwick and Barki (1994) that system usage drops significantly after about three months due to subsiding subjective norm as well as by (2) Agarwal and Prasad (1997) who reported that mandating system use can increase initial system utilization, we assume that participation declines after the starting phase (see H1). We further assume that visualizing social interactions has an impact on community member's subjective norm and thus leads to increased system usage, like predicted by the technology acceptance model TAM2 (Venkatesh & Davis, 2000). We therefore expect that after the introduction of the social visualization tool CyberCircle the participation rate of community members increases within a short-term phase (see H2a) as well as for a long-term phase (see H2b). To test our assumptions we propose the following hypotheses:

H1: *Participation in virtual communities decreases significantly after the starting phase.*

H2a: *The incorporation of the CyberCircle increases the short-term participation rate of community members.*

H2b: *The incorporation of the CyberCircle increases the long-term participation rate of community members.*

The three hypotheses will be tested for four different participation criterions: (1) the number of logins into the platform (visits), (2) the number of posts to the discussion forum, (3) the number of personal messages sent to other community members, and (4) the number of chat messages.

Conducting a study aiming to test those hypotheses requires an appropriate virtual community plus platform. Using an existing virtual community does not usually allow such kind of research since log files are not available. Further on, many communities are based on one communication technology (e.g. discussion forum, mailing list, etc.) instead of the different kinds of technologies we are interested in, such as discussion forum, personal messages, and chat room. In order to conduct this study we first needed to create an appropriate virtual community and to build a platform. The community, its platform, and the social visualization tool we tested within this community will be described in the method section below.

METHOD

In the following the community itself, its platform and the visualization tool called CyberCircle will be described, followed by a description of subjects and the study design.

CyberMentor: Virtual Community for Girls Interested in STEM

Building a sustainable virtual community from scratch is a challenging task. You need a good purpose and the idea of the community has to be attractive to potential members. Doing research in the field of gender and science (Stoeger, 2007; Stoeger, Ziegler, & David, 2004; Ziegler & Stoeger, 2004, 2008) and knowing about the female shortage of skilled labour in science, technology, engineering, and mathematics (STEM) in Germany (Statistisches-Bundesamt, 2006) we decided to build a virtual community to foster girls' interest and participation rate in STEM. Mawasha, Lam, Vesalo, Leitch, and Rice (2001) identified strategies to foster interest in science and technology among girls. These strategies involve (1) increasing girls' knowledge about STEM, (2) providing information about career opportunities in STEM, and (3) allocating role models, contact persons, and mentors. Based on these requirements and further empirical evidence about gender, girls and STEM (for more information refer to Deaux & Lafrance, 1998; Eccles-Parsons, 1984; Eccles, 1994; Packard, 2003; Packard & Hudging, 2002) we developed the virtual community CyberMentor. One important aspect of our community is "mentoring" between girls (mentees) who are interested in science and female mentors who are vocationally engaged in STEM. Over the course of ten months mentors and mentees communicate via e-mail in one-to-one relationships. This approach provides the girls with female role models and increases their knowledge about the field of STEM and possible careers in various STEM domains. By offering this virtual community, formal and informal learning about science topics takes place. On the one hand, participants learn from their mentors, on the other hand, they also learn from and together with other female students. As same-age role models are as important as older role models (Breakwell & Beardsell, 1992) the participating girls are encouraged to engage in team work projects (Schimke & Stoeger, 2007) and to communicate with each other via our community platform.

The Community Platform

"Just as traditional communities require a vehicle for participation, virtual communities require a system that supports the exchange of electronic information among members" (Moore & Serva, 2007, p. 154). The community platform we developed serves as a virtual meeting place for the community members. It is accessible for community members only. Each applicant's identity is verified (mentees need signatures from legal guardians; mentors need to name two contact persons for enabling the program administrator to recheck identities) before login information is provided. Within this platform, each participant can introduce herself by filling out a personal profile and uploading a picture. Each personal page includes a wall for posting comments. For group communication we incorporated an open source discussion forum (http://www.phpbb.com/) as well as an open source chat room (http://www.phpfreechat.net/). The personal message system – like the whole community platform - is based on common Web technologies (PHP, HTML, CSS, JavaScript, and Ajax) and was developed by us. One important function of the platform is its tracking capacity, which allows us to store information about logins, number of posts to the discussion forum, number of chat messages and the number of personal messages in a MySQL database.

The platform was developed, tested and adjusted in a first CyberMentor season from September 2005 till June 2006.

CyberCircle: Visualizing Social Interaction

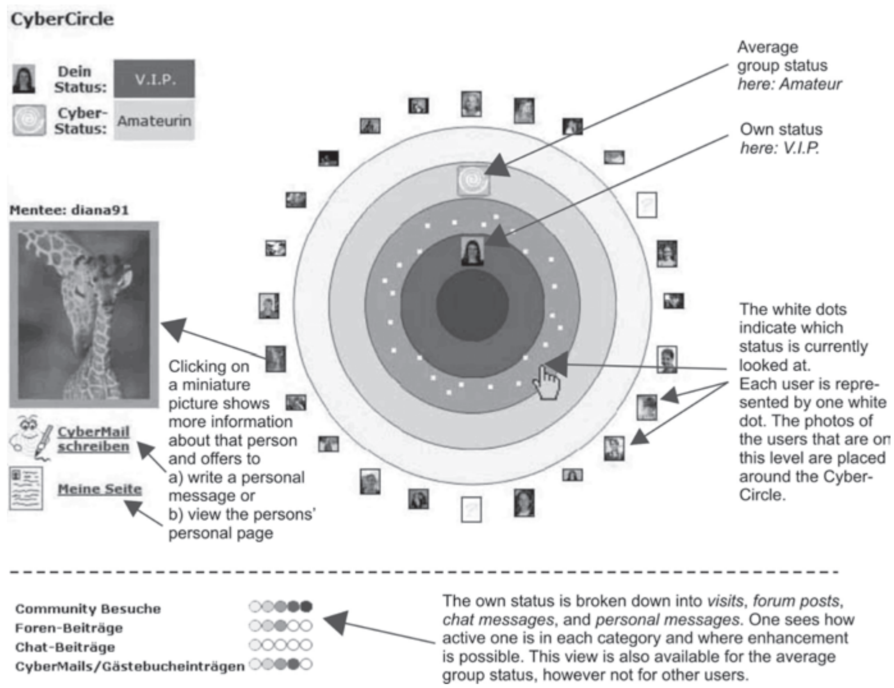
The CyberCircle is a social visualization tool that provides information about the users' participation rates. It assigns each community member to one of the following categories: Beginner, Amateur, Professional, V.I.P., Top-CyberMentee. The assignment to either category or "status" is based on different criterions: (1) number of community logins, (2) number of posts to the discussion forum, (3) number of personal messages, and (4) number of chat posts. For each category each person gets points according to her activity level; the sum of all points assigns a person to one of the five categories. However, the assignment is not fixed. It involves the factor "time" and calculates the current status based on an algorithm which values more recent activities stronger than older ones. Unlike Sun and Vassileva (2006) we did not apportion the levels; instead every member could be in the top or any other level. The users' status is displayed on the first page within the community platform as well as on the CyberCircle site. Within the CyberCircle view users can click on the different levels (Beginner, Amateur, etc.) to see all members assigned to these levels. To get an idea of the average usage level of all users, the mean group level is also displayed. Figure 1 shows and explains the visualisation tool.

SUBJECTS AND STUDY DESIGN

The study was carried out within the CyberMentor platform which is accessible to registered members only. During the time the study was conducted (September 2006 – June 2007) the CyberMentor community had 231 female student members and as many female mentor members. The mentors however were not included in this study and will not be mentioned in the following anymore. The 231 student members – the subjects of this study – were all middle and high school students visiting grades six through thirteen. The mean age was M = 15.19 (SD = 1.97). Since CyberMentor is about science, technology, engineering, and mathematics (STEM), the participating girls were all interested in those topics. For being accepted into the CyberMentor program interested girls had to apply and state reasons for participation. After applying online, they had to print out the e-mail with their application data, sign it (under aged girls also needed a signature from legal guardians) and send it or fax it back to the program administrators. By signing the application they agreed to take part in our research study.

To answer our research questions we conducted a timeline study and divided the ten months duration of the study (September 2006 till June 2007) in four phases: the starting phase (month 1 and 2), the consolidation phase (month 3), the short-term effect phase (month 4 and 5), and the long-term effect phase (month 6 through 10). The CyberCircle was incorporated into the community platform

Figure 1. Visualization tool CyberCircle

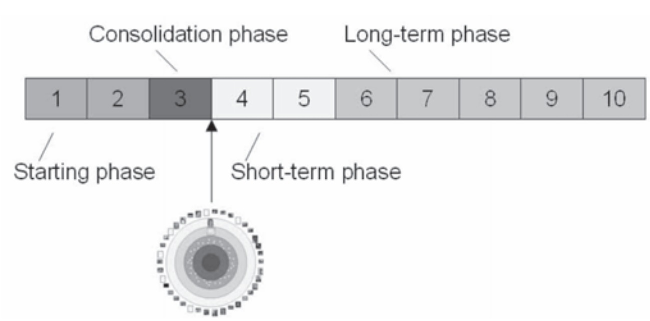


after the consolidation phase (between months three and four). Figure 2 shows the phases and lengths of phases as well as the time of inclusion of the social visualization tool CyberCircle.

Data Selection and Measurement Variables

For this study we did not use questionnaires as measurement instruments, instead we used data stored in a database and gathered through log file analysis. Based on the technology acceptance model TAM2 (Venkatesh & Davis, 2000) we assumed that the incorporation of a visualization tool would lead to greater system usage. To be able to measure and compare system usage rates in different phases, we stored the timestamps and number of (1) logins into the community platform, (2) posts to the discussion forum, (3) personal messages, and (4) chat messages for each subject

Figure 2. Phases of our ten months study and point of time of inclusion of the CyberCircle



in a MySQL database.

Due to different lengths of the phases (starting phase: 2 months, consolidation phase: 1 month, short-term phase: 2 months, and long-term phase: 5 months), we calculated mean values of the mentioned variables for each phase for each subject. Doing this we had the following sixteen variables for each subject:

- **visits phase1, visits phase2, visits phase3, visits phase4:** Mean number of logins into the community platform in each phase.
- **forum phase1, forum phase2, forum phase3, forum phase4:** Mean number of posts to the discussion forum in each phase.
- **messages phase1, messages phase2, messages phase3, messages phase4:** Mean number of personal messages sent to other community members in each phase.
- **chat phase1, chat phase2, chat phase3, chat phase4:** Mean number chat messages in each phase.

RESULTS

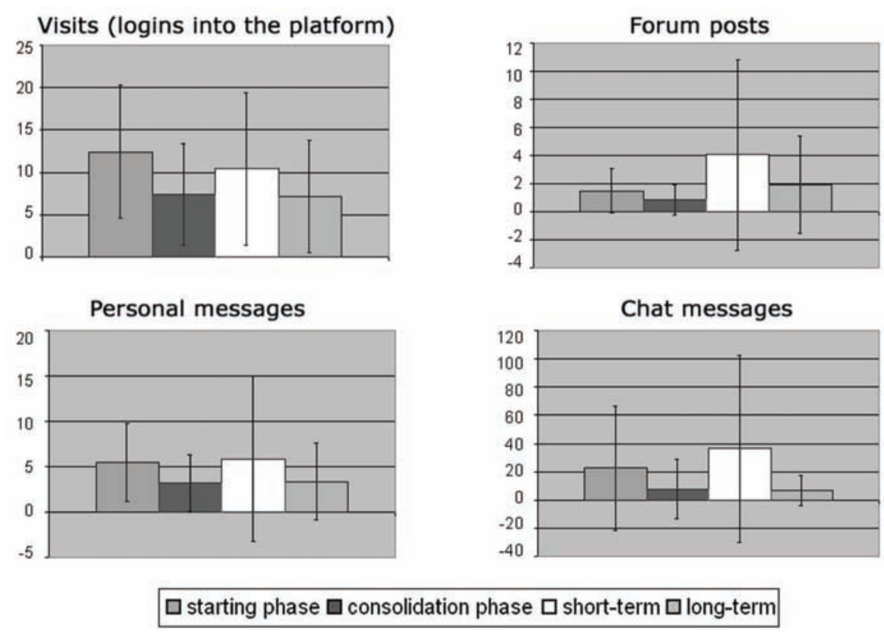
Since our data showed no normal distribution, we could not use the t-test. For this reason we used the nonparametric Wilcoxon test for paired samples to test our hypotheses. Figure 3 shows the average participation rates and standard deviations for each criterion (visits, discussion forum posts, personal messages, chat messages) for the four phases (starting phase, consolidation phase, short-term phase, and long-term phase).

Hypothesis 1: For hypothesis 1 we wanted to test if participation in virtual communities decreases after the starting phase (two months duration). We compared the mean participation rates for the four participation criterions (number of visits, forum posts, personal messages, and chat messages) of the starting phase (first bar in each diagram in figure 3) to the consolidation phase (second bar). We found a decline for the number of visits ($Z = -10.52$, $p < .001$), the number of discussion forum posts ($Z = -4.76$, $p < .001$), the number of personal messages ($Z = -7.34$, $p < .001$), and the number of chat posts ($Z = -5.26$, $p < .001$). Hypothesis 1 *"Participation in virtual communities decreases significantly after the starting phase"* can be confirmed for all four participation criterions.

Hypothesis 2a: We assumed that the incorporation of the CyberCircle tool would enable an increase in the participation rate of community members. To test this hypothesis we compared the participation rates of the consolidation phase (no *CyberCircle* yet; second bar in the diagrams in figure 3) to the short-term phase (this is the phase right after the *CyberCircle* was incorporated into the platform; third bar in each diagram) using the *Wilcoxon* test for paired samples. Concerning the number of visits to the platform, no significant increase could be found ($Z = 1.15$, $p > .10$) between the consolidation and the short-term phase. For the discussion forum ($Z = 6.19$, $p < .001$), the number of personal messages ($Z = 2.24$, $p < .05$), and chat messages ($Z = 5.29$, $p < .001$) we found significant increases in the short term phase. Hypothesis 2a "*The incorporation of the CyberCircle increases the short-term participation rate of community members*" can therefore be confirmed for the number of discussion forum posts, the number of personal messages and the number of chat posts. It can not be confirmed for the logins into the platform (visits) however.

Hypothesis 2b: For hypothesis 2b we wanted to test if the incorporation of the CyberCircle increases the participation rate of community members in the long run. We compared the mean participation rates before the *CyberCircle* was incorporated into the platform (consolidation phase; second bar in each diagram in figure 3) with the participation rates of the long-term phase (forth bar in each diagram), which covers months six through ten. We did not find a significant increase in the number of visits, instead we found a significant

Figure 3. Means and standard deviations of activity levels of interest in the four phases



decrease (Z = -3.24, p < .01). The participation rate within the discussion forum however was significantly higher in the long-term phase compared to the consolidation phase (Z = 2.44, p < .01) as well as the participation rate in the chat room (Z = 1.96, p < .05). No significant increase was found for the number of personal messages. Instead we found a significant decrease (Z = -3.24, p < .01). Hypothesis 2b "*The incorporation of the CyberCircle increases the long-term participation rate of community members*" can be confirmed for the number of discussion forum posts and chat messages. It can not be confirmed for the number of visits and the number of personal messages sent to other community members.

Table 1 gives an overview of all hypotheses and participation criterions tested in this study.

DISCUSSION

The purpose of this study was to find out if the incorporation of a tool that visualizes social interactions within a community platform affects the amount of system usage of virtual community members. To answer this question we tested three hypotheses (***H1***: *Participation in virtual communities decreases significantly after the starting phase,* ***H2a***: *The incorporation of the CyberCircle increases the short-term participation rate of community members,* ***H2b***: *The incorporation of the CyberCircle increases the long-term participation rate of community members*) and analyzed the four participation criterions (1) number of visits to the platform, (2) number of discussion forum posts, (3) number of personal messages, and (4) number of chat posts.

For hypothesis 1 we tested the assumption that the participation rate of community members decreases after a starting phase (2 months). The hypothesis could be confirmed for all participation criterions (visits to the platform, number of discussion forum posts, number of personal messages, and number of chat posts). These results are in line with findings of Hartwick and Barki (1994) and Agarwal and Prasad (1997) who report higher system usage in beginning phases versus later phases. Within the CyberMentor community

Table 1. Overview hypotheses and results

Hypotheses	Tested for participation criterion	Hypothesis confirmed?
H1: Participation in virtual communities decreases significantly after the starting phase.	Visits	yes
	Discussion forum posts	yes
	Personal messages	yes
	Chat posts	yes
H2a: The incorporation of the *CyberCircle* increases the short-term participation rate of community members.	Visits	no
	Discussion forum posts	yes
	Personal messages	yes
	Chat posts	yes
H2b: The incorporation of the *CyberCircle* increases the long-term participation rate of community members.	Visits	no
	Discussion forum posts	yes
	Personal messages	no
	Chat posts	yes

the decrease in activity makes also sense because mentor's names and contact information were announced in the beginning and members were curious to find out more about other community members. The decline in participation after two months was therefore not surprising. As participation is crucial for virtual communities to survive we needed to find strategies for fostering members' participation. On the basis of the TAM we assumed that this could be done by the incorporation of a social visualization tool. For this reason we built a visualization tool and introduced it to the community after a three months period. To test its effectiveness we compared mean participation rates of the phases before and after the incorporation. We found no increase in the number of visits to the platform – neither for the short-term, nor for the long-term phase.

However, we found significant increases of the actual amount of interaction within the virtual community platform, concerning posts written in the discussion forum and messages posted within the chat room for both, the short and long term, phases. A possible explanation for the increases in these two participation criterions might be that people who were reading others posts without contributing before (such community member are usually defined as lurkers; for more information about lurkers and lurking refer to Nonnecke & Preece, 2000) got motivated and actively engaged in discussions after the incorporation of the *CyberCircle*. Preece, Nonnekce, and Andrews (2004) studied reasons for lurking and conveyed strategies to get lurkers (more) involved. These strategies involve clearly stating that interaction is wanted and honouring activity with a high(er) status within the virtual community. Both those strategies are fulfilled by the *CyberCircle*: its incorporation clearly states that interaction is wanted and if getting involved more users reach a higher status.

Interestingly, an increase in participation for personal messages could only be confirmed for the short-term phase (H2a), not for the long-term phase (H2b). A reason for this result might be that users feel more pressure to interact within public spaces where their presence is witnessed by more than one other person – which applies to the discussion forum and chat room. This would fit the idea that the subjective norm does have an influence on usage intention – especially when there is a higher visibility in the community that might lead to pressure, like in mandatory systems. Another explanation could be through social facilitation, which states that the presence of others serves as a source of arousal (Zajonc, 1965) which might influence participation. Contributions to a discussion forum or a chat room have a greater audience than one-to-one communication via personal messages. Therefore social facilitation might have a greater effect. This might explain why we found long-term effects among one-to-many communication technologies but not among one-to-one communication technologies. However, more research is needed to confirm this assumption.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Some important factors need to be considered regarding our study. First, we did not have a control group, which means that we cannot completely disqualify the assumption that the results are based on effects other than the incorporation of the visualization tool. Since only few research results about the effectiveness of visualization tools exist so far, it was important for us to conduct a study evaluating the *CyberCircle* systematically. Based on experiences of our pilot study (September 2005 till June 2006) and from literature review (e.g. Preece, 2000; Whittaker, 1996) we knew, that a critical mass of users is needed in order to initiate a sustainable interactive discourse. Splitting all members in two halves and creating two separate communities with the same conditions would probably not have worked in our case due to too few members. Having enough members and the opportunity to set up two comparable communities of which one uses social visualization while the other one does not would be an interesting investigation for the future.

Another shortcoming of our study is that we used the technology acceptance model only as an explanation. We did not actually measure the components of the model such as subjective norm or perceived usefulness. For future research it would be important to test the components of the model and see if and how strongly subjective norm is influenced by social visualization. With our approach we tried to build a community that fits accepted definitions of a virtual community and that allows us to conduct our research and collect the data we needed. However, more research in different virtual communities and with different target groups needs to be done to find out if our results can be generalized.

There is also a shortcoming concerning the design of our social visualization tool as it is only applicable for relatively small virtual communities with three hundred community members or less. For virtual communities with more members it might get too crowded and unclear. For this reason different design options should be tested in future research. We see, there is a wide range of factors that needs to be considered and many more questions have to be answered before a clear statement about the impact of social visualization tools within virtual communities can be made. Concerning our future research we plan to answer some of the questions mentioned above.

CONCLUSION

First studies on virtual communities were reported in the early nineties. Back then, the research mainly focused on the question if virtual communities are "real" communities and what consequences arise through participation in virtual communities. Some critics worried that the involvement in virtual communities would cause the disengagement from "real" communities (e.g. Kraut et al., 1998). In the mean time, research has provided evidence that virtual communities can indeed be "real" communities (e.g. Baym, 1995; Utz, 1999) and many people today use virtual communities as a new way of "meeting" and staying in contact with each other, while still being engaged in face-to-face interactive groups. Utz (2008) supposes that fundamental principles underlying virtual communities are similar to those underlying face-to-face groups. However, she names some aspects in which virtual communities differ, such as (1) an easier connection of people from all over the world, (2) the facilitation of large-scale collaboration, and (3) access to information that would not be available otherwise.

Based on these findings research nowadays focuses mainly on topics like the emergence and persistence of virtual communities, the content exchanged within virtual communities, or the potential of virtual communities for learning. Researchers agree that virtual communities depend on its members and their interaction, thus one important field of study deals with participation in virtual communities. This is also the domain we are interested in. For our study presented in this chapter we conducted an empirical study based on theories from social psychology and computer science and found interesting hints how to increase participation in a virtual community. After the incorporation of a visualization tool displaying community members' usage behaviour, the number of forum posts, chat posts and personal messages increased significantly. While the results of our study give answers to some first questions concerning the effectiveness of visualization in virtual communities, many questions remain open and need to be answered. For example: "Does visualization encourage participation in all virtual communities?", "Does it affect all users in the same way?" or, "What happens if people want to stay anonymous in the virtual community – do they get discouraged by a visualization tool?". There is more research needed in this young field of study. Cooperation of researchers with different backgrounds and from different disciplines is surely needed to further advance this field of research.

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KEY TERMS AND DEFINITIONS

E-Mentoring: Mentoring that is mainly based on computer-mediated communication like e-mail, chat, or bulletin boards.

Mentee: A less experienced person who is mentored by a more experienced and usually older person. A common synonym for mentee is protégé.

Mentor: The term was derived from Homer's epic tale The Odysseus. In the tale, Mentor, a friend of Odysseus, served as a friend and council to Odysseus's son Telemachus, while Odysseus was in the Trojan War. Today a mentor is usually an older and more experienced person who guides, instructs, and encourages a less experienced person.

Mentoring: Mentoring aims at promoting less experienced persons. One can differ between informal and formal mentoring. Informal mentoring usually develops randomly – for example between a faculty member and a student. In formal mentoring programs the mentor-mentee-tandems are usually arranged and temporal.

Social Visualization: Erickson (2003) defines social visualization as "a visual (or sonic or other perceptual) representation of information from which the presence, activities, and other characteristics of members of a social collectivity may be inferred, and, by extension, can provide the basis for making inferences about the activities and characteristics of the group as a whole" (p. 846).

STEM: Abbreviation for Science, Technology, Engineering, and Mathematics.

Technology Acceptance Model (TAM): A theoretical model by Davis (1989, 1993), based on the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), that explains and predicts usage behaviour of information systems.

virtual community: A simple but appropriate definition of a virtual community (synonym: online commuity) is from Lazar and Preece (2002) who define virtual communities as "a set of users who communicate using computer-mediated communication and have common interests, shared goals, and shared resources" (p. 128).

Visualization Tool: A tool that visualizes usage behaviour of community members or relationships between members of a virtual community.

This work was previously published in Virtual Community Practices and Social Interactive Media: Technology Lifecycle and Workflow Analysis, edited by D. Akoumianakis, pp. 145-163, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.8
A Framework for Analyzing Social Interaction Using Broadband Visual Communication Technologies

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ABSTRACT

Broadband visual communication (BVC) technologies—such as videoconferencing and video sharing—allow for the exchange of rich simultaneous or pre-recorded visual and audio data over broadband networks. This chapter introduces an analytical framework that can be utilized by multidisciplinary teams working with BVC technologies to analyze the variables that hinder people's adoption and use of BVC. The framework identifies four main categories, each with a number of sub-categories, covering variables that are social and technical in nature: namely, the production and reception of audio-visual content, technical infrastructure, interaction of users and groups with the technical infrastructure, and social and organizational relations. The authors apply the proposed framework to a study of BVC technology usability and effectiveness as well as technology needs assessment in remote and rural First Nation (indigenous) communities of Canada.

DOI: 10.4018/978-1-60566-368-5.ch047

INTRODUCTION

People, groups, organizations and communities are increasingly using broadband visual communication (BVC) technologies for social interaction in a wide range of settings - from institutional uses such as business, government, health and education to more informal uses, such as entertainment for family and friends, social networking and digital storytelling.

Researchers use the terms *broadband visual communication* and *broadband video communication* interchangeably. The term *broadband* refers to both broadband networks and broadband Internet - telecommunication in which a wide band of frequencies is available to transmit information. BVC technologies allow both simultaneous and pre-recorded exchange of rich visual and audio data over Internet. The visual and audio data may also be accompanied by text data. The National Research Council Canada (NRC) has used the term "BVC" for many years to refer to videoconferencing which allows synchronous audio-visual communication. More recently, we use "BVC" to refer also to asynchronous communication using pre-recorded videos, such as video sharing on the Internet by people with the capacity to both create and view videos. Increasingly, synchronous and asynchronous BVC are used together for social interaction.

Videoconferencing was introduced commercially in the 1970s. For the next decades, it was used almost exclusively in health care, military, and educational institutions, failing to gain more widespread adoption. In the past few years the decreasing costs and increasing penetration of broadband Internet has stimulated a huge uptake in videoconferencing. Set-top videoconferencing units are now found not only in the previously mentioned settings but also in voluntary organizations, community centers, community health clinics, and schools. Videoconferencing has several immediate and tangible benefits: it encourages interaction between people who cannot meet in person and allows the exchange of visual information, such as facial expressions that encourage trust and intimacy; it encourages "green" meetings that reduce participants' travel and carbon footprint. Videoconferencing can also be an important tool for knowledge sharing, provide essential social services, support for people in rural or remote communities, and aid in community building and development (Molyneaux et al., 2007a; Molyneaux et al., 2008a).

Sharing videos online has exploded in popularity in a very short time as home computers with webcams and digital video cameras have become ubiquitous. The most popular video sharing website, YouTube.com, claimed to receive more than 100 million views per day by more than 20 million users internationally with more than 65,000 new user-generated videos uploaded daily - a mere 22 months after its launch. YouTube users also posted millions of comments about the videos and engaged in exchanges with other users. In 2006, *Time Magazine* named its "Person of the Year" as "You," claiming that the users of YouTube and other user-generated content-sharing Internet sites were "seizing the reins of the global media… founding and framing the new digital democracy …and beating the pros at their own game" (Grossman, 2006).

The objective of this chapter is to discuss the requirements for analyzing social interaction using BVC technologies and to provide an overview of our solution – creating an analytical framework. The analytical framework is a common reference point for multi-disciplinary teams working with BVC technologies seeking to understand the variables that help and hinder people's use of social interaction technologies. We use our research framework to understand the social implications of BVC technologies and the social aspects of technology design and implementation. We also apply the framework to the study of technology usability and effectiveness as well as technology needs assessments. We illustrate how this framework can by used by presenting a case study of BVC in remote and rural First Nations (Indigenous) communities in Canada.

BACKGROUND

BVC involves both simple and complex social and technical interactions. The complexities arise as the interaction grows from communication between two individuals in the same location to communication between multiple individuals in multiple locations, working for multiple organisations rooted in different communities. The main technologies are a camera, a microphone, and some recording and viewing software and hardware. There are multiple hardware and software versions and platforms with compatibility problems, using broadband networks that have access, bandwidth, and management challenges.

In 1997, a study was published that outlined different ways to approach research on video-mediated communication (Finn, Sellen, & Wilbur, 1997). Referring to this publication, in 2002, colleagues working on BVC at the National Research Council developed a cluster of evaluation factors for analyzing BVC among multiple stakeholders in different geographical locations. Five evaluation factors were identified: social infrastructure, technical infrastructure, physical space, interaction style, and content (Barfurth et al., 2002).

Since 2002, broadband Internet capable of supporting high-quality visual communications has become mainstream in most developed countries. This has led to a virtual explosion of visual communications. Applications such as online video sharing, which until 2006 were unknown by the general public, are now used regularly by hundreds of millions of Internet users globally. The use of desktop videoconferencing has also seen a huge upsurge, particularly in young people: a recent study of 1,060 adolescents found that 57% occasionally use webcams while instant messaging and 32% sometimes use microphones (Peter et al, 2007).

Given these new developments, we decided it was time to propose a more comprehensive framework for analyzing social interaction using BVC technologies. Our framework started with our colleagues' earlier work (Barfurth et al., 2002). We then reconfigured it to focus on social interaction and include videoconferencing and online video sharing. This moves it from the realm of small groups to both small very large groups of people, communicating synchronously, asynchronously, or both.

ANALYTICAL FRAMEWORK

Basic Requirements

We aimed for the analytical framework to meet four basic requirements.

Provide a Common Point of Reference for Multidisciplinary Teams

There is a shift in technology research and development toward multi-disciplinary teams. (Members of our research team have advanced degrees in 10 different disciplines.) The framework needed to be flexible enough to embrace a wide variety of theoretical and methodological approaches and research interests. We envisioned the framework as a focal point that would let us share a common language.

If we review literature from disciplines as diverse as those found in our research team - communications and media studies, computer science, clinical psychology, cognitive psychology, educational psychology, philosophy, electrical engineering, sociology, history, and educational technology - we find that there are literally hundreds of variables involved in social interaction using BVC. The concept that many different variables will help or hinder communication using technology is understood and theorised in many different fields. The framework needed to encompass many variables – enablers and constraints – of many kinds. To give a practical example, excellent audio quality during a videoconference enables communication in one location, while poor audio quality constrains it in another location. Other constraints would be if certain participants in one location cannot access the technology to make videos or view them online because they cannot afford it or if their rural community does not have adequate bandwidth. These enablers and constraints shape social interaction. The framework needed to accommodate variables that address different types of concerns from different disciplines.

Include Both Social and Technical Elements

Along with the trend toward multidisciplinary research teams, there is a growing recognition in the technology development field of the need to address both the social and technical elements of technology use and deployment. Actor network theory and the social actor concept posit that the technical and the social are inseparable: people together with their technologies comprise social networks while social actors are simultaneously enabled and constrained by socio-technical affiliations and environments (Blechar, Knutsen, & Damsgaard, 2005; Lamb & Kling, 2003; Rowlands, 2006). In particular, our framework is guided by the social informatics approach of Kling: that is, the relationship between the social and technical is complex and mediated by context, structure and agency, history, culture and meaning systems, political and social processes and symbolic and material interests and resources (Kling, 1999; Lamb & Sawyer, 2005; Robbin & Day, 2006).

Emphasize Both the Production and Reception of Visual Content

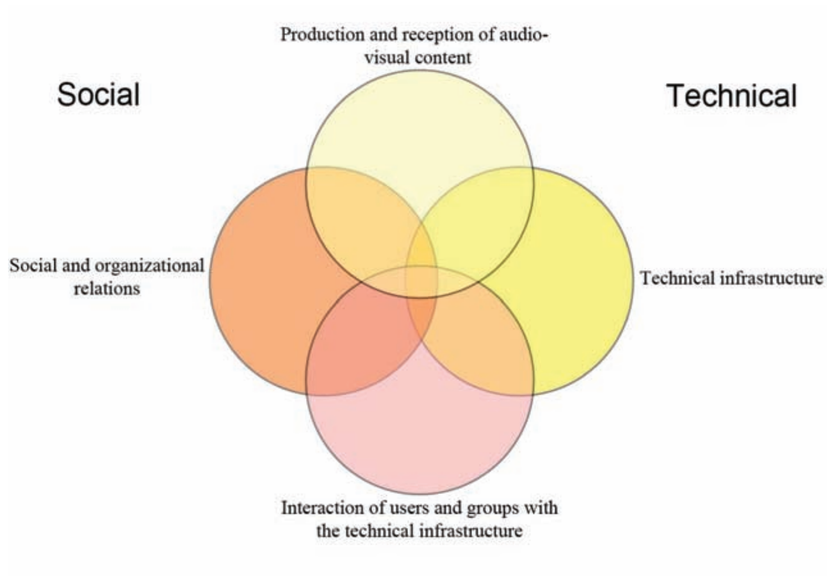
A novel feature of new media is the ability for people to be both producers and viewers of digital content (Lievrouw & Livingston, 2006). Traditionally, videoconferencing research has included both the production and reception aspects of communication, but research on traditional forms of video and visual content generally has focused on either the production or the reception, but not both. Analysing online videos presents a new challenge for researchers because it is important to understand the users of the technology as both producers and viewers or audiences (Molyneaux et al., 2008b).

The most influential theorist of how people respond to visual images is Hall (1999). His central argument is that although creators of a visual image may have a message in mind when they create or "encode" it for its viewers, it does not necessarily follow that the viewers will "decode" the message the way it was intended. Viewers actively construct meanings rather than passively receive them. Both encoding and decoding are socially constructed activities, and Hall's theory stresses that visual messages will be constructed and interpreted differently depending on socio-cultural contexts. Some messages are connected to specific beliefs, practices and interests and are thus dominant in social groups that share these perspectives. Therefore analyzing visual images can reveal the dominant beliefs held by the encoders, and analyzing the viewing audience can reveal the different interpretations decoded by different social groups.

Focus on Multiple Levels of Social Interactions

As noted earlier, using BVC for social interaction is a complex process. Visual communication among multiple people in multiple locations rooted in different contexts implies many analytical variables. There are numerous theories and approaches that build understanding of social interaction using communication technologies at the levels of individuals, groups, organizations and communities. For example, at the group level, the concept that different groups of people have different levels of acceptance and use of a new technology is implicit in influential theories: such as, Rogers' (2003) diffusion of innovations in the field of communication and media research and Davis' technology acceptance model (TAM) in management information systems research (Davis, 1989). In the TAM model, people who

Figure 1. Analytical framework



perceive technology as useful and easy to use will accept it more readily than those who do not, with usefulness more important than ease of use. Extensions of the TAM model identified gender differences (Gefen & Straub, 1997) and cultural differences in e-mail perception and use (Straub, Keil, & Brenner, 1997). The framework needed to include variables for social interaction using BVC at the individual, group, organization and community level.

Core Categories and Variables

Based on the essential requirements outlined above, our analytical framework includes social and technical variables in four core categories: the production and reception of audio-visual content, technical infrastructure, interaction of users and groups with the technical infrastructure, and social and organizational relations (see Figure 1). The categories are not entirely discrete: there is some overlap among the variables in each category.

To identify variables within these four categories, we first conducted a wide-ranging review of almost a hundred published articles and reports on the use of videoconferencing and multi-site videoconferencing and participatory communication in many different contexts, including health and medicine, education, government, corporate, non-profit, research and community uses (Liu, Molyneaux, & Matthews, 2008; Molyneaux et al., 2007a; Molyneaux et al., 2008a). The studies included: literature on virtual teams (Becker &Goodwin, 2005; Jarman, 2005; Jarvenpaa & Leidner, 1998; Mankin, Cohen, & Fitzgerald, 2004; Mansour-Cole, 2001; Nemiro, 2000), literature on multi-party videoconferencing (Anderson, 2006; Blignault, 2000: Sonnenwald et al., 2002), and literature on videoconferencing in health, education, and other areas (Blignault, 2000; Ho & Jarvis-Selinger, 2005; Rees & Haythornthwaite, 2004). The review focused on identifying issues and variables of concern under the four core categories.

We then refined our framework through a series of studies that allowed us to validate the existing variables and add new variables under each of the core categories. These studies produced publications on the use of: YouTube (Milliken et al., 2008; Molyneaux et al., 2008a, 2008b; O'Donnell, 2008), the use of videoconferencing and online video technologies in a live discussion on topical issues by students in six high schools across Canada (O'Donnell et al., 2007; Simms et al., 2008); the use of videoconferencing and online video by First Nation (Indigenous) communities in remote and rural areas of Canada (O'Donnell, Perley, & Simms, 2008); challenges to conducting participatory research on videoconferencing in a health organization (Gibson & O'Donnell, 2008a); and the use of multi-site videoconferencing by a regional health board in Canada for non-clinical health administration and education (Gibson & O'Donnell, 2008b). Whenever possible we also solicited and included feedback from our research partners and participants to inform our procedures, findings, and thinking. Some of our studies also used participatory research approaches.

The four core categories and their associated sub-categories are described below.

Technical Infrastructure

This category covers the variables that are primarily technical. To date we have identified four main sub-categories:

Quality and Availability of Networks and Bandwidth

Broadband visual communication requires considerably more bandwidth than text exchange, and two-way communication requires similar upload and download speeds. The term *broadband* is used to describe many different types of networks and Internet connections, not all of which support adequate two-way exchange of audio and visual data. For example, some people have "broadband" Internet connections that allow them to download and play videos easily, but they run into difficulties when uploading their own videos to share with others. Another infrastructure variable affecting social interaction is the need for managed networks and quality of service (QoS) for synchronous visual communication in remote communities - especially areas serviced by satellite connections. For example, a videoconference from a community with limited bandwidth may have poor visual and audio quality if QoS is not managed, thus limiting the quality of social interaction. Another variable in this sub-category is firewalls in corporate networks.

Type of Software and Hardware for Video Capture, Storage, and Playback

For videoconferencing, there are several brands of set-top units and a wide variety of desktop options. Videoconferencing by mobile phone is now possible as well. Each of these options presents different possibilities and challenges. Some of the variables include: the capacity of the devices and software; the flexibility of the technology to support different group setups, locations, and time constraints; the maximum number of users and groups who can communicate synchronously and asynchronously using the technology; the availability of a critical mass of the technology; the technical compatibility of systems, hardware, software; and the flexibility and capacity of a system for incorporating new features and elements.

Availability of a Videoconference Bridge and Video Sharing Server

For some kinds of multi-site videoconferencing, a videoconferencing bridge (also known as an *MCU*) is required, and technical challenges for bridging different kinds of software and hardware can be considerable. A server is required for sharing videos, and again there can be many technical challenges associated with this.

Quality and Placement of Cameras, Microphones, Screens, and Speakers

In other publications we have discussed the many issues involved with cameras and microphones for BVC (Molyneaux et al., 2007a; Molyneaux et al., 2008a). Not having a good quality audio or visual connection when communicating with this technology can be a significant inhibitor to communication in many settings.

Interaction of Users and Groups with the Technical Infrastructure

This category includes variables that have both technical and social elements. To date we have identified four main sub-categories:

Access by Users and Groups to the Hardware, Software, and Network
As noted earlier, BVC, and its software and equipment requirements, is more complex than text-based communication. Most households in the US and Canada have computers and an Internet connection; however, not all of these households also have a digital video recorder or a webcam and microphone as a part of their computer setup. Accessing higher-end videoconferencing equipment can be a challenge and may have prohibitive associated costs.

Levels of Awareness, Comfort, and Technical Skills of Participants
Different people have varying levels of awareness, comfort and technical skills with BVC, and these will have an impact on the communications and social interaction. One variable is that some people are camera-shy. Our study of online video production and viewing by 150 high-school students in three Canadian provinces found that more than 25% said that in general they do not like to appear on camera (Simms et al., 2008). Our work with the health board found anecdotal evidence that sometimes participants will point the videoconference camera at the site location sign rather than themselves if they do not want people looking at them that day.

Levels of Technical Support
For videoconferencing in particular, the technical support required is generally beyond what an ordinary computer user can manage. Participants who have ready access to technical support will find it much easier to participate in many different forms of BVC.

Ease of Use, Ease of Viewing
Many variables are involved in making BVC easy to use and easy to view. These include the computer interface, position of the screen or monitor, and a wide range of human-computer interaction variables.

Production and Reception of Audio-Visual Content

This category also includes both social and technical variables. To date we have identified four main sub-categories.

Task Relevance and Usefulness of Broadband Visual Communication
Broadband visual communication can be very useful for supporting certain kinds of interactions and tasks. At other times BVC might not be worth the effort. For it to be successful for social interaction, BVC must be a good fit with the group or organization process and be a real solution to a real communication need. Participants will not be motivated to use the technology effectively if they do not believe it will be useful for them (Davis, 1989).

Use of Protocol and Etiquette
Successful meetings by videoconference will use established etiquette (Molyneaux et al., 2007a). Sharing online videos successfully also requires that certain protocols be followed: for example, considering privacy concerns and not sharing material without permission from everyone on camera.

Use of Communication Modes and Methods
For video sharing in particular to have a communication impact, the video producers should

be thinking about the communication value of their production. It does not necessarily follow that the message intended would be the one received by the viewer; however, a video made without any consideration of the communication intent and impact on the viewers will likely not have a good communication outcome. There are many variables involved in making an effective audio-visual message, from body language and clarity of the speaker to the production values of the video. For videoconferencing as well, if the speakers are not actively trying to communicate with people at the remote sites, their communication is not likely to be effective. Other variables in this sub-category include: how the visual is framed, the use of color and movement, and other visual elements.

Use of Participants' Physical Space

For videoconferencing and also for making and viewing videos, there will be an optimum use of the physical space. Variables include furnishings (position, quality), room (size, obstructions), lighting, room configuration, and even the color of the wall or background. To give an example, in our multi-site videoconferencing study in a health authority organization (Gibson & O'Donnell, 2008b), it was clear that room size could have a significant impact on the success of a videoconference. In one instance, the room could comfortably fit up to 16 people; but it was not uncommon for 45 individuals to be put into this room for the videoconference event, leaving many people without a view of the videoconference screen, without a seat, and without the opportunity to ever appear on the video.

Social and Organizational Relations

This category includes purely social variables. To date we have identified five main sub-categories.

Impact of Group Dynamics: Trust, Norms, Group Size, Leadership

Many variables in the sub-category of group dynamics can make the difference between a successful and unsuccessful social interaction using BVC. Trust is a primary consideration. Participants who prefer to build up trust by meeting in person rather than by video and who have that option readily available will not be very interested in meeting by videoconference or by sharing videos. Other variables in this sub-category are: group size, structure, and stage of development; group norms; and group leadership. For multi-site videoconferencing, we have identified a tendency for people who come together for a committee meeting to rate their feelings of connection (e.g., perceive that a warmer environment is created, feel more like part of a group) with the other videoconference participants as higher than people who do not consider themselves to be a part of a group and who meet for educational videoconference events (Gibson & O'Donnell, 2008b).

Influence of Gender, Class, and Race

A sociological perspective on communication will always consider the core sociological issues of gender, class and race; and they do need to be considered when analyzing BVC for social interaction. There are many ways that these variables will have an impact on social interaction using BVC technologies. Our study of gender on YouTube, for example, found differences between how females and males used video sharing to connect with the YouTube community (Molyneaux et al, 2008b).

Participants' Culture and Community Membership

Broadly speaking, BVC is used among people separated by geographical distance; often this will mean participants are living in different cultural and community contexts. Some communities and cultures will have different levels of comfort with and attitudes toward communicating visually using technology. For example, in our research with First Nations (Indigenous) communities in Canada, we found concerns about cultural exploitation by sharing videos online. One participant interviewed said it was important to get the permission of community leaders before making a video about their culture (O'Donnell, Perley, & Simms, 2008).

Location of Participants

One's social location and position will shape the social interaction experience – in our multi-site videoconferencing study within a health organization, we found that often the remote and rural sites were at a disadvantage. For example the majority of individuals in a videoconference session, including the event's chair or facilitator, were situated at an urban site. The rural and remote sites were sometimes forgotten, as noted by several participants in our study who added that if they are lucky they may be solicited for feedback a few times during a session (Gibson & O'Donnell, 2008b).

Economic and Political Factors

Finally, structural social relations can shape social interaction using BVC technologies in numerous ways. If there is a stakeholder organization involved, it will make a difference if it has a governance model that is top-down vs. community-based and bottom-up. Other variables are the availability of funding and business models to support development of audio-visual content and the demand for and marketing of services and information.

Case Study

Our analytical framework is a tool that can be used by multidisciplinary research teams to explore how BVC is used and can be used for social interaction. The expectation is that every investigation we conduct will consider not every single variable in the framework – that would be unrealistic. Rather, we will consider variables from each of the four core categories: social and technical issues, production and reception issues, and social relations. In this section we present a case study based on our recent research using the framework (O'Donnell, Perley, & Simms, 2008).

Challenges for Broadband Visual Communications in Remote and Rural First Nations in Canada

For Canada's remote and rural communities, BVC provides a vital lifeline. We used our analytic framework to explore the challenges for BVC in remote and rural First Nation (Indigenous) communities. We collected data from actual users of visual communications technologies in First Nation organizations and communities. The study, part of an ongoing participatory research project with First Nation partners, draws on data from 18 in-depth interviews, 43 completed survey questionnaires, and the transcripts of two public meetings held by multi-site videoconference with participants from many remote and rural First Nations across Canada. This research, and all our other research involving people, was approved by our institution's research ethics board.

We used our analytical framework at four stages of the research. First we used it to develop the questions for the in-depth interviews and survey questionnaires. This involved selecting variables from each of the four categories and formulating questions for the interview participants and survey respondents about their experiences with these variables. Second, we used the framework to identify major coding categories for qualitative data analysis of the interview transcripts. This involved creating codes for variables in the four core categories and their sub-categories. With these codes, we coded the transcript text using a qualitative data analysis software tool, *NVivo*. Third, we drafted the research report using the four core categories from the framework as headings and the relevant variables as sub-headings. Finally, we verified the draft findings by consulting with our First Nation research partners. This checking process allowed us to validate the framework in the specific community context, add more variables to our framework, and strengthen our confidence in this framework as a research tool.

Using the framework in this specific study enabled us to identify the many and varied challenges to using BVC for social interaction in remote and rural communities. All the examples and quotes below are from our publication about the study (O'Donnell, Perley, & Simms, 2008).

The main technical infrastructure challenges identified in the study were network and bandwidth constraints, the need for network management and quality of service in remote communities serviced by satellite, the need for a critical mass of quality videoconferencing units in communities, and specific technical challenges for sharing videos online in communities with limited bandwidth. For example, one participant interviewed stated: "In our regions, in our communities and in our organizations, we have to carefully manage a limited resource. There is no such thing as unlimited bandwidth, so it has to be carefully managed, just like the highway has to be carefully managed and taken care of."

The main challenges identified for community members interacting with the technology were the lack of awareness of and comfort with using BVC technologies in communities, low levels of skills training and few community champions, the low level of technical support in many of the remote communities, and difficulties accessing equipment in the communities. To give an example, we found that although a community center may have videoconferencing equipment, it may only be available at certain hours that are not convenient for everyone in the community, and it may be difficult to find the key to the room with the equipment.

The main challenges for the production and reception of audio-visual content included: the varying levels of time, interest and motivation to produce audio-visual content, the low levels of knowledge about topics of interest to other community members, low levels of knowledge of videoconference etiquette, the lack of visibility of existing audio-visual content in the communities, and concerns about cultural exploitation by sharing video content online.

Finally, the two main challenges for social and organizational relations were the need for program developers and sponsors of broadband infrastructure to have a community development focus and the low level of BVC activity by urban organizations. One participant interviewed described the need for a community development focus for funding BVC: "Because too often in the communities, there's such a small pool of people that are comfortable enough and trained to use the equipment, and if we can support those persons and if we make sure they're compensated, then they're going to take a lot better interest in keeping the equipment and therefore be more willing to use it. So it's not only supporting the community network, but supporting the community people as well."

FUTURE TRENDS

We are confident that social interaction using BVC technologies will continue to increase in both institutional and informal settings. Market research reports predict that videoconferencing will see solid and steady growth over the next five years – 19% growth in North America and 24% for Europe, the Middle East and Africa (Frost & Sullivan Reports, 2008a, 2008b). The use of online video is exploding – predictions of 40% growth per year are common. There is little doubt that the rapidly growing use of these technologies will involve increasing levels of social interaction.

The analytical framework described in this chapter identifies the core categories and subcategories with variables that enable and constrain social interaction using BVC technologies. Using the framework and exploring these variables in specific situations is the focus of future work. We consider this framework a work in progress and will continue to refine it as our research on BVC technologies continues. Further research needs to be conducted to find ways to encourage the enablers and mitigate or overcome the constraints using practical and innovative social processes and technological solutions.

One of the next steps for us as researchers is to explore and expand our use of participatory research methods for doing this kind of research. We are mindful of the feminist approach of standpoint theory (Harding, 2004). Standpoint theory suggests that although there are commonalities and differences between various members in a group, there can also be solidarity among diverse group members. Drawing on the assumptions of standpoint theory we value the experiential knowledge and perspectives of the users of the technology. Consequently, much of our research is participatory-action research and involves working closely with authentic user groups and using their knowledge and experience to inform our needs assessments, interventions, and evaluations.

CONCLUSION

The use of broadband visual communication (BVC) technologies for social interaction is increasing rapidly as digital video cameras, webcams, videoconferencing equipment and broadband approach ubiquity. Analysing social interaction using BVC technologies is challenging. We created an analytical framework as a reference point for our multidisciplinary research and development team working in this area. We developed our framework initially by reviewing almost a hundred studies of BVC technologies and participatory communication. We further developed and validated our framework by conducting a series of studies of social interaction using BVC technologies in different social and cultural contexts. Our framework is a key research tool that guides our work from the development phase through to data analysis and interpretation and presentation of findings. We will continue to strengthen and develop our framework in the coming years through ongoing and new research projects. Our hope is that our analytical framework will be useful for other researchers in this exciting research area.

ACKNOWLEDGMENT

The authors would like to thank their colleagues working on the National Research Council Canada's Broadband Visual Communication Strategic Initiative (BVC-SI) who contributed to many discussions of the analytical framework and variables introduced in this chapter.

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KEY TERMS AND DEFINITIONS

Actor Network Theory: Related to the social actor concept, actor network theory states that people, together with their technologies, comprise social networks. Technical and social elements cannot be separated in this theory.

Asynchronous Visual Communication: Communication using pre-recorded videos, such as video sharing on the Internet.

Broadband: In this chapter, *broadband* refers to both broadband networks and broadband Internet. In general, the term refers to telecommunication in which a wide band of frequencies is available to transmit information.

Broadband Visual Communication (BVC): BVC technologies allow the simultaneous or pre-recorded exchange of rich visual and audio data over broadband networks.

First Nations (Indigenous) communities: First Nations are recognized by the Canadian Constitution as one of the founding nations of Canada.

Online Video Sharing: Posting and viewing asynchronous (pre-recorded) videos over broadband networks.

Social Informatics: A theory that argues that the relationship between the social and technical is complex and mediated by context, structure and agency, history, culture and meaning systems, political and social processes and symbolic and material interests and resources.

Synchronous Visual Communication: Simultaneous video communication, accomplished by videoconferencing.

Technology Acceptance Model (TAM): In the TAM model, people who perceive technology as useful and easy to use will accept it more readily than those who do not, with usefulness more important than ease of use.

Videoconferencing: Synchronous audio-visual communication using broadband networks.

Videoconferencing Bridge: The multipoint control unit (MCU), commonly known as the *videoconferencing bridge*, is a device that allows multiple sites to videoconference simultaneously.

This work was previously published in the Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova and R. Fiordo, pp. 528-541, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 3.9
The Hybrid Course: Facilitating Learning through Social Interaction Technologies

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ABSTRACT

This chapter surveys the benefits and challenges of hybrid courses, which blend face-to-face instruction with online learning, and opportunities provided by the introduction of Web-based social interaction technologies. It discusses the pedagogical implications of various Web 2.0 tools: that is, asynchronous discussion boards, blogs, wikis, podcasts, RSS, e-portfolios, folksonomies, educational gaming, data mashups, and simulations. The authors argue that as hybrid courses continue to evolve to meet the needs of students, instructors, and institutions of higher learning, the integration of Web 2.0 applications in a hybrid model requires thoughtful course design, clear educational objectives, and carefully planned activities.

DOI: 10.4018/978-1-60566-368-5.ch020

INTRODUCTION

The traditional face-to-face classroom, in which an instructor lectures, demonstrates, and leads discussion, has been the primary method for acquiring an education in colleges and universities. However, advances in social interaction technologies have resulted in greater variation in educational experiences for online learning. A study by the National Center for Education Statistics surveying over 4,000 two and four year degree granting institutions found that 88% plan to increase or start offering courses using asynchronous computer based instruction as the primary mode of delivery (National Center for Education Statistics, 2003). Asynchronous instruction means that students and faculty are not required to be present at the same time (either electronically or in person) to participate in the class. Technology is clearly transforming the educational landscape.

On the continuum from fully face-to-face to fully online courses, *hybrid* or *blended* courses are centered somewhere in the middle merging the most desirable aspects of both approaches (So & Brush, 2008). In a hybrid course, students spend more time learning online through planned activities, tutorials, assignments, and discussion. To make time for online activities, the face-to-face class meeting time is reduced significantly. Unlike the traditional lecture-based classroom (also known as face-to-face teaching), students have more flexibility regarding the time and place where learning occurs (Aycock, Garnham, & Kaleta, 2002). Some contend that this promotes students' active engagement in their learning, typically called *student-centered* or *constructivist learning*. Bransford, Brown, and Cocking (1999) argue that active, as opposed to passive, learners are better able to understand complex information, are more likely to transfer concepts learned in one setting to another, and are more likely to retain information.

BACKGROUND

As recently as the mid 1990's, most students did not own a personal computer, used single function technologies (e.g., phone, camera, video player), and had irregular access to the Internet. Today's students typically own computers, have multi-function mobile technologies, and use the Internet on a daily basis (McGee & Diaz, 2007).

The technological environment continues to change for faculty as well. During the 1990's the "technology" in the classroom originally consisted of chalkboards, overhead transparency projectors and VCRs. Classroom Internet access was not common. Additionally, faculty may or may not have had access to email from home, and if they did, dial-up service made home use of the Internet slow and sometimes unreliable. Today, more classrooms are equipped with various types of technology including Internet access, integrated projectors for computers and DVDs, audio and video devices for distance learning, and document cameras, to name a few. Typically, faculty members have home access to campus computing resources using improved broadband connections. Learning management systems, sometimes called *course management systems*, are becoming more commonplace and are enabling communications, learning materials, assignments, and grading to occur online.

Although face-to-face lecturing is still a mainstay of many professors' teaching repertoire, emerging technology is shifting the methods used by faculty (Maloney, 2007). Educators are no longer solely lecturers, but are increasingly becoming designers and facilitators of learning environments. Along with changes in technology, advancements in learning theory also play a role in this paradigm shift. Educators are now advised to incorporate more constructivist pedagogy in which active learning is accomplished (Rovai, 2007). Instead of focusing exclusively on the transfer of knowledge from teacher to student, educators are encouraged to find ways to motivate and involve students in the discovery and even the creation of knowledge. The expected outcomes of effective teaching are also changing. As educators move from a teaching-centered to a learning-centered model, student recall of information is not necessarily the preferred outcome. Student understanding, integration, and application become salient desirable outcomes. Indeed, changes in technology and learning theory are having an impact on how contemporary educators approach instruction. Many educators are beginning to teach in ways that differ from how they were taught when they were students (Hartman, Dziuban, & Brophy-Ellison, 2007).

According to Burbules (2007), education needs to be understood in the current context of technological ubiquity. Although definitions of Web

2.0 vary, the term acknowledges development of web applications beyond read-only websites that now allow Internet users to increasingly become content providers as well as receivers. The earlier developments on the World Wide Web served to disperse information in a top-down manner. Today, the web has evolved to be more participatory with collective users building information from the bottom up or interacting with each other in real time or asynchronously. The web is also increasingly accessible and user-friendly. Web feeds or web syndications update relevant information automatically, harnessing the combined intelligence of users. Social networking and resource sharing sites have emerged rapidly and "students have turned these sites into the nexus of their social and even academic universe" (Hartman, Dziuban, & Brophy-Ellison, 2007, p. 66). The current uses of technology are blurring traditional spheres previously viewed as separate. Work and play, learning and entertainment, accessing and creating, and public and private areas are no longer demarcated with clear distinction (Burbules, 2007).

This chapter reviews newer and emerging applications of technology, many of which are being used in education, particularly in hybrid courses blending traditional face-to-face teaching with enhanced technology. Learning management systems, user-created content, social networking, collaborative learning, podcasting, virtual worlds, and educational gaming are beginning to broadly affect higher education, and will continue to do so in the near future. The benefits and challenges of these emerging applications for hybrid learning are discussed.

HYBRID COURSES AND SOCIAL SOFTWARE

Courses taught in hybrid mode do not simply "add technology" to the existing curriculum, but should involve thoughtful course redesign in order to apply principles of good pedagogy fully augmented with outside-of-class activities enabled with technology. Bloom's taxonomy describes several categories of learning. In the cognitive learning domain, instructional activities range from lower levels to higher levels of learning. For example, as one moves up the hierarchy (knowledge, comprehension, application, analysis, synthesis, and evaluation) the development of intellectual attitudes and skills become increasingly sophisticated (Bloom, 1956). Higher thinking rests on a foundation of lower order thinking. For most courses, hybrid mode is best implemented by having the students do preparatory work outside of class so the in-class activities can provide an opportunity for learning at higher levels of Bloom's taxonomy with very little traditional lecturing occurring.

A Learning Management System (LMS) is an important component of most hybrid courses. It is a software application or web-based instructional technology used to develop, implement, and evaluate student-learning activities. Examples of learning management systems include Blackboard®, Webboard®, or WebCT®. Some faculty members create their own websites providing resources analogous to an LMS. An instructor may use the LMS to provide learning materials (e.g., readings, assignments, brief video, links to external websites, etc.) and social software applications (e.g., interactive chat, blogs, etc.).

A typical tool embedded in an LMS is an *asynchronous discussion board*. According to Martyn (2003), the asynchronous discussion board lets the students post technical and content-oriented questions, clarify assignments, post and answer each other's questions under the supervision of the faculty member, and build community. Gannon (2004) explains how she incorporated active learning into her course by giving students weekly online assignments, which included using the discussion board. Students were informed that their postings would be graded for quality and quantity, and Gannon observed that most students were motivated to participate and successfully completed the work. Likewise, a sample of 413 students in a hybrid setting reportedly found the discussion board tool more useful than in-class discussions because: (a) they could take their time to compose a response, (b) they were required to participate online as opposed to face-to-face where participation was not required, and (c) students who normally do not participate in class were less reluctant to participate online (Amrein-Beardsley, Foulger, & Toth, 2007). There is also evidence that participation in online discussion can enhance engagement during face-to-face in-class discussions (Vess, 2005).

Rovai (2007) provides a thoughtful synthesis of current techniques for facilitating online discussion effectively. Among his recommendations, instructors should provide forums for socio-emotional discussions as well as content and task oriented discussions. This serves to build a sense of community within the course. Similarly, instructors should balance developing a social presence in the virtual environment while avoiding monopolizing discussions. Additionally, instructors need to attend to social equity issues, and have an awareness of the communication patterns of culturally diverse students.

The LMS can also be used to observe student participation online, evaluate student work, exchange material with students, hold virtual office hours or classes, manage groups or teams, anonymously deliver student evaluations and grades, and provide for wikis or blogs. One study found that students identified the online grade book and announcements as most useful (Amrein-Beardsley et al, 2007). In this study, students appreciated timely posting of assignment grades, found it helpful to monitor their progress, and felt more college instructors should use the tool.

A web-based LMS should have the capability to link transparently to other web resources such as educational games, simulations, or other resources. Often a teacher will collect a number of resources in an organized fashion within the LMS, known as a learning module. The learning module enables students to accomplish one or more learning outcomes by performing a series of activities in an organized fashion. An LMS may be open-source, purchased for a license fee, or developed by a teacher to meet specific course requirements. LMS developers are encouraged to adhere to standards by following the Shared Content Object Reference Model (SCORM) to enable compatibility between LMS (for more information about SCORM, see http://www.adlnet.gov/scorm). LMS can have various Web 2.0 capabilities including: blogs, wikis, virtual classrooms, podcasting, Really Simple Syndication (RSS®), and e-portfolios, which are described below.

Blogs

A *blog*, short for *weblog*, provides the capability for the user(s) to post information about a particular topic or to maintain a diary with entries typically posted in reverse chronological order. Currently the fastest growing area of the web, blogs account for around 27% of all Internet use (Ramos & Piper, 2006). In March 2005 there were approximately two million blogs worldwide. Technorati®, a blog search engine, is now tracking over 70 million blogs, and notes about 120,000 new blogs are created worldwide each day. In academic settings, student blogs may be used to share information, to report on events, to practice writing, to develop argumentative and editing skills, and to engage in collaborative design. Students reading blogs may benefit from exposure to a variety of perspectives, values, and life experiences. Ramos and Piper (2006) argue that as the Internet becomes more accessible around the world, so do "the voices in the blogosphere, representing viewpoints from a diversity of cultures, and allowing glimpses into people's lives that have never before been possible" (p. 571). Blogs can be authored by groups or individuals, and may be authored by instructors or students.

Research on blogs has looked at their personal journal or storytelling function. Herring, Scheidt, Bonus, and Wright (2005) examined a random sample of blogs and found that more than 70% could be classified as personal journals. However, blogs differ from diaries in the sense that they are public and others can comment on blog entries. Stefanone and Jang (2007) studied the personality characteristics of bloggers and observed that individuals high in extraversion and self-disclosure tend to have larger online social networks with stronger ties. Furthermore, they found that rather than promoting isolation, blogs tend to enhance existing relationships. Research on educational uses of blogs is presently limited. Stefanone and Jang (2007) remark that the potential exists for studying the effects of public accessibility of personal information. Other potential research areas include: the strategic use of blogs by students, student decision-making on blog content, demographic and psychological factors affecting blog behavior, perceived student benefits of blogging, and faculty experiences with the use of blogs as an educational tool.

Wikis

A *wiki* is a writing space that is created and edited by a community of users (Saxton, 2008). Wikis provide the opportunity for educational collaboration where users may create text, link web pages, and edit their work. Wikis enable bottom-up editing where expertise is not limited to a few, but rather emerges from the combined efforts of the many (Ramos & Piper, 2006). Wikis and blogs can incorporate text, images, audio and video. They may be included in an LMS, or available as an open source product or licensed product. Wikis may be private to the class, often by authentication through the LMS, or open beyond the class. It is important to choose a wiki that meets the instructor's educational objectives. Phillipson (2008) identifies several different types of educational wikis, three of which are presented here. For example, he describes the *resource wiki* as an assemblage of a collaborative knowledge base, much like the popular Wikipedia®. The *presentation wiki*, on the other hand, may aim to represent class content to the outside world, and may also highlight the process the class followed to assemble the information. A *simulation wiki* is an interactive environment where exploration, decisions, and branching pathways dominate. Phillipson (2008) describes how students involved in the Holocaust Wiki Project, used background information to invent a family. Then, using multiple actors, narratives and story lines, they were able to explore and study this historical event through participation in the wiki. Although these and other potential uses of wikis as an educational tool are just beginning to be explored, clearly, wikis have wide ranging potential in student learning.

Podcasts

Podcasting, a term derived from the combination of Apple's *iPod*® and *broadcasting*, involves transferring digital media files, such as audio and video, over the Internet for replay using portable media players and/or personal computers. The function of a podcast is communicative; it is useful for sharing ideas and information, and enables learning to occur in a convenient and portable format. Podcasts appear to have significant potential as a mobile learning tool. Evans (2008) explored the use of podcasts as a method for students to review material after taking a traditional lecture class, but prior to their final examination. In this study, podcasts were not used as an alternative to attendance, but rather as a supplemental method of review. The findings demonstrated that students were receptive to using podcasts and felt that podcasts were more effective than their own textbooks and notes in helping them to learn. Podcasting can also make material more accessible to diverse learners (Cebeci & Tekdal, 2006). Some have even converted entire lecture courses into podcasts, allowing class time to be dedicated to problem solving and group project sessions. However, McGee, and Diaz (2007) advise against transmitting entire lectures through podcasting; instead, they recommend selecting shorter, more pointed segments for transmission which they contend will result in more student use. Villano (2008) provides practical advice for designing better podcasts in areas, such as communication skills, sound quality, length, and editing, to name a few. Additional research is needed on the effectiveness of podcasting as a learning tool (Evans, 2008). Podcasts have the ability to be syndicated, or subscribed to using an aggregator, such as an RSS® reader.

Really Simple Syndication (RSS®)

An *RSS® reader* receives feeds from content that is frequently updated, such as blog entries, podcasts, and/or news headlines. The reader or *aggregator* will frequently check the content of subscribed sites for updates and will display the new material. It will *aggregate* material from multiple sites into one location so that the user does not have to check multiple sites for updates. The RSS® reader may be incorporated in other educational tools, such as an LMS, wikis, or blog.

E-Portfolios

E-portfolios are an integrated collection of web-based multimedia documents that may include curriculum standards, course assignments and corresponding student artifacts, and reviewer feedback to the student's work (Gathercoal, Love, Bryde, & McKean, 2002). The evolution of web-based technology has made it easier to construct, store, and present evidence of academic work online. This, coupled with a shift toward competency-based education where students demonstrate what they have learned makes electronic portfolio development a growing trend (Johnson & Rayman, 2007). One example is the Digital Notebook project at Georgetown University. Students have an online space for learning, creating, collaborating, and storing the evidence of their work. Maloney (2007) explains: "Our hope is that the *Digital Notebook* will help students track how their thinking developed from their freshman to their senior year, in part by giving them the tools to map connections between the pieces of information they have learned and to share those connections and knowledge with others" (B27). As a practical matter, it is important to choose an e-portfolio format that meets the instructor's education requirements.

Virtual Classroom

Another possible component of some hybrid courses is the *virtual classroom*. "Virtual office hours" are possible through synchronous interactive chat (the equivalent of Instant Messenger®). The virtual classroom also provides other resources, such as an online "whiteboard" which has the capability to project material onto a "shared" screen which can be viewed by students when they are online. These sessions may be recorded and made available so that students can view them at a later time.

Folksonomies

With this capability, it is possible to add *tags* (keywords) to information providing the user with the ability to manage the information. This is also known as *collaborativetagging* and *socialclassification*. These tools make it possible to categorize and annotate content using tags and to provide the capabilities to associate tags with individuals. A *folksonomy* is user-driven and directly reflects the vocabulary of users. Folksonomies often arise in communities of web users, such as the Flickr® photo sharing site. It is anticipated that they will become popular because they place the responsibility of organization on the user. Folksonomies will likely become an important tool in student learning.

Educational Games

The video game market is currently the third fastest growing segment of the entertainment media market, and is expected to be a 48.9 billion dollar industry in 2011 (Scanlon, 2007). Two areas slated for growth are the so-called "serious games" which are used for non-entertainment or educational purposes, and the innovative attempts to begin combining gaming with the social networking features of Web 2.0 (Scanlon, 2007). These games (sometimes called Massively Multiplayer Online Educational Gaming) bring multiple players together in a goal-oriented activity that can be collaborative or competitive in nature. Educational games (*edugames*) typically involve role-playing exercises where player-learners work towards achieving educational objectives. For example, games designed to make business deals and build wealth help learners practice strategy and apply knowledge competitively (New Media Consortium, 2007). Another educational game might include virtual immersion (Multi-User Virtual Environments) in a foreign language or culture, where players read directions, travel, and interact with others to complete a quest.

One advantage of these games is that learning may be accelerated when there is an emotional response involved, such as excitement or interest (Waters, 2007). Another advantage is that the virtual world may provide a safe environment for trying new skills and making mistakes. In the virtual world, player-learners often use *avatars* (a computer user's one, two or three dimensional representation of himself or herself). These representations can enable player-learners to save face as they try to improve their skill (Waters, 2007). Research demonstrates that well designed *edugames* have the potential advantage of increasing intrinsic motivation and deepening learning (Moore, Fowler, & Watson, 2007). Although educational gaming is not heavily used today, the proliferation of open-source gaming engines will make it more realistic for developers to produce these tools for educational purposes.

Data Mashups

According to Maloney (2007), *mashups* are websites that "take dynamically changing pieces of information from completely different sources and compile the data into an integrated user experience, one that continues to change and grow as the underlying information changes" (B26-27). For example, the U.S. Environmental Protection Agency has created a Google® Earth mashup that generates maps of the earth displaying air quality based on pollutants from businesses (New Media Consortium, 2008). It is anticipated that mashups will help educators show their students relationships between large data sets in ways that are meaningful. They can also be used for artistic and creative expression.

Simulations

Because it is impractical or too costly to execute some educational experiments or events, often *simulator* tools are used to represent key elements of a physical or conceptual system. Because of the complexity of many of these systems, it is necessary to limit the number of elements represented. The *simulation* may be used to represent such things as a scientific experiment, a business process, or an engineering system. There are tools available for creating simulations such as those developed by Carnegie Mellon University as a part of their Open Learning Initiative. As these and other tools are developed further, it is anticipated that hybrid courses will play an important role in the evolution of the educational landscape.

BENEFITS OF HYBRID COURSES

Well designed hybrid courses have the potential to benefit students in a variety of ways. Students have access to multiple course resources, and are not limited to learning in a particular physical space. In many ways, hybrid courses shift the focus away from the instructor, and promote a more *learner-centered* model. The extended access to the materials allows students to learn at their own pace. Additionally, students typically participate in online discussion and networked shared learning. So and Brush (2008) found that students who perceived high levels of collaborative learning in their course tended to be more satisfied with their hybrid experience. Building community, having exposure to other points of views, expressing ideas, and giving and receiving peer feedback are important aspects of hybrid courses. Students also benefit from practicing technical and online skills they will need upon entering the workforce.

Marcketti and Yurchisin (2005) emphasized that undergraduates preferred the hybrid format to traditional offline format, and to a course that had exclusively online elements. Some argue that a good hybrid design can result in better student learning of past course objectives and achievement of new objectives. DeNeui and Dodge (2006) observed a significant positive correlation between students' usage of online components and their success in the course. In their study, those who used Blackboard® more frequently scored better on exams than those who used it less frequently. Furthermore, research using a blind review process demonstrated that students in well-designed hybrid courses completed projects that scored between 10-12% higher grades than those written by students in lecture format classes (Martyn, 2003). Also, well-designed hybrid courses add new learning outcomes, such as life-long learning and team-based learning skills. Institutions with increasing enrollments and limited physical space may find that reducing in-class time can lead to more effective utilization of classrooms and meet the greater demands for education (Olapiriyakul & Scher, 2006).

CHALLENGES OF HYBRID COURSES

Developing new methods of teaching takes motivation and an investment of time. When considering hybrid courses and the use of social software tools, it would be worthwhile for educators to conduct a *Strengths, Weaknesses, Opportunities and Threats* (SWOT) analysis of the objectives of the project. This will provide an opportunity to consider the various factors that are either favorable or unfavorable. The results of the analysis will be unique to the faculty member and the course involved. There are several good models for moving to a hybrid mode on various university websites. Also, some learning modules have been developed by universities and are freely available for use by other universities. The efforts of Carnegie Mellon University and the Massachusetts Institute of Technology (MIT) are noteworthy. Other modules are generally available on the Merlot.org website, and there are commercially developed products.

In addition to the specific technical aspects of the LMS software and other technology, faculty may need training in pedagogical principles that apply to hybrid courses. Training may include understanding the impact of various learning styles and principles, creating learning outcomes, and designing appropriate online content, assignments and assessment methods. Faculty members need institutional support in the form of incentives or release time from teaching to take on the additional work that comes with converting a face-to-face course into one with an online component (Grosjean & Sork, 2007). They also need access to faculty development professionals who have technical and pedagogical knowledge, as well as awareness about how to facilitate compliance with the Americans with Disabilities Act (ADA). Some of the other challenges that faculty and administrators should consider follow:

1. Faculty who are using hybrid mode will find it beneficial to explain to students how the use of this approach will help to achieve specified learning outcomes. In other words, explaining *why* they are participating in new educational activities is helpful. "Today making the transition from passive to active learners means engaging them [students] in the conversation from the beginning" (Moore, Fowler, & Watson, 2007, p. 52). Because this may be a new experience for the students, they will also need training and rules for professional behavior ("netiquette") in this environment.
2. The skills of research, critical thinking, and evaluation will be increasingly important to students who have unprecedented and instant access to user-created content of varying quality (New Media Consortium, 2007).
3. Most student evaluations of teaching effectiveness instruments were designed to assess face-to-face instruction, focusing primarily on an individual instructor. In hybrid courses, a broad spectrum of elements shapes the learner's experience (Grosjean & Sork, 2007). Some of these include the technology itself, the design of content, the organization and integration of materials, and even the faculty member's ability to moderate an online community. Methods of evaluating instructors may need to be modified to assess the instructor as a designer and facilitator of an interactive learning environment. In this learning environment, teaching excellence is becoming more multifaceted (Hartman et al, 2007).
4. Because faculty may be using the web and commercial products, they need to be aware of the Family Educational Rights and Privacy Act (FERPA) requirements as well as copyright and intellectual property requirements when using the products of others, including the copyright and intellectual property rights of their students.
5. Hybrid courses emphasize more self-regulated learning on the part of students. Although this develops students' active involvement, the research by Aycock and colleagues (2002) suggests that students' poor time management skills can be an obstacle. Understanding student motivation, appropriately pacing workload, providing sequential tasks, and having discussions about students' self-directed learning roles may be helpful.
6. It is also useful when implementing new instructional methods to provide students with opportunities for regular feedback. Grosjean and Sork (2007) recommend that instructors should be prepared to change aspects of their hybrid course if something is not working as intended. Evaluation, feedback, and reflection are necessary to make adjustments to hybrid courses over time.

FUTURE TRENDS

Although there is extensive research on students' satisfaction and perceptions of learning, only a few empirical studies have examined the influence of hybrid course technology on objective measures of student learning (DeNeui & Dodge, 2006), and more outcome-based research is needed. As a result, professional conferences and workshops related to hybrid learning are increasing in number and quality, with the non-profit Sloan Consortium (Sloan-C) as one of the leaders (http://www.sloan-c.org).

Shih, Feng, and Tsai (2008) examined research and trends in the field of e-learning between 2001-2005 and concluded that studies related to instructional approaches, information processing, and motivation will likely be influential topics for subsequent research. They predict that an essential issue in future research will be "how to maintain and enhance students' learning motivation and teachers' teaching motivation in a constantly changing educational environment" (p. 965). Additionally, they contend there may be enhanced "personalization" of education, whereby increased variety in the ways in which teaching occurs can accommodate various learning styles.

Many of the Web 2.0 tools now available have been developed with little thought about using them for educational purposes. It is anticipated that the future will bring seamless ties between these tools allowing them to be geared more towards educational applications. For example, although not used significantly in education currently, it is anticipated that social resources, such as Second Life®, will be incorporated as a learning tool along with social software networks that were developed primarily for industrial use.

According to the most recent *Horizon Report* (New Media Consortium, 2008), as globalization increases, online collaboration webs and the tools that support them are also expected to increase. Collaborative webs are networking sites that interested individuals or groups can access to foster educational sharing capabilities. Some examples include San Francisco State University's Digital Information Virtual Archive (diva.sfsu.edu) and Skoolaborate® (www.skoolaborate.com).

As ubiquitous as the broadband mobile phone has become, the varied features of it have also become more common: e.g., music playing, recording, camera and video capability, and photo storage. It is anticipated that these portable multimedia features will also be increasingly used for educational applications (New Media Consortium, 2008).

CONCLUSION

This chapter has discussed the benefits and challenges of hybrid courses that blend face-to-face instruction with online learning and opportunities provided by the introduction of web-based social interaction technologies. The best hybrid courses are based on thoughtful design and utilize active learning, both in online education and interactive face-to-face meetings. The success of a hybrid course will be enhanced by: (a) effective planning and integration of the face-to-face and online activities to achieve the desired learning outcomes for the course; (b) choosing the appropriate tools to achieve the desired outcomes; (c) faculty preparation to enable the effective use of the new learning environment; and (d) developing a plan positioning students to understand their new role and how they can be successful in it. If a hybrid course is designed properly, the strengths are likely to be: (a) increased learning by students; (b) more engagement by students because the course can be designed to allow them to bear responsibility for its success; (c) more enthusiastic participation by the students; (d) an opportunity for faculty to participate in a completely new way of teaching by having student-centered activities; and (e) ultimately a course that is more organized. The use of technology and development of hybrid courses will continue to evolve to meet the needs of contemporary students, faculty, and institutions of higher learning.

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KEY TERMS AND DEFINITIONS

Asynchronous Discussion Board: An online bulletin board where users may post and respond to messages in *forums* which are specific topic areas for discussion. Subordinate discussions within a forum are often called *threads*. Since users do not have to be online at the same time, they can enter the discussion board according to their own schedules.

Avatar: A computer user's one, two or three-dimensional representation of himself or herself in a virtual space (See Multi-User Virtual Environment).

Blog: Short for *weblog*, a *blog* provides the capability for the user(s) to post information about a particular topic or to maintain a diary with entries typically posted in reverse chronological order.

Electronic Portfolios or E-Portfolios: An integrated collection of web-based multimedia documents that may include curriculum standards, course assignments and corresponding student artifacts, and reviewer feedback to the student's work.

Folksonomy: Also known as *collaborative tagging* and *social classification*, *folksonomies* make it possible to categorize and annotate content using *tags* (keywords) and to provide the capabilities to associate tags with individuals.

Learning Management System (LMS): A software application or web-based technology used to develop, implement, and evaluate student-learning activities. Examples of Learning Management Systems include Blackboard®, Webboard®, or WebCT®.

Multi-User Virtual Environment (MUVE): A virtual environment that enables simultaneous participants to represent themselves with avatars, interact with other participants and digital artifacts, and practice building skills or solving problems that have applications in real world contexts.

Podcast: A method of publishing digital media files for transfer to and playback on a computer or a portable media player.

Web 2.0: An improvement in the application of the web infrastructure to support communities on the web and deliver services such as *wikis*, *blogs*, *folksonomies*, and other social interaction technologies.

Wiki: Software that provides the infrastructure for faculty and/or students to collaboratively develop and link Internet web pages. Each *wiki* has its unique characteristics, but most have tracking of individual effort and recovery of past versions.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 220-232, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 3.10
The Use of Social Interaction Technologies in E-Portfolios

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ABSTRACT

The chapter focuses on the potential of electronic portfolios (e-portfolios) to engage and motivate the learners and presents a framework for the informed inclusion and adoption of social interaction technologies as a means to increase the effective use of e-portfolios. Electronic portfolios are a Web-based format for providing genuine evidence of student performance, self-reflection, competence, career planning and leadership. The e-portfolios meet the needs of the digital learner in the knowledge society. The collaboratively constructed artifacts enable the articulation of shared knowledge building and self-reflective practice, further confirming the status of e-portfolios as living documents. By their electronic nature, e-portfolios open promising opportunities for the assimilation of social interaction technologies such as blogs, wikis, podcasts, video, and photo sharing. The authors trace the development and use of e-portfolios within the context of higher education. Various e-portfolio tools are discussed along with their educational potential and the associated challenges.

DOI: 10.4018/978-1-60566-368-5.ch021

INTRODUCTION

A significant body of research exists that identifies electronic portfolios (*e-portfolios*) as a first-rate tool for providing genuine evidence of performance, self-reflection, competence and leadership in students. The collaboratively constructed artifacts enable the articulation of shared knowledge building and self-reflective practice, further confirming the status of e-portfolios as living documents. e-portfolios, by their electronic nature, open promising opportunities for the integration of various social interaction technologies, such as blogs, wikis, podcasts, video, photo sharing, and others.

The chapter focuses on the potential of social interaction technologies to engage and motivate learners to extend their participation in the e-portfolio process and so enable them to document lifelong learning capabilities as well as promote deeper learning (Tosh & Werdmuller, 2004). The authors trace the history, development and use of e-portfolios within the higher education context. Theoretical frameworks and educational potential are addressed along with the associated developmental challenges including individual commitment and engagement, deep learning and reflection, and assessment. The theories of "constructivism" and "connectivism" (Siemens, 2004) that underpin the adoption of social interaction technologies are reexamined. Finally the chapter concludes with arguments for the informed inclusion of social interaction technologies as a means to address factors currently impeding the effective use of e-portfolios.

BACKGROUND

The use of e-portfolios in higher education is preceded by the traditional use of paper-based portfolios. Portfolios have had a long history as the showcase tools of artists, whereby they contained completed pieces of work to demonstrate skills and talent. Since this time portfolios have been widely used in a variety of disciplines, particularly in the field of education. The extensive use of paper-based portfolios in education (Tomkinson, 1997) has informed the transition to electronic portfolios, also known as e-portfolios.

In the U.S. and Western European education and training, extensive resources have been allocated to assist in a system-wide adoption of e-portfolios. Portfolios are being increasingly used as a career advancement tool (Redish, Webb, & Jiang, 2006). In Europe, The Centre for Recording Achievement in the United Kingdom (Beetham, 2006) and the European Institute for eLearning (The Higher Education Academy, 2005) are promoting the use of Personal Development Plans whereby each individual has a personal electronic portfolio that contains "evidence of an individual's achievements over a lifetime of learning and employment." In the teacher education sector, for example, some graduates in the United States are required to demonstrate mandated National Standards prior to being granted teacher registration (Ma & Rada, 2005). With the introduction of Teacher Registration Boards and other accreditation bodies in all Australian States, it appears that Australia is moving in the same direction.

In its simplest form, an e-portfolio is a collection of evidence that reflects a learner's progress, development and achievement over time. Depending on the discipline, the e-portfolio usually contains education history, certificates, work-samples, awards, personal values, interests, photos, videos, observation, feedback from supervisors/peers, evaluations, and—importantly— reflections on each piece of evidence. The reflective comments highlight the reason for selection and the learning that occurred. These reflective processes and comments are the key to an e-portfolio. It is through this reflective process that the learner is provided with "learning spaces where he or she "can gain insights and a better understanding of him/herself as a learner" (Greenberg, 2003, p.12).

The expansion of the World Wide Web has considerably transformed the potential of e-portfolio. The graphical nature of the web and ability to link digital artifacts has revolutionized how information is located and reviewed. Web technologies now allow authors to seamlessly integrate text with graphics, audio and video. This visual capacity provides additional options for showcasing the authors' accomplishments. Importantly, the linking mechanism of the web allows for tight integration between the elements of a portfolio and adds opportunity to connect the portfolio to the whole world.

According to Siemens (2004), the growth of e-portfolios has been "fuelled by three broad factors: the dynamics of functioning in a knowledge economy, the changing nature of learning, and the changing needs of the learner." In a knowledge economy, he argues, it is important for individuals to demonstrate their knowledge effectively, and the e-portfolio can display competencies and attributes undetected in an academic transcript. Siemens (2004) asserts that learning is also changing and that it is important to recognize that learning occurs in communities. Formal education becomes simply one aspect of one's learning journey. The final factor influencing the adoption of e-portfolios, as Siemens (2004) claims, is that the social impact of technology has changed learners' needs. Learners currently entering higher education are comfortable with the electronic environment, and actively seeking to engage with it.

Although, e-portfolios, conceptually are similar to paper based portfolios, they have some distinct advantages over their paper counterparts. It is easier to organize, view and search an electronic portfolio. Depending on the software being used, a larger number of records can be securely stored, retrieved, and managed, and records and artifacts can be refined with little effort. e-portfolios enable the inclusion of more varied and extensive material, such as audio and visual artifacts, thus allowing for a multidimensional representation of the learner. The electronic nature of the e-portfolio enables a more creative and non-linear organizational structure. Their reduced size enables easy portability and access. This ease of access allows the learner to receive rapid and regular feedback from others.

Unlike traditional portfolios e-portfolios may be reviewed by anyone, anywhere and anytime, and the author can control the nature of the interaction through organizing access (Greenberg, 2003). Exchanges can be private or public – teachers can provide feedback and discuss the student's progress, students might discuss their work with each other, feedback can be sought from a wider audience, and individuals can reflect on their learning experiences (Greenberg, 2003). E-portfolios are relatively simple and inexpensive to reproduce and distribute. In addition, e-portfolios can showcase the technical and communication skills of the creator. A growing body of research documents the advantages of electronic over paper based portfolios to enhance student reflection and learning and to provide improved evidence of student achievement to external groups (see, for example, Barrett, 2000; Butler, 2006; Greenberg, 2003; Jafari & Kaufman, 2006; Wetzel & Strudler, 2005). The use of e-portfolios in an educational environment facilitates student centered, reflective learning practices to complement flexible curriculum design. In addition, it provides students with a vehicle to demonstrate the acquisition of attributes and competencies valued by potential employers.

Integrating Electronic Portfolios with Web 2.0 Technologies

Institutions of higher learning around the world are embracing student centered learning as a dynamic and effective approach for higher education: an approach which places the student at the center of their own learning experience and allows them to become active participants in their learning endeavors, constructing knowledge on their own terms (Biggs, 2003; Entwistle, 1997; Entwistle & Ramsden, 1983; Laurillard, 2002). In response to this trend, curriculum design in colleges and universities is increasingly focusing on capabilities rather than content. Students are progressively being asked more to demonstrate not only their general knowledge and skills within their discipline areas but also to articulate explicitly how they analyze, reconstruct and apply knowledge contextually in a variety of real life learning situations (Bowden, 2004; Bowden & Marton, 1998).

Student e-portfolios are extremely responsive to current curriculum reform because they can be used to satisfy a variety of assessment and evaluation requirements in courses and programs. e-portfolios offer a suitable environment for a range of summative assessment tasks, as well as provide for continuous growth and reflection in the formative development of students and professionals alike. They are particularly well suited to holistic and iterative assessment and offer a forum where group work, self-assessment, and other employability skills can be articulated and evidenced.

By their very nature e-portfolios are flexible tools which can be tailored to specific educational contexts (Meeus, Questier, & Derks, 2006) and are used in a wide range of ways in student learning contexts. Meeus, Questier and Derks (2006) suggest that e-portfolios are grounded pedagogically or educationally because they are student centered, competence oriented, and multimedia oriented; they are also cyclical with regard to action and reflection. It is these characteristics and the flexible nature of the technology which optimizes their educational use.

From a learning theory perspective, e-portfolios support student centered learning approaches as they give students the opportunity to display a broad range of learning skills and attributes across an extensive range of learning domains (Knott, Lohani, Griffin, Loganathan, Adel, & Wildman, 2004). However, as Norman (1993) points out, modern day curricula often provide students with learning activities that are more concerned with experiencing various phenomena than encouraging reflective cognition. Electronic portfolio practitioners (Barrett, 2006; DiBase, 2002; Knott et al, 2004; Lambert & Corrin, 2006; Richards, 2005) claim that e-portfolios facilitate the reflective process in students by recording and articulating students' learning experiences on multiple levels, thus enhancing the learning experience and engaging the student in a more profound analysis of the subject content.

David DiBase (2002) in his long term e-portfolio work at Pennsylvania State University notes that the key benefits of e-portfolios relate more to the process of developing and constructing the portfolio than to the final portfolio product. The constructive stages of collection, selection, reflection, projection, and presentation of the e-portfolio help to facilitate and encourage students to adopt a more reflective approach to learning. It is through this constructive process that students become more actively involved in planning their learning and more personally responsible for setting and achieving their educational goals (DiBase, 2002; Meeus et al., 2006). e-portfolios empower learners by allowing them to take control over their personal learning journey (Siemens, 2004; Tosh & Werdmuller, 2004). The reflective nature of e-portfolios encourages transformative practice. This notion is consistent with constructivist theory which argues that learners construct their own knowledge rather than simply receive it from others. Institutes who have a university wide commitment to curriculum that is student centered, or based on authentic learning models, are more likely to be able to encompass the broad range of educational opportunities that e-portfolios can provide.

The adoption of a more student centered, authentic approach to learning ultimately promotes the notion of life-long learning. e-portfolios can be shared with other staff members and a systematic record of student progress can be established. When staff members collaboratively participate in the assessment process of e-portfolios, either formative or summative, they not only provide students with feedback concerning their progress toward achieving their learning goals, but also provide feedback about the effectiveness and impact of the learning experiences the course provides. When this process is adopted, students have evidence they can plan the advancement of their personal learning and staff can see how their teaching, and ultimately the course, can be improved (Raison & Pelliccione, 2006). This three-way approach benefits the learner, staff and the institution.

Traditionally universities have been successful at developing knowledge and skills within defined discipline areas; however, both global challenges and pressure from industry to produce work ready graduates (see, e.g., European Ministers of Education, 1999; UNESCO, 1998) has forced academic staff to rethink how they can explicitly develop and assess less tangible capabilities. These include: the ability to deal with new, changing situations and problems, self-reflection and critique, the application of prior learning to new contexts, the ability to understand and deal with others' perspectives, and how individual students can work within a team to resolve and deal with multiple issues and problems. These skills and abilities are frequently referred to as graduate attributes, key competencies or generic attributes. Many colleges and universities are now looking to e-portfolios as tools to demonstrate and articulate students' acquisition of these attributes.

Social interaction technologies, often referred to as "Web 2.0 technologies," are providing academics with flexible online learning environments to stimulate and record complex social interactions that can evidence student acquisition of "work-ready" attributes and skills. These new technologies along with other "digital traces" or "digital knowledge artifacts" (such as writings, images and digital media files) are already allowing for sophisticated representation of relational concepts or processes (Vuorikari, 2005). A range of Web 2.0 technology tools is being utilized for e-portfolio development which afford learners different degrees of control, flexibility, and skill requirement: including specifically designed digital portfolio systems (such as PebblePad, Learning Assistant, and QuickStep); and, content-management systems offering e-portfolio functions (for example, Blackboard, WebCT, and LearnWise).

Weblogs and wikis are being increasingly and successfully used within electronic portfolios to establish collaborative learning environments that both engage and motivate students, and promote greater retention of knowledge (BECTA, 2007, Shelley, Cashman, Gunter & Gunter, 2007). Hiler (2003) refers to the *blog* as "the latest disruptive technology" and the "killer application." He claims that blogs provide a space for a variety of interests and promote collaborative activity, knowledge sharing, reflection and debate. Oravec (2002) also found that blogging encourages personal reflection and collaboration. The exposure to blogging tools empowers students and encourages them to become more sophisticated critical and analytical thinkers (Ferdig & Trammel, 2004; Oravec, 2002). In addition, Ferdig and Trammel (2004) suggest that the relaxed and conversational tone makes the experience more conducive to improved student and lecturer relationships.

The potential of Web 2.0 technologies to enhance educational learning environments, in particular e-portfolios, has not escaped the notice of commercial vendors. Waters (2008a, 2008b) documents the influence of these new tools on a number of commercial electronic portfolio systems -- Digication, Desire2Learn, Angel Learning and Epsilen. Waters (2008a) refers to the *Epsilen* as a "new species of electronic portfolios." The Epsilen software was developed by the CyberLab at the Indiana University-Purdue University of Indianapolis which is directed by Ali Jafari, computer technology professor, who has a long history working with electronic portfolios. A basic Epsilen e-portfolio account is available free to registered students and staff at all United States colleges and universities. They currently have members from 950 institutions (Epsilen, 2008). A similar environment to Epsilen, named *PebblePad,* was developed in the UK and claims to bridge the gap between social and institutional learning: "PebblePad supports personal learning whilst providing a powerful suite of tools to improve learning in institutional contexts" (PebblePad, 2008).

In addition, a number of open source e-portfolio systems have embedded various Web 2.0 features, such as blogging, wikis, messaging and group collaboration capabilities. An example of this system is the OSPortfolio (OSP) which is part of Sakai (an open source web-based collaboration and courseware management platform); it has been adopted by at least 60 institutions across 8 countries (Cambridge, 2008). One of the most recent open source e-portfolio systems was designed and funded in New Zealand by New Zealand's Tertiary Education Commission's e-learning Collaborative Development Fund (2006). *Mahara,* which is colloquial Maori for "think" or "thought," is an open source e-portfolio, weblog, resume building and social networking system. It differs from other e-portfolio applications by its particular emphasis on social networking and system architecture inspired by *Moodle* for better interoperability (Wyles, 2008).

Integration of the Web 2.0 technologies and electronic portfolios continues. In a recent paper "The Value of eJournals to Support e-portfolio Development for Assessment in Teacher Education" presented at the 2008 Annual Meeting of the American Educational Research Association, Crichon and Kopp (2008) introduced an application called Electronic Documentation of Learning (eDOL) which allows students to document their field experiences in the form of an eJournal using text, photo, and video entries. Other software developers also continue to refine the assessment mechanisms of e-portfolio systems and are now attempting to extend the learning capabilities of the e-portfolio by taking advantage of the interactive facilities of the Web 2.0 technology. Subsequently, e-portfolios are beginning to take the form of a collage with various applications: namely, file sharing, databases, search facilities, wikis, podcasting, and other social media. Perhaps, the future of these new and other emerging tools will see the merging of e-portfolio systems with the personal learning environments (PLE) of new digital age students.

FUTURE TRENDS

Gary Brown, the director for the Center for Teaching, Learning, and Technology at Washington State University, has argued that the advent of Web 2.0 technologies will invariably change the boundaries between e-portfolios and personal learning environments (cited in Waters, 2008b). He views electronic portfolios as being part of a continuum with assessment management systems at one extreme and personal learning environments at the other. Personal learning environments can be viewed as systems that are designed to help learners take control and manage their own learning space. It is argued that a personal learning environment can enable students to set their own learning goals, monitor their progress, manage the process and content of their learning, and set up communication networks that support both their formal and informal learning.

In an earlier article from Handley and colleagues (Handley, Wilson, Petersen, Brown, & Ptaszynski, 2007) the concept of creating personal learning spaces in higher education is further explored. The authors suggest that university educators move beyond the traditional "walled gardens" approach to the point of designing learning spaces for each learner. In this way the learner is able to "aggregate, synthesize and reflect upon their learning." The key concept is to place the learners at the center of their educational universe by providing them with the tools to control who has access to their own personal "walled garden." The Microsoft SharePoint System (2007) is seen as a functional platform that can provide such an environment. Washington State University has recently adopted this collaboration and document-sharing platform to introduce e-portfolios across the university. Specifically they suggest: "In the model facilitated by SharePoint as an e-portfolio, the student is the central node in the learning network. A course, learning object, learning activity is available and students are invited to engage, but they are the owners of their own space and the work they will do, share, and showcase in that space" (Handley et al., 2007, p 3).

Siemens (2006) stresses that educators need to continuously reflect on how learning has changed and how this change impacts the way the learning spaces and structures are designed. He argues that the utilization of new technology tools alters the way people work and function and posits a new theory of learning called "connectivism." This theory acknowledges trends in learning, the use of technology and social and learning networks, and the "diminishing half-life" of knowledge (2005, 2006). Connectivism integrates elements of a number of learning theories, social structures, and technology to present a theory more conducive to the needs of the knowledge society. Siemens (2006) notes:

Our desire to connect – to externalize – is a vital component of the learning process. Instead of merely developing learners for careers, we have an obligation to create a learning ecology where learners are able to shape their own meaning.

Siemens (2006) challenges educators to design learning spaces that reflect a new understanding of learning and meet the needs of the digital learner in the knowledge society. The challenge has implications for the future landscape and use of e-portfolios. He claims that freedom and flexibility to design such learning spaces will be lost if the trend to centralize and standardize e-portfolio tools and services continues (2004).

The web is shifting from being a utility where information is transmitted and consumed into a platform where content is created, shared, and remixed with a community of learners (Downes, 2006). Brown (2002) considers this as a fundamental shift from using technology to support the individual to using technology to support relationships between individuals. The new social media applications and social networking sites support learning communities by providing tools that enable and promote dialogue, collaborative content building, and the sharing of information, giving learners access to a range of knowledge and ideas (Lee & McLoughlin, 2005). The merge of e-portfolio tools and processes with social software has the potential to deliver the dynamic and flexible learning spaces required for digital age learners. This union will not only build knowledge but will build relationships and encompass the powerful elements of reflective practice, higher order thinking, learner control, "connectivism," community of learners, social integration, and lifelong learning.

There are many benefits associated with the use of e-portfolios; there are also many hidden costs, obstacles, and challenges involved in their implementation (DiBase, 2002). Most practitioners and institutions that adopt e-portfolios report that they are labor intensive and require considerable time in planning, monitoring and provision of feedback to students (Linn & Gronlund, 2000; Strudler & Wetzel, 2005). Students need time, support, technical training and guidance (Heath, 2005; Pecheone et al, 2005; Smith & Tillema, 2003; Tosh et al, 2005; Wade & Yarbrough, 1996). Technical skills required may disadvantage the student if the student is being assessed on their technology skills over their learning (Abrami & Barrett, 2005). If used predominantly for assessment purposes, e-portfolios can be difficult to assess, requiring extensive preplanning in the establishment of reflective evaluation and performance (Abrami & Barrett, 2005).

Students also need to be given clear guidelines as to the validation of claims and authenticity of evidence as artifacts are easily plagiarized from the Internet (Abrami & Barrett, 2005). Students need briefing about issues surrounding digital rights, intellectual property, copyright, privacy and free speech (Challis, 2005; DiBase, 2002). Many of the Web 2.0 technologies require extensive moderation and skill development. Institutions need to be aware of the ramification on their curriculum accreditation processes, professional development of staff, and the hidden costs associated with the technological "up-skilling" of students.

Institutions will need to address ways of storing the large volume of data produced by students as well as developing policies on how long they support and maintain the data. Issues of access, security and privacy will also need to be addressed.

Future consideration will need to be given to the development of new learning spaces to enable the crossing of the social, educational, cultural, professional, and political boundaries of students to give voice to a learner's efficacy in a variety of overlapping contexts.

E-portfolios will need to become living documents that are "portable" through the life of the learner to meet a variety of usages encompassing assessment, promotion, cultural identity and professional reflection (Vuorikari, 2005). An integrated approach to e-portfolios can certainly support community building among learners but is unlikely to be driven by educational agendas alone. The technology associated with these new environments will also need to deal efficiently with the rapid re-contextualization of content for a variety of different purposes in the learner's life.

CONCLUSION

Electronic portfolios offer students the prospect of reflecting on their personal and profession skills and the opportunity to demonstrate a range of lifelong capabilities. e-portfolios can be used to reflect the knowledge and skills obtained in an academic context; they can also incorporate social abilities and skills acquired in community, work and familial settings. e-portfolios can be constructed in such a way that they become living transportable documents used in a variety of career and professional contexts. The e-portfolio has the potential to become a living document managed and maintained dynamically over time; it can be constructed and reconstructed to meet a variety of social, professional and personal needs. Social interaction technologies have the power to add dynamic dimension to the e-portfolio process by creating spaces that encourage the development of a reflective community of learners that will motivate and inspire individuals to revisit, revise and reshape their experiences to reflect their learning journey.

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Wyles, R. (2008). *Mahara - open source ePortfolio.* Retrieved July 1, 2008, from http://www.eportfoliopractice.qut.edu.au/docs/AeP_presentations_web/AeP_SC_Mahara_6Feb08.pdf

RESOURCES

Angel Learning - http://www.angellearning.com

Australian ePortfolio Project - http://www.eportfoliopractice.qut.edu.au Blackboard - http://southbank.blackboard.net The Centre for International ePortfolio Development - http://www.nottingham.ac.uk/eportfolio Digication - http://risd.digication.com

Desire2Learn - http://www.desire2learn.com

Epsilen - http://www.epsilen.com

European Institute for E-Learning (ElfEL) - http://www.eife-l.org/about

LearningAssistant - http://www.learningassistant.com

Learnwise - http://vle.bilborough.ac.uk

Mahara - http://www.mahara.org

Moodle - http://moodle.com.au OSPortfolio - http://osportfolio.org/testimonials

PebblePad - http://www.pebblepad.com/default.asp Sakai - http://sakaiproject.org

KEY TERMS AND DEFINITIONS

E-Portfolio: A collection of evidence that reflects a learner's progress, development, and achievement over time in a digital format.

E-Portfolio Artifacts: Tangible evidence (i.e., work samples, reflections, photos, videos, feedback from supervisors/peers, awards, etc.) that demonstrates knowledge and skills and their application to various tasks and situations.

Epsilen: A comprehensive e-learning environment designed in the U.S. that includes an e-portfolio feature.

PebblePad: A flexible commercial e-portfolio system designed in collaboration with the University of Wolverhampton, UK.

Personal Learning Environments (PLE): Learning systems that are purposely designed to help learners take control and manage their own learning space.

Sakai: An open-source course management system that includes a full-featured online portfolio.

Student Centered Learning: An instructional approach that places the student at the center of the learning experience and allows students to become active participants in their learning endeavors and construct knowledge on their own terms.

This work was previously published in the Handbook of Research on Social Interaction Technologies and Collaboration Software: Concepts and Trends, edited by T. Dumova and R. Fiordo, pp. 233-244, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 3.11

The EduOntoWiki Project for Supporting Social, Educational, and Knowledge Construction Processes with Semantic Web Paradigm

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ABSTRACT

The Web is going to produce a revolution in learning and teaching: the debate on the role of ICT in educational processes leads to a reconsideration of how we deal with information and knowledge. The widespread use in educational contexts is also due to the ease with which learning resources can be retrieved and shared: for example, the recent introduction of learning objects means that the contents which reside in different e-learning platforms is easy to find and access. But knowledge is also deeply embedded in millions of Web pages. Nonetheless, searching for information on the Web is not a simple task and the great number of documents found using search engines, such as Google, is beyond the human cognitive capacity to deal with this information overflow. Teaching information literacy skills or stimulating collaborative information filtering that supports the discovery of resources in a way that is responsive to the context of users may help, but there is a need for more efficient cognitive tools to search, organize, and discuss information in order to codify it in shared knowledge structures.

INTRODUCTION

The Web is going to produce a revolution in learning and teaching: the debate on the role of ICT in educational processes leads to a reconsideration of how we deal with information and knowledge. The widespread use in educational contexts is also due to the ease with which learning resources can be retrieved and shared: for example, the recent introduction of learning objects means that the contents which reside in different e-learning platforms is easy to find and access. But knowledge is also deeply embedded in millions of Web pages. Nonetheless, searching for information on the Web

DOI: 10.4018/978-1-59904-845-1.ch026

is not a simple task and the great number of documents found using search engines, such as Google, is beyond the human cognitive capacity to deal with this information overflow. Teaching information literacy skills or stimulating collaborative information filtering that supports the discovery of resources in a way that is responsive to the context of users may help, but there is a need for more efficient cognitive tools to search, organize, and discuss information in order to codify it in shared knowledge structures.

In a more and more complex world we need support to think at a high level so the technologies let us develop strong knowledge structures that do not have the representational problems of the old schemas. An attempt in this direction is the Semantic Web: if we succeed in making the Semantic Web available and useful for education, it could revolutionize the way we think about teaching and learning with ICT. Our current research is aimed at the development, experimentation and evolution of an integrated learning environment called EduOntoWiki that is backed up by a semantic structure based on the active consent of communities of practice.

BACKGROUND

Current research suggest that it is not correct to assume that the introduction of ICT necessarily changes the way students learn. We have to acknowledge that the teacher plays a critical pedagogical role in creating the conditions for technology-supported learning through selecting and evaluating appropriate technological resources and designing learning activities (Galliani, Costa, Amplatz, & Varisco, 1999). We can distinguish between two approaches to ICT: a technology-centered approach and a learner-centered approach (Mayer, 2005). The former generally fails to lead to lasting improvements in education: looking back at the many predicted educational revolutions, in which the current "new" technology (radio, television, computer, multimedia, the Web) would have been the "killer" application for teaching and learning processes, we see that they failed to materialize (Cuban, 1986) and so was the case with the claims and worries, during the 1960s, that computers-as-tutors would replace teachers (Cognition and Technology Group at Vanderbilt, 1996). A learner-centered approach can, on the other hand, help students and teacher to learn and teach through the aid of technology with a focus on how ICT can be used as an aid to human cognition and consistent with the way the mind works solving complex tasks and dealing with today's information overflow. The quantity and kind of information students today need to assess has expanded exponentially in the last few years, due mainly to the World Wide Web and improvements in the capabilities of search engines. In this context, it is important to consider both student and teacher roles using a constructivist approach that can stimulate collaborative formalization and knowledge building.

SEMANTIC WEB AND ONTOLOGIES

The Web has arrived at an important epistemological crossroad and there is a need to integrate the current dialogic-informative model, which allows us to interact with people and search for documents on the Web, with a model based on the contextual knowledge domains within which we operate: the Semantic Web approach (Berners-Lee et al., 2001). Both models are strongly based on a learner-centered approach so the applied research, in particular in the field of ICT and educational technologies, is moving in two directions:

1. The development of solutions for information exchange, and in general, for intelligent knowledge management;
2. The development of a collaborative/cooperative approach to knowledge building.

The Semantic Web was coined by Tim Berners-Lee to refer to a vision of the next evolution of networks that can add meaning to the navigational context of the current World Wide Web. It is the new-generation Web that makes it possible to express information in a machine-interpretable form, ready for software agents to process, as well as to understand what the terms describing the data mean both on the syntactic and semantic levels (Hendler, 2001). An important role in the development of the Semantic Web is played by ontologies (Gruber, 1993). The term is borrowed from philosophy but it is used in a different and more pragmatic sense: they are an explicit specification of a conceptualization, that is, a formal description of concepts and relationships that can exist in a knowledge domain, that is intended as a knowledge base to be shared and re-used in the real world. These ontological structures will, for instance, allow us to no longer surf the universe of documents on the Web through hypertext links from text to text, but from concept to concept; or even to retrieve information in a relevant way without the "noise" that characterizes search engines. In order to achieve this aim, formalized languages have been created (XML, RDF) to mark texts semantically. These languages, which are able to codify knowledge through domain ontologies, can be easily understood both by humans and by ad hoc programs such as semantic browsers (Dzbor, Domingue, & Motta, 2003) or by specific software agents.

The importance of ontologies has been recognized in different research fields, and even from an operational point of view the current application areas are different: from medicine to knowledge content standardization, from legal information systems to biological and geographical information systems, from e-commerce to natural language processing, and finally education (Devedzic, 2004). Our current research project is aimed at extending and integrating the construction and evolution of a semantic learning space that is backed up by ontological structures relative to educational sciences (Petrucco, 2003) based on an active consent of communities of practice.

THE EDUONTOWIKI PROJECT

The different training and background of those who contribute to educational theory, the different cultures they belong to, and the rapid development of scientific work today require the development of a series of shared conceptual schemas. It is important then to generate these schemas not as general principles but as justified, motivated, documented and finally usable schemas as control "criteria" of pedagogic discourse. As an ontology is basically a conceptual organizer of scientific discourse, it is a formidable support to hermeneutic work.

Within this context we developed the idea to build an ontology of education. The project takes into account the state of the art of educational research in Italy, France, Spain, Germany, England and Spain. The three thematic areas studied, at least in this first step of the project, are: *didactic planning*, *educational communication*, and *assessment* and *evaluation*. The ontology is "negotiated" in working exchanges and dialogical moments in order to develop a circularity of information flow within the virtual community of the experts involved in the project and other actors participating.

The project has been developed with the immediate aim of building an integrated semantic learning environment called "EduOntoWiki" (http://multifad.formazione.unipd.it/eduonto), a wiki-based environment where it is possible to construct, discuss, and contextualize ontologies suitable for describing the actors, processes and technologies of educational sciences. A wiki was chosen because it enables easy and immediate insertion, modification and sharing of texts and materials by a community of users (Wikipedia is a good example) and because it gives freedom over the knowledge creation process to users. The recent promising research in the application of the semantic Web to wiki software (Campanini, Castagna, & Tazzoli, 2004; Hepp, Bachlechner, & Siorpaes, 2005; Scaffert, Gruber, & Westenthaler, 2005) confirm this decision.

Indeed, our initial vision conceived the instrument as a tool to help in the creation of an ontology and the description of a specific knowledge domain mediated by a discussion within a community of practice. To be really useful an ontology requires the active consensus of a committed community of practice in a knowledge domain (Domingue, 1998; Trentin, 2004) as experts of do not always completely share the same categorizations, interpretations and distinctions. Often this is not only because of the reciprocal irreducibility of fundamental theoretical orders, which is both physiological and necessary, but rather because of the confusion created by the different meanings given to "key" terms in the discipline in question.

If it were possible to have an "ontological" reference model with shared lexis and semantics, as regards both terms and their relations, this would probably help to reduce conflicts which arise from misunderstandings and incomprehension. Ontologies created in this way would also have a significant side-effect for all the actors involved: first of all the definition of a common lexis (Wenger, 1998), then a strong push towards the conceptualization of tacit knowledge, and finally the sharing of a metamodel in which processes, knowledge and relations are shared. Defining ontologies which support educational applications based on the Web is therefore no simple task, above all because of the difficulty in formally conceptualising a domain which has always played on the idiosyncratic interpretation of each philosophical/pedagogical approach.

Ontologies would be useful not only to the academic community, but as far as their didactic use is concerned, we can think of an ontology or a series of "educational" ontologies, that could be used and discussed by students, teachers, and people interested in the real world of applications and training contexts. This "open" ontology paradigm can offer considerable advantages. For example, it could provide a medium which would foster the sharing of the basic knowledge in a discipline and a place where students could easily find educational resources (learning objects) with a strong context relation to the subject. Today the learning objects paradigm means that the contents which reside in the different systems used in e-learning platforms, need to become reusable, accessible and interoperable. Each object therefore needs to be described beforehand by others through unambiguous formalisms (so-called LOM, learning objects metadata) so that people can retrieve them more easily. But this retrieval paradigm is often wrong: the meaning of the metadata must be shared by most communities of users possible and this is not the common case. The practice of describing resources may at first appear to be simple and straightforward, however, when a system of description is analyzed deeply it becomes evident that it is actually ambiguous. The use of metadata presupposes not only a set of logical relations but also a specific vocabulary generally agreed upon by a linguistic community (Downes, 2004). Ontologies, integrated with social tagging processes (i.e., folksonomies) (Mathes, 2004), could indeed offer a strong support for solving this problem because every learning object would be *embedded* in the structure of the ontology itself; in this sense there is a side-effect that consists of the collaborative setting up of a learning object repository that uses the ontological base for "intelligent" consultation. Learning objects have always existed in teaching: in their practice, educators operate within a deconstruction and reconstruction process of materials and resources, but what is missing is often a conceptual and disciplinary framework to go back to, which, in today's world, could be easily accessible and consultable through the Web. It is precisely this that the various domain ontologies could provide.

The wiki interface of the ontologies is well suitable for developing a constructivist environment, where people of a learning community can add and modify the concepts dialogically (Souzis, 2005). If we then assume that the learning process is never confined to the materials used in an online course, but that it is also fruit of the interaction among the members of the group, with the wiki-based ontologies we provide a *scaffolding* (Devedzic, 2004) which will facilitate communication and the construction of meaning among all the actors involved (academics, teachers, tutors, students) and at the same time represent the structure and contents of the discipline.

FUTURE TRENDS AND DEVELOPMENTS

As ontologies in EduOntoWiki will be the result of the active involvement of both a community of practice of academics and actors from different educational fields (teachers, students and trainers), the social/relational aspect which turned out to be increasingly significant in the course of this research, led us to systematically further the study of the relationships within a community, as well as between different communities, in relation to the knowledge construction process supported by the wiki-based software. We want to verify how this environment can ease knowledge construction and formalization as "instance" from different communities of practice interacting together. In fact, the direction that the most promising, current research is taking involves the study of so-called "complex constellations of communities of practice" (Wenger, 2004). This definition has been used to describe the special relationships which unite various communities and render them permeable in such a way that they can reciprocally share knowledge, contextualizing, and enriching it with new meanings, thus favoring creative solutions to complex problems.

On the basis of these premises, we will seek to verify whether a social theory of learning can effectively lead to the overcoming of rigid borders between training/educational systems, work environments and social activities. In this sense, we can try to "free" learning so it is no longer seen to be linked to a specific area or moment of one's life, but actively constructed in the inter-community interactions of a lifelong learning continuum.

What will be investigated in particular are the negotiational interrelations between people who, in various forms, are members of different communities, people who share an active interest in all training environments and who bring valuable examples of "good practice" even if they belong to different work contexts. This aspect, led us to expand a new learning dimension, aimed at stimulating reciprocity, transferring and recontextualization processes, insofar as learning is recognized as a social/relational process, and the multiple contexts where learning takes place that becomes a precious alternative representation (Lave, 1988), effectively expressed by the learning subjects by means of a narrative description (Bruner, 1996) that a rigid codified ontology formalization would, on the contrary, risk penalizing. Narrative is used in education and training contexts to motivate and to illustrate, the reason for this is that the cognitive structures we use to understand the world around us are similar to the cognitive structures we use to understand narratives. It is assumed that the interaction, comparison and reciprocal recognition of the different communities involved will succeed in triggering off a virtuous process of crossfertilization able to transfer skills, processes, and models.

An important challenge highlighted by a close examination of international research on this theme, is that inter-community relations are not easy to manage or formalise since the members can only count on relatively limited shared meaning and practices (Friesen, 2002). Interoperability among communities, which our EduOntoWiki environment wishes to foster, is thus closely linked to a negotiation of meanings, identities and roles. Identity and roles for example, can be formalized using the semantic standard FOAF, (friend of a friend) while other important personal relations are more difficult to express. Maybe the only way is to include the innovative approach of the folksonomies (Petrucco, 2006) and/or the creation of specific "instances" in the ontologies intended mainly as a narration of personal and contextual experiences lodged in a precise space, time and place. It is not by chance that social networking tools, such as LinkedIn, Friendster and Orkut, are now considered a necessary extension of the recent blog phenomenon. In fact, we intend to evaluate whether, and in what way, it is possible that this process of *narrative conceptualization* can lead from the formulation of "descriptive instances" to spontaneous formalization, on behalf of community members, of "normative instances", that is, knowledge models which can be reused in multiple experiential contexts for solving problems.

CONCLUSION

Our research group believe that the potential effects of the Semantic Web for the world of education and training, and in particular for e-learning, will certainly be positive, but only if governed by a strong pedagogical-methodological reference structure which facilitates integration of the new technological-semantic paradigm into the more recent social theories of learning. Given these assumptions, combining the Semantic Web with social software appears to be a natural choice: it can support the creation of semantically enriched content using simple interfaces and by allowing domain experts and novices, teachers and students to collaborate within rich inter-cultural communities, sharing their true life experiences. To conclude, while it is true that the EduOntoWiki project presents considerable challenges both on a technical-scientific and on a theoretic-methodological level as it attempts to integrate the most innovative instances of international research on the Semantic Web and on pedagogic research, we also believe that fast and complex contemporaneous social evolution necessarily requires adequate instruments able to interpret and manage it.

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KEY TERMS AND DEFINITIONS

Communities of Practice: Communities of practice are groups that form to share what they know and to learn from one another regarding some aspects of their work. People in organizations often realize they could benefit from sharing their knowledge, in-sight, and experiences with others who have similar interests or goals. For the most part, this process of informal gathering and sharing of expertise is a voluntary.

Folksonomies: Folksonomies are bottom-up taxonomies that people create on their own, as opposed to being created and imposed by a group or institution such as by professional librarians using complex and lengthy rule sets (e.g., Dewey decimal system or Library of Congress index). Synonyms include folk categorization, social tagging, and ethnoclassification. They are grassroots classification systems for data. The value in folksonomies is derived from many people adding their own tags. The more people tagging one object, the better, because it gives alternative ways of searching for and finding information.

LOM (Learning Objects Metadata): We can define metadata as "information about information", and a LOM is a metadata about a learning object that can refer to multimedia or digital educational resources. Sets of metadata are used to identify and meaningfully describe characteristics relevant to these resources, for example, the learning resource type, the intended end user, difficulty level, educational goal, and so forth. The Learning Technology Standards Committee (LTSC) give rise to the IEEE LOM (Learning Object Metadata) 1484.12.1-2002 standard of educational metadata.

Ontologies: An ontology is a formal representation of knowledge about an area of interest. The part of the world conceptualized or described is called the "knowledge domain." Ontologies provide a vocabulary for representing and communicating knowledge domains and a set of relationships that hold among the terms in that vocabulary.

Semantic Web: The Semantic Web is an extension of the current Web in which information is given a well-defined meaning, better enabling computers and people to work in cooperation. The mix of content on the Web has been shifting from exclusively human-oriented content to more and more data content. The Semantic Web brings to the Web the idea of having data defined and linked in a way that it can be used for more effective discovery, automation, integration, and reuse across various applications. For the Web to reach its full potential, it must evolve into a Semantic Web, providing a universally accessible platform that allows data to be shared and processed by automated tools as well as by people. [W3C]

Social Network: A social network is a set of people or organizations or other social entities connected by a set of social relationships, such as friendships, coworking or information exchange. The connections between them may show specific patterns and can be represented by graphs. Recently many online social networking sites have begun to flourish with millions of users describing themselves in terms of who they are, what music they listen to, what books they read, and so forth, and trying to discover other people with similar interests.

Wiki: A Wiki is a collaboratively-edited Website that uses a software publishing tool. The distinguishing feature of wikis is that they typically allow all users to edit any page, with full freedom to edit, change and delete the work of previous authors. Collaborative knowledge creation is thus a central aspect of a wiki system. Wiki pages are accessible and usable at any time, and the content constantly evolves. The first wiki was created by Ward Cunningham, and the word "wiki" came from a phrase in Hawaiian—"wiki wiki"—which means "quick". It's quick because the process of editing is entwined with the process of reading. Both are done using a standard Web browser. Unlike most Websites, there's no need to edit a file, upload it to a Web server, then reload the original to check it.

This work was previously published in Encyclopedia of Information Communication Technology , edited by A. Cartelli; M. Palma, pp. 195-201, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.12
Course Management Meets Social Networking in Moodle

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ABSTRACT

Moodle is currently one of the more popular opensource course management systems in online education. Some evaluations have also indicated that Moodle is one of the top-rated programs when compared to other open-source course management systems (Graf & List, 2005). The creators of Moodle describe their program as a course management system built on social constructivist pedagogy. Social constructivist pedagogy is a collaborative approach to learning based upon the works of Jerome Bruner, Lev Vygotsky, and Jean Piaget. Moodle's unique focus on pedagogy allows online learning to cross over from the traditional educational realm of factual recall and rote memorization into the realm of social networking. Social networking has recently become one of the more popular uses of the Internet, with sites like MySpace and FaceBook attracting millions of users every month. Social networking Web sites began to appear on the Internet around 2002 (Downes, 2005). Social networks are now seen as an important component of modern society – even in educational contexts (Finin, Ding, Zhou, & Joshi, 2005). Current online social networking sites thrive on social constructivism pedagogy – whether the users or designers know this or not.

DOI: 10.4018/978-1-60566-198-8.ch073

INTRODUCTION

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Social networking has recently become one of the more popular uses of the Internet, with sites like MySpace and FaceBook attracting millions of users every month. Social networking Web sites began to appear on the Internet around 2002 (Downes, 2005). Social networks are now seen as an important component of modern society – even in educational contexts (Finin, Ding, Zhou, & Joshi, 2005). Current online social networking sites thrive on social constructivism pedagogy – whether the users or designers know this or not.

The following discusses research conducted on the relationship between social connection and success in online courses and examines how some tools in Moodle – such as blogs, Wikis, and chat rooms – can be used to support learning. Additionally, instructional design issues that can be addressed with these tools are also explored.

BACKGROUND

Generally speaking, most online courses are delivered through a program called a learning management system (LMS), sometimes also referred to as a course management system or virtual learning environment. Learning management systems are used in many fields, including education and business. From a business perspective, Szabo and Flesher (2002) define the LMS as "computer based database and presentation systems which manage the entire instructional program and learning progress of employees with respect to the competencies specified by the goals and objectives of an organization" (p. 2). From an educational perspective, students would be the employees and the school would be the organization. Therefore, learning management systems can be seen as the administrative storage area for online courses as well as the portal for content delivery.

Since some might consider learning as something that can't be managed by a computer program, some LMS designers refer to their programs as course management systems or virtual learning environments. The designers of Moodle have chosen to use the term course management system (CMS). The stated goal of the Moodle CMS is to create online communities – not just deliver course content and store course records. This distinction is important when examining social constructivist pedagogy.

Social constructivism is a theory of knowledge used in many disciplines. Moodle's official online philosophy looks at social constructivism as a "social group constructing things for one another, collaboratively creating a small culture of shared artifacts with shared meanings" (http://docs.moodle.org/en/Philosophy). The creators of Moodle see social constructivism as an extension of constructivism and constructionism – constructivism being the point of view that learners construct new knowledge as they interact with their environment, and constructionism being the belief that learning happens best when you construct knowledge for other people.

Another key concept that Moodle developers find helpful in guiding their philosophy is that of constructed behavior. Learners that exhibit constructed behavior know when to work as a team (or connected behavior), and when to work as an individual (or separate behavior). Moodle gives instructors tools that allow for learners to learn on their own as well in groups.

THE SOCIAL ASPECTS OF MOODLE

One of the more popular activities online today is social networking. Social networking sites such as MySpace, FaceBook, and Friendster have all had their fair share of exposure as well as controversy. The main idea of these sites is that users sign up, connect with people, and share information. Therefore, these sites thrive on social constructivism pedagogy – whether the users or designers know this or not. Social constructivism basically says that learners will learn best when they are constructing shared knowledge as a group.

The question then becomes "how can we harness the social nature of the Internet to increase learning and academic performance?" This is a question that the designers of Moodle have been wrestling with since day one. Moodle's design is based on social constructivist pedagogy. This focus means that instructors using Moodle have access to a wide range of tools that help them increase social activity in their online classes.

In general, online learners need to have a higher level of self-motivation, persistence, and commitment than learners in face-to-face courses (Martinez, 2003). This would seem to indicate that online learners need to be the independent, "work on their own" type. However, as discussed below, some research has indicated that increasing immediacy and social presence in online classes will lead to greater learner satisfaction and academic achievement – even though more research is still needed in this area.

Social Presence is generally seen as a student being aware of the other students in a course and those students' involvement in the course communications (Xu, 2005). Some researchers feel that there is still not an agreed upon method for measuring social presence (Lin, 2004). In spite of this, many studies have explored the impact of social presence in face-to-face classes (Tu & McIssac, 2002). However, these studies examine factors that can not be replicated in online learning, such as posture, dress, and facial expressions. Some research has shown that social presence can affect student satisfaction and learning outcomes in an online course (Richardson & Swan 2003). Other recent literature, such as that by Reio & Crim, has called for more research into the importance of social presence in online learning (2006).

Immediacy generally refers to the perception of distance between two people in a class. Swan (2002) noted that several researchers have found that instructors can increase learning in face-to-face classes by decreasing the perceived distance. Some of the methods for decreasing perceived distance include methods that might not work in online classes – such as verbal clues. Recent studies into the impact of instructional immediacy have called for more research into the impact of immediacy in online courses (Melrose & Bergeron, 2006).

Some researchers feel that imitating face-to-face communication in an online environment is not necessary. Rogers & Lea (2005) believe that a sense of belongingness to a group can be achieved online through other methods. For example, one such method to create belongingness is to create a shared social identity.

Social Tools in Moodle

Some evidence suggests that a course management system can increase interactions between the instructor and the student (Morgan, 2003). Other studies have found that learning management systems are heavily used for social activities such as peer support and collaborative working – sometimes even more so than for other uses such as assignment submission (Jenkins, Browne & Walker, 2005). Moodle is designed to take advantage of these increased interactions by providing several tools that can increase social presence and immediacy, while at the same time creating a shared group identity. Tools that will be examined here are blogs, wikis, discussion boards, groups, profiles, and chat rooms.

Blogs. Recent versions of Moodle have been slowly introducing a site-wide blog feature. Moodle blogs allow users to add personal thoughts on a site wide basis. Bloggers can use a set of site-defined or personally-defined tags to connect their blog entry to all the other entries that have been contributed. This connectivity allows students to construct shared knowledge on a social level. Moodle blogs do not currently allow comments on entries, but designers claim that this feature is coming. Discussion boards can be used for comments.

Wikis. In Moodle, wikis are used as a collaborative class project. Students can works as a class or in smaller groups to create content that is shared with everyone in the course.

Discussion Boards. Discussion boards in Moodle are used in much the same manner as they are used in other LMS applications. Students discuss and comment on a question, sometimes proposed by the teacher and sometimes proposed by other students. In Moodle, teachers have the option of allowing students to rate other students' posts.

Groups. Most activities in Moodle, including some of the activities above, allow teachers to place students in groups. This works in much the same way that it does in other learning management systems. Instead of getting lost in a larger class, placing students in groups allows more students to participate in activities.

Profiles. Moodle allows students a large degree of control over their personal profile. Moodle users have the option of creating a customizable "About Me" section. This section has full html support. In addition to this, Moodle allows users to upload pictures (if the site admin allows) that will post next to all class contributions, including discussion posts, blog entries, and chat messages. This feature helps personalize all contributions to the course.

Chat Rooms. Moodle chat rooms have fewer features than other chat room programs, but they still handle the basic chat. The reason that they lack some features is due to the fact that Moodle designers try to avoid using Java applets for functionality. The Moodle chat rooms will work with any browser without installing extra software. This system has the advantage of being lightweight in regards to system resources, but also lacks some features (such as a whiteboard) that some instructors may be accustomed to using in chat sessions.

Instructional Design Issues

Due to the large number of tools available for instructional use, course designers can become tempted to use a particular tool just because they find the tool new and exciting. All tools in Moodle, including the ones listed above, need to be examined in order to insure that they meet the specific instructional need of students in a course. However, the built-in flexibility of the Moodle program allows instructors to try an activity out, see how it works, and remove or change the activity as needed.

Another issue that Moodle is built to address is course work flow. Instructors need to ensure that course lessons flow in a logical manner from one activity to the next. However – smooth work flow is sometimes difficult to predict. Moodle allows instructors to quickly rearrange course activities in a matter of seconds, or to completely customize the work flow from unit to unit.

FUTURE TRENDS

Online learning will continue to become more social in nature. Recent research has shown that teen computer users are increasing their use of online social networking services (National School Boards Association, 2007). As these learners advance in their education and enroll in more online courses, they will help encourage this shift towards more socialization in online courses. More research into the effects of social presence and immediacy needs to be conducted, as well as specific research into the effectiveness of various online tools. Also, research into the interface preferences of online learners is needed to see if the design of Moodle is preferred over the interface design of other learning management systems or not.

Another future trend that may affect Moodle and other online educational programs is the growth of online virtual communities such as Second Life. Virtual interactions in online worlds like these appear to be gaining momentum and attention in the online education community. Some projects, such as Sloodle, have started to find ways to integrate Moodle with the social aspects of virtual worlds. This is still a very new area, but the possibility does exist that one day online learning could move into these virtual worlds.

CONCLUSION

This article has examined the nature of social learning tools in the Moodle course management system, as well as why social tools are important to online learning. Many other tools exist in Moodle that also enhance the learning experience. The social aspect is only one factor in designing an online course.

Social constructivist pedagogy has proven effective in face-to-face courses. Some of these concepts and techniques can be transferred in to online class environments. Like any teaching method or activity, caution must be exercised in order to ensure that the instructional needs of students are met first and foremost. Despite popularity or predictions of future growth trends, solid pedagogical principles must underline every tool and activity added to the online learning community.

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KEY TERMS AND DEFINITIONS

Constructed Behavior: Refers to a learner's ability to know when to work as a team, and when to work as an individual.

Constructionism: Learning theory that states that learning happens best when learners construct knowledge for other learners.

Constructivism: Learning theory that states that learners construct new knowledge as they interact with their environment.

Immediacy: The perception of distance between two people in a class.

Learning Management System: Computer based presentation program that manages an instructional program and student progress.

Social Constructivism: Learning theory that states that learners learn best when functioning as a social group that collaboratively constructs a shared culture of artifacts with shared meanings.

Social Networking Service: Web-based program that focuses on building online communities of people with common interests.

Social Presence: Refers to a learner's awareness of the presence and involvement of other learners in a course.

This work was previously published in Encyclopedia of Distance Learning, Second Edition, edited by P. Rogers; G. Berg; J. Boettcher; C. Howard; L. Justice; K. Schenk, pp. 505-509, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.13
Personal Digital Libraries

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ABSTRACT

This chapter presents the services and functionality that a personal digital library (PDL) system should provide. The chapter includes a reference architecture for supporting the characteristics and functionality of the personal digital library. In particular, a currently available project called PDLib is used as an example of this type of system. The authors address some of the particular problems that personal libraries impose with respect to the overall administration of personal collections of digital documents and how personal libraries may become a commodity and a way of social interaction. The chapter objective is to increase the research interests on personalized digital libraries and their usability in our daily live.

DOI: 10.4018/978-1-59904-879-6.ch005

INTRODUCTION

As digital and information technology advances, the effects of the adoption of such advances to our daily life are more evident. Today we, as users of information technology goods, produce a large amount of digital documents such as e-mail messages, office paperwork, personal documents, school homework, and even still-images, audio, and video. These myriad of digital documents usually reside in our personal computers or workstations, and some of them are placed on public places (i.e., our personal Web page and/or a Web sharing repository) where others can access our digital content. We are not only producers, but also consumers of digital documents; more and more frequently we get our daily news from the Web or via an e-mail service subscription. Also, while doing research in our area of interest, we consult the digital content available through the digital library services that our local library provides.

The personal computer is the place where we collect our personal digital archives and we have been using hierarchical folders to classify this information; with the increase in volume data the search utilities provided by operating systems are inadequate to ease the finding of documents, e-mail messages, or multimedia files because they do not analyze content. In the last couple of years, the search engine industry has introduced desktop search engines, tools that try to index the data in the file and gather as much metadata available (Cole, 2005) to provide a better search experience.

We organize all of those documents into collections, which will form in a way our personal library. Each user decides the contents of each collection following the user's own classification schema. Creating, organizing, sharing, searching, and retrieving documents from our personal collections are the intentions of personal digital libraries. A personal digital library (PDL) includes traditional digital library services for individual users.

In this chapter, we present and discuss the services, functionality, and characteristics of personal digital libraries in the context of our own development project called PDLib (Alvarez, Garza-Salazar, Lavariega, & Gómez-Martínez, 2005). PDLib is a universally available personal digital library. It is "universally available" in the sense that it allows the user to access personal digital library from most computing devices connected to the Internet, including mobile phones and PDAs, therefore granting access "from anyplace at anytime." We also discuss how social interactions happen at different levels in the context of PDLib.

BACKGROUND

Digital library research has produced specialized, cohesive repositories, typically delivered via a Web interface and targeted to support both academic and industry organizations. A requirement to bridge organizational boundaries has been issued as the interoperability challenge (OAI, 2006), which calls digital library systems to take measures to share data with other digital repositories. Traditional digital library systems are seen as large data repositories that provide services to multiple users. Many of these systems are supported by distributed architectures for scalability purposes (Janssen, 2004; Smith, Barton, Bass, Branschofsky, McClellan, Tansley, et al., 2003; Witten, Boddie, Bainbridge, & McNab, 2000; Witten, Moffat, & Bell, 1999).

We propose a different perspective of the digital library, that is, a PDL universally available. The objective of personal digital libraries is to take the concepts of traditional (or collective) digital libraries to the user level and provide tools to promote the social interaction. Our PDL's concept proposes the notion of providing one repository for each user, enabling users to interact with each other with regards to both personal and shared data objects. We also emphasize on universal access, that is, users should be able to access their own personal libraries wherever they are.

Personal digital libraries provide traditional digital library services such as document submission, full-text and metadata indexing, and document search and retrieval, augmented with innovative services for the moment-to-moment information management needs of the individual user. These innovations include provisions to customize the classification of documents, interact with other digital libraries (whether personal or collective), and support user-to-user exchange of generic digital content.

The creation of the personal digital library implies the submission of digital documents and their placement on the personal digital library under user-defined classification schemas. The documents of a personal digital library must be accessible via a mechanism capable of providing meaningful answers to users' queries. In a personal digital library system, search and retrieval mechanisms must adapt to the personalized classification schema defined by the users of the system. The effectiveness of the document retrieval process from personal digital libraries must be assured with the provision of an intuitive classification schema and the indexing of documents. A personal digital library must provide each user with mechanisms to restrict unauthorized access to their personal digital library and with administrative tools to manage digital library content.

Since PDLs extend the traditional library services for the mobile environment in order to realize the abstraction of personal libraries, we must cope with the technological challenges imposed by the implementation of digital library services (Adam, Holowczak, Halem, & Yesha, 1996; Bhargava & Annamalai 1995; Garza-Salazar & Lavariega, 2003), the mobile environment (Barbara 1999; Madria, Mohania, Bhowmick, & Bhargava, 2002; Pitoura & Samaras, 1998), and the specific requirements of personal digital libraries. In the next sections we present the services, characteristics, architecture, and relevant problems presented in personal digital libraries.

PERSONAL LIBRARY SERVICES

Traditional digital library systems grant to a group of users access to a digital library. Personal digital library systems provide a digital library to each user with supporting functionality found in traditional digital libraries plus services that allow users to form their own collections, share documents with other users, and have universal access to the library contents.

Traditional digital libraries provide services such as digital document creation, efficient storage, classification and indexing, capabilities to search, filter, and summarize big volumes of data, images, and information, use of interfaces suitable for the presentation of results, distribution of the library content to the end user, and administration and access control. Also in traditional DL systems there are at least three types of users:

- **Administrators:** This group of users is the technical people who create users accounts and access rights to the collections in the DL. Administrators are responsible of the normal operation of the DL system.
- **Contributors:** This group represents people authorized to submit documents in the digital collections. They are authors, curators, or information science experts.
- **Common users:** This group represents the information consumers. People that browse in the DL collection or search for specific works based on some metadata such as author, topic, publication date, and so forth. Searches may be also set as a combination of metadata elements and document content.

In traditional DL a user may play more than one role simultaneously, but it is not a requirement. In contrast, in a personal digital library, a user necessarily plays the three roles simultaneously. The user needs to define who is granted access in the user's personal collection (or collections); also, users are responsible for placing content in the user's personal collections and set a classification criterion for the submitted documents. And of course the user can search for information inside the user's own collection or in the collections of other users who have authorized others to browse and search in their collections.

Another notable difference between traditional and personal digital libraries is the notion in normal DL that users "go" to someplace to search and browse in well-formed collections (i.e., collection which content has been validate and approved by a collegiate body). On the contrary, in personal DL, personal collections "travel" or move with the user, and collections' content is defined by the user. In personal digital libraries there exists the notion of universal available collections due to the "traveling" of user's collections. This notion is mainly realized by providing access to collections through any personal device (i.e., laptops, PDAs, and cellular phones). Dealing with mobile devices of limited capabilities presents interesting challenges for a personal digital library (Barbara, 1999) such as limited display space, and connection availability.

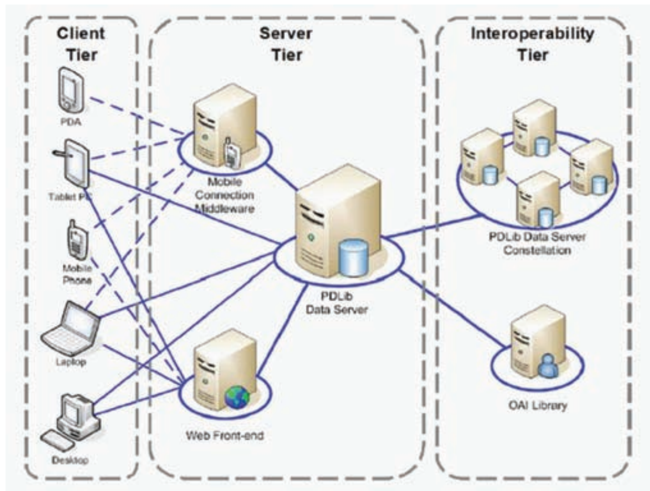
In order to support our vision and illustrate the functionality and capabilities of the PDL concept, we developed PDLib. PDLib is a personal library system that allows the user to shape and access the user's digital library from anyplace at anytime using nearly any computing device (i.e., universal access). To realize universally available digital libraries, the following requirements were defined for the PDLib system. The following functional requirements define the personal digital library services available in PDLib:

- **Flexible collection and metadata management:** Collections must be provided as a mechanism for document classification. Users should be provided with the ability to define the metadata set that will be used to describe the contents of each collection. These interactions will allow the user to customize a personal library as desired.
- **Digital document submission:** The user should be able to add any digital document to a personal digital library. Submission from several device types should be supported. The personal digital library must be able to accommodate several document formats for the same document. Additionally, the user must be able to (a) select or create the collection that will contain the document and (b) provide metadata information for the document according to the collection's metadata set.
- **Search and retrieval:** Search and retrieval mechanisms must adapt to the personalized classification schema defined by the users of the system.
- **Universal access:** In order to provide universal access to the documents and services of the personal digital library, several client application types suitable for mobile and fixed hosts of mobile environments must be considered. Clients with diverse capabilities may be supported.
- **Administration and access control:** The owner of a personal digital library always has unrestricted access to the owner's personal digital library content. In addition, the owner has the capability to grant other users with access to the owner's individual personal digital library.
- **Interoperability:** Interoperability with other personal library users and with other digital library systems using well-known interoperability protocols must be provided. Interoperability happens in PDLib with other systems by using the open archive initiative protocol OAI-PHM (OAI, 2006). However, users should be allowed to define their own document descriptors. It is also desirable to support direct interaction with digital content providers such as Web search engine, as well as to store the results from the Web search into a personal collection.
- **Data model:** Personal digital libraries must provide a simple and flexible data model where each user's library is composed of collections. Collections contain, in turn, other collections and/or documents. Users can interact with personal digital libraries by creating and deleting collections and submitting, moving, copying, or downloading documents. In addition, users can define the metadata set that will be used to describe the contents of each collection. These interactions allow the user to customize a personal library as desired

ARCHITECTURE OF PERSONAL DIGITAL LIBRARY

An overview of the PDLib system is shown in Figure 1. The PDLib software architecture consists of three layers:

Figure 1. PDLib system overview



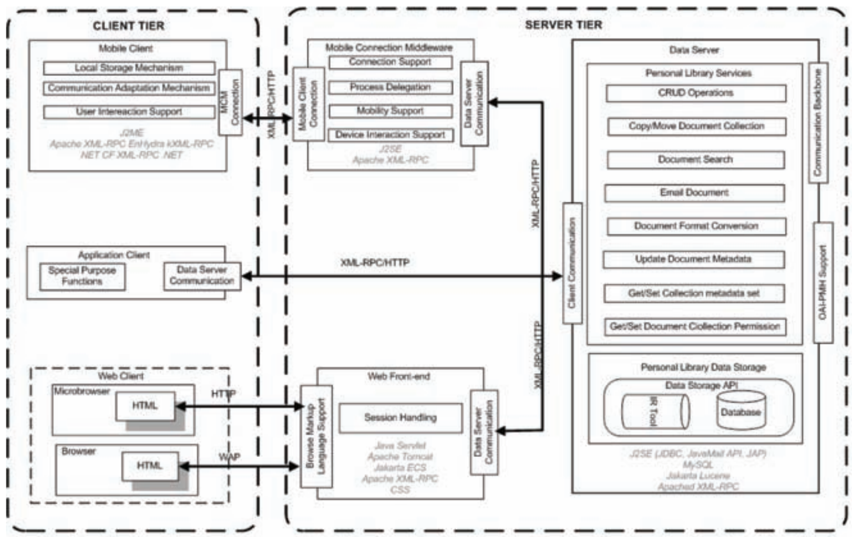
1. **The client tier** includes the variety of devices with which a user can interact with PDLib. Clients can be classified depending of their mobility and client-side architecture into: mobile thin client, mobile thick clients, fixed thin clients, and fixed thin clients. In thin clients, the application is delivered on a browser or microbrowser, while in thick clients both code and data may reside in the client device. Mobile thick clients are especially important to achieve off-line operations possible, therefore mobile applications should be based in this type of clients. Web applications typically focus on fixed thin clients.
2. **The server tier** includes the server system infrastructure that provides services to clients: (a) data server, (b) mobile connection middleware (MCM), and the (c) Web front-end. These components are addressed in a further section within this chapter.
3. **The interoperability tier** which allows the connection to other (PDLib) data servers and/or to OAI-PMH (OAI, 2006) compliant digital library systems.

The devices of the client tier communicate with the server tier to access PDLib digital library services. The access type of the client tier with the server tier varies according to the client device's capabilities: *middleware access* supports mobile devices, especially those with limited computing resources; *Web access* provides hypertext transfer protocol (HTTP) access to any device that includes a Web browser (WML/hypertext markup language [HTML]); and *direct access* for applications with very particular requirements can access the data server directly. PDLib architecture (Figure 2) is supported in two main components: 1) mobile connection middleware and 2) data server.

Mobile Connection Middleware

One of the main problems to solve in order to provide the data server services is the fact that the data server has been designed to be used by a wide range of devices and not just mobile devices. However, there is a clear difference in computing resources between mobile and fixed devices. This computing resource disparity makes it difficult to adapt the data server to the capabilities of mobile devices and signals the need of a middleware component to mediate the interaction of the mobile device and the data server. We call this middleware the mobile connection middleware (MCM), which provides the following functionality:

Figure 2. PDLib architecture



- **Connection support:** It is required by mobile clients in order to perform adaptation to the high bandwidth variability of the mobile environment and to cope with the frequent disconnections of mobile devices.
- **Process delegation:** Execute functions that would demand an excessive (or unavailable) amount of computing resources to the mobile device.
- **Mobility support:** Operations such as prefetching can be performed to speed up the retrieval of documents from the data server and store them in cache servers that are closer to the user. When the user changes location, it would be necessary to support migration of the information between different instances of the MCM.
- **Device interaction support:** Performs adaptation of content according to the characteristics of the device on which it is desired to show the information.

Data Server

The data server provides the services of a personal digital library, stores, indexes, and classifies digital documents. It supports interoperability with other digital libraries and helps users to organize their collections. The data server provides the following:

- **Personal library services:** The data server offers creation, retrieval, update, and deletion operations over the library objects stored in the personal data storage (collections, documents and metadata). The data server also provides services to copy and move documents or collections search for documents in a personal library, and send documents to the personal library of other users.
- **Data model:** The digital library data model in PDLib establishes that a library contains one or more collections. A collection contains documents or more collections and is associated with a metadata set. The metadata set is composed by one

or more metadata definitions. The fields that compose document metadata are determined by the metadata set of the collection. The metadata set of a collection defaults to the metadata set of the parent collection and can be redefined by the user on a per collection basis. Both collections and documents have an associated permission. Permissions are particularized in the following access rights: (a) personal, where access is restricted to library owner; and (b) incoming, where other users are allowed to create documents and collections. This access right applies only to collections.

- **Information retrieval:** One of the most interesting challenges in personal systems such as PDLIb is the retrieval of information based on metadata, where the metadata set for describing documents within the library may be quite different. Some work has been initiated (Saavedra, 2007), considering that different representations and labels may exist for a single concept.
- **Personal data storage:** It stores the data of the personal digital libraries. A text search engine is used to index the content of the personal digital libraries. A database is used to store the objects of the personal digital libraries. The use of a text search engine and a database in the data server permit to combined text-based queries and SQL queries, supporting the hierarchical classification of personal library content.
- **OAI-MHP support:** The data server exposes the metadata of the personal digital library documents via the OAI-MHP. In addition, the data server harvests metadata of other OAI-MHP compliant library systems to provide users with a subset of the personal digital library services to interact with other (OAIMHP compliant) library systems.

PDLib services allow users to collaborate by sharing documents and collections of documents of different types. Documents and collections are indexed and stored for further user navigation and accessing. Collections act as a collaborative memory. The main services that we provide as a means of collaboration are:

- **Public/Private access control:** Any collection or document can be made public or private by the owner. When a user has at least one public element as part of the user's library, then any user can browse and retrieve such public collections and documents.
- **Document sharing:** When a PDLib user wants to share a private copy of a document with another user, there are two services available for this purpose. 1) If the target user has a PDLib repository, the "send to PDLib user" service places the document into the target user's special collection named "unfilled documents." This is a very fast and efficient way of sharing the information since no actual network bandwidth is used for this purpose. 2) For non-PDLib users, the send library content via e-mail service is available.
- **RSS support:** RSS (RSS, 2006) is supported for collections and queries. At the collection level, any user with an aggregator can subscribe to any user's PDLib public collection. Any time that the PDLib user adds a new document to the user's collection, the feed is updated. PDLib supports the retrieval, storage. and indexing of syndicated information from any RSS source and allows users to have collections of feeds as part of their own personal space.
- **Collection creation from external search engines results:** Search engines offer an excellent list of initial resources (documents including Web pages) while looking for a unknown topic. Usually results from Web search engines are relevant to user

interest in the first few hits. Those results may be consulted immediately, but a very useful service should be to store them for further reference in a collection instead of click and saving bookmarks one by one. PDLib offers the service for creation of collections based on results of external Web search engines such as Google or Yahoo!.

- **Mobility support:** In order to enhance the possibilities for social interactions, personal digital libraries services have to be available wherever the user needs it. The mobile environment challenges are addressed by the PDLib's mobile clients. Our current PDLib's mobile client implementation supports two platforms, one based on CLDC/MIDP J2ME and other based on .Net technology

CONCLUSION

This chapter presented an overview of the PDLib system and the services it provides. PDLib services not only facilitate the management of user's personal documents, but also help users to increase interactions among colleagues and friends. In this way, a personal digital library system can be seen as an approach for supporting social computing. The current version of PDLib supports all the functionality described here.

Digital libraries are systems that have much to offer to social computing (Schuler, 1994). Even though the focus of both areas may seem to be initially quite different, on one hand, social computing is working with system informality and spontaneous communication to enable people collaboration and interconnection, and on the other hand, the digital library community has focused its efforts towards classification services and content structuring within centralized documents repositories. However, personal digital libraries support perfectly the management of personal information and the notion of collaborative/cooperative work by sharing collections of documents among individuals, making available to groups interesting findings, and consulting several sources of information from a single entry point.

As future areas of research and development we envision the incorporation of off-line operations and a synchronization mechanism from personal digital libraries mobile clients. Creation of ad hoc networks for the sharing of documents in small groups is also an area of opportunity for enhancing the user experience.

Currently we are developing a voice-processing capability that makes it possible to capture voice conversations, to convert them to text, and to store them into the system. Another development in progress is the creation of a peer-to-peer network of PDLib library servers. There are other issues such as scalability of the collections, consistency of information, and optimal document management that need to be addressed not only in PDLib, but also in personal information systems.

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KEY TERMS

Digital Document: Any document in a digital format. A digital document can be text, image, video, or any combination of these formats.

Middleware: Any software component that mediates between an application server and a set of mobile clients.

PDLib: The personal digital library project developed at Monterrey Tech. Information and product available at http://copernico.mty.itesm.mx/pdlib.

Personal Collection: A set of digital documents that belongs to a specific user.

Social Computing: The ways of using computer applications to enhance and influence forms of social relations. The term "social computing" also refers to the social and ethical implications that software professionals have in an increasing "computerized" society

Thick Client: Software product that request information to a central information server. Thick clients have both application code and data residing on the client device (e.g., desktop, laptop, PDA, or cell phone)

Thin Client: Software product that request information to a central information server. In thin clients, the application is delivered on a browser (for large or middle size devices) or microbrowser (for a more restrictive device such as a PDA). Thick and thin clients can coexist in a single device.

This work was previously published in Handbook of Research on Digital Libraries: Design, Development, and Impact, edited by Y. Theng, S. Foo, D. Goh, J. Na, pp. 41-50, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.14
Knowledge Media Tools to Foster Social Learning

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ABSTRACT

The aim of this chapter is to overview the ways in which knowledge media technologies create opportunities for social learning. The Open Content movement has been growing rapidly, opening up new opportunities for widening participation. One of the Open Educational Resources (OER) initiatives is the OpenLearn project, launched by the Open University, which integrates three knowledge media technologies: Compendium, FM and MSG. In this chapter, the authors analyse some examples, which show how these tools can be used to foster open sensemaking communities by mapping knowledge, location and virtual interactions. At the end, they present some questions and future horizons related to this research.

DOI: 10.4018/978-1-60566-208-4.ch024

INTRODUCTION

Due to the widespread use of new technologies, people have greater access to information, interaction at distance and knowledge reconstruction than ever before. Open learning materials, online libraries, electronic journals and collective repositories are part of a larger movement to create a public online space providing open high-quality content in different formats such as hypertext, image, sound and video. The Open Educational Resources (OER) movement has also been opening up new opportunities for widening participation (Willinsky, 2006; Dholakia, King & Baraniuk, 2006; Downes, 2006; O'Mahony & Ferraro, 2003; Open Source Initiative, 2007).

The Open University UK´s OpenLearn Project, for instance, is a large scale project that makes a selection of higher education learning resources freely available on the internet. OpenLearn, which is supported by William and Flora Hewlett Foundation, was launched in October 2006 and in eighteen months released over 5,400 learning hours of the OU's distance learning resources for free access and modification by learners and educators under the Creative Commons license (OpenLearn, 2006). OpenLearn also offers three knowledge media tools: Compendium (knowledge mapping software), MSG (instant messaging application with geolocation maps) and FM (Web-based videoconferencing application).

This chapter introduces these three OpenLearn technologies and presents examples about the use and integration of these tools to promote social learning. During its first year and a half there are 50,000 registered users in OpenLearn, over 1,000,000 unique visitors to the site, over 1,000 video meetings booked, 1,377 Compendium Knowledge Map downloads and 17,000 MSG users.

Our current work is to investigate how these tools can be applied to foster open sensemaking communities (Buckingham Shum, 2005a) around the OERs, that is, the interpretative work that must take place around any resource for learning to take place. How can these technologies be used to support this critical activity in an OER context when learners must find and engage with peers themselves, if they do not wish to study alone?

"Open sensemaking communities" refer to open and self-sustaining communities that construct knowledge together from an array of environmental inputs (Buckingham Shum, 2005a; Weick, 1995). Thousands of open communities can be found on Facebook, MySpace, Orkut, Flickr, Yahoo groups, Google Groups, Moodle etc. However, there are some challenging issues for an "open community" (Reagle, 2004) to turn into an "open sensemaking community"(Buckigham Shum, 2005a). Participants must literally reflect upon information (Brooks & Scott, 2006) and "make" sense together by giving shape or modelling diverse ideas through significant representations (Buckingham Shum and Okada, 2008). They need transform their abstract thoughts about what is being learned into their personal framework - "knowledge objects" (Entwistle, 1995) and into "collective representations of knowledge" (Nonaka and Takeuchi, 1995). The term knowledge object is used *"to describe the essence of these quasi-sensory experiences of aspects of understanding*", through structures of thinking paths or summaries of integrated body of knowledge produced by a student (Entwistle, 1995:50). However, the "making" of a "shared artefact" to express the emerging, collective view of the problem/solution is an important distinction. Sensemaking is a "*mutually negotiated understanding*" (Weick, 1995:4). It means interpreting and representing plausible narratives about the world collectively. Through sensemaking, externalising one's understanding clarifies one's own grasp of the situation, as well as communicates it to others — literally, "*the making of sense*" (Weick, 1995: 4). An example of open sensemaking community is a community of open source software's developers. They learn with each other by representing and sharing understanding about the content, programming code, and also the process. They construct their set of principles and practices by themselves which facilitate access and quality to the design and production of their products and knowledge.

In higher education, how can knowledge media technologies be used by online learners interested in learning with their social network? How can they represent and share meanings together constructed from what they are studying? In the next sections, we present ways in which Compendium, FM and MSG have been used by participants of an OpenLearn Community. Based on these examples, we analyse some benefits and also their difficulties of using knowledge media tools for social learning and for fostering open sensemaking communities.

BACKGROUND

Information and Communication technologies have been promoting the rapid and flexible dissemination of open content and educational resources. There are currently many open content initiatives offering free access to learning materials on the Web. However, one of the main challenges for online learners is not only to be able to access free high quality content; they also need to be able to capture, organise, discuss and make sense of it including the deluge from search engines, news feeds, digital libraries, blogs and emails in order to construct meaning from this ocean of available information and opinions (Okada and Buckingham Shum, 2006).

The simple access to information does not necessarily mean understanding. In order to develop understanding, students need to be engaged in higher order thinking which operates beyond mere exposure to factual or conceptual information. Understanding means going beyond the information given to make inferences, connections and explanations. "*Understanding is not mere knowledge of facts but inference about why and how, with specific evidence and logic – insightful connections and illustrations*." (Wiggins and McTighe, 2005:86).

In contrast to "information technologies" whose purpose is to deliver data structured through different media and representations, "knowledge technologies" aim to support learners to interpret those representations and construct their understanding together (Buckingham Shum, 2005a). Interpretation means the process of assessing information to construct personal meaning. It is making an implicit idea "x", explicit as "y". (Jonassen, Beissner and Yacci,1993). Understanding involves being able to explain meanings and apply it in different contexts (Wiggins and McTighe, 2005).

The term "knowledge media tools" introduced by the Knowledge Media Institute KMi at the Open University UK means technologies to support the processes of generating, understanding and sharing knowledge using several different media, as well as understanding how the use of different media shape these processes. KMi considers that "media-rich learning experiences based on constructivist models of education are the key for ownership of understanding". Knowledge media technologies empower individuals - schoolchildren, adult learners, or corporate employees and their managers - to create their own content, to represent understanding and reconstruct their own knowledge. Learners need to develop their critical authorship rather than being merely recipients of information. Through these tools, users can research topics, collect information, discuss the content, manipulate digital media, categorise and structure meanings and publish their reconstructed thinking and knowledge on the Web (Eisenstadt and Vincent,1998:ii). Knowledge Media Tools are designed to assist users in giving form to their ideas as they evolve from ill-formed, inchoate structures to more formal, rigorously organised expressions and foster their own "open sensemaking communities" (Buckigham Shum, 2005b).

Contemporary approach on education consider learning as a process that is developed through dialogue (Vygotsky, 1962; Bakhtin, 1981). Learners construct their understanding through dialogic interactions with peers, teachers and learning materials. A critical discussion scaffolded by a learning community enables participants make sense of what they are learning. They internalise new meanings from significant dialogues developed interpersonally to form new understandings intrapersonally in their ZPD - zone of proximal development (Vygotsky, 1962).

Sensemaking is enacted through the interaction of explicit and tacit knowledge (Nonaka and Takeuchi, 1995) from individuals to groups (Cook and Brown, 1999). Tacit knowledge is highly personal and hard to communicate to others. "*We know more than we can tell*" Polanyi(1967:4). In contrast, explicit knowledge is easily stored, expressed and reused (Nonaka, 1991). Sensemaking is a process shaped not only by tacit knowledge - what people have in their mind, but also explicit knowledge – from interactions with their social and physical world (Cook and Brown, 1999).

The spiral of collective building of knowledge (Nonaka and Takeuchi, 1995) shows that, students need to learn to connect their own ideas with the other people's and knowledge from different domains to their own experiences (combination). They need to make sense of their own selected network of information, generate questions, critical arguments and pursue their reasoning to some coherent conclusion or outcome (internalisation). Students also need to know how to represent their insights, reflections, interpretations through images, sound, words, even maps, (externalisation) and share their thinking with their community (socialisation) using knowledge media tools.

Knowledge technologies have a role to play in this process, and the focus must move from simply capturing and storing knowledge to supporting learning and sharing understanding (Finerty, 1997; Ruggles, 1998; Sumner et al, 1998). Social tools designed for educational use support and engage individuals to learn together by eliciting their implicit knowledge based on their individual and collective needs (Anderson, 2007). In this context, knowledge media tools can be used to engage learners to (see Figure1):

1. Externalise their implicit knowledge by representing what they have in their minds through modelling, mapping and writing it down in forums, chats, Web videoconference or knowledge mapping tools.
2. Combine explicit knowledge by connecting different perspectives, adding new meanings, tagging or categorising best examples.
3. Internalise explicit knowledge by accessing, analysing, questioning and interpreting codified knowledge
4. Socialise implicit knowledge by sharing new experiences, observing, brainstorming and opening new opportunities for feedback.

Table 1, which is based on the examples presented in this chapter, summarises the role that some knowledge media technologies (Compen-

Figure 1. Spiral of the collective building of knowledge(Nonaka and Takeuchi, 1985)

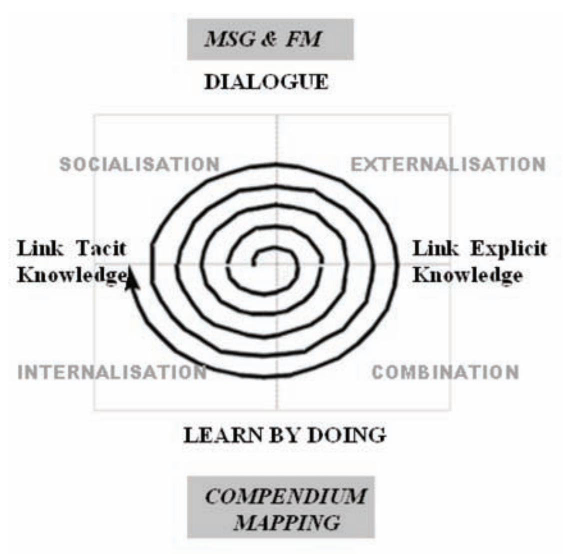


Table 1. Knowledge media tools integrated in the OpenLearn project

	Compendium a hypermedia mapping tool	FM a web videoconferencing application	MSG an instant messaging application
Externalisation	Represent reasoning through knowledge maps.	Present and discuss ideas through web video conferencing.	Point out opinions and feedback through instant messaging.
Combination	Connect ideas, concepts, argument, and web resources.	Connect questions, feedback, comments from different media (text, audio, urls, graphs).	Connect location, social presence and social awareness.
Internalisation	Visualise, reflect and analyse connections in order to develop better interpretation.	Replay the discussion in order to reflect on and analyse the content.	Access the chat history to recall answers, solutions and insights.
Socialisation	Share knowledge maps by downloading editing and uploading them again.	Share FM events, taxonomy system in order to search and find events.	Share relevant content from instant messages by copying and pasting it in a forum, a FM session or a knowledge map.

dium, FM and MSG) can play in order to construct knowledge collectively.

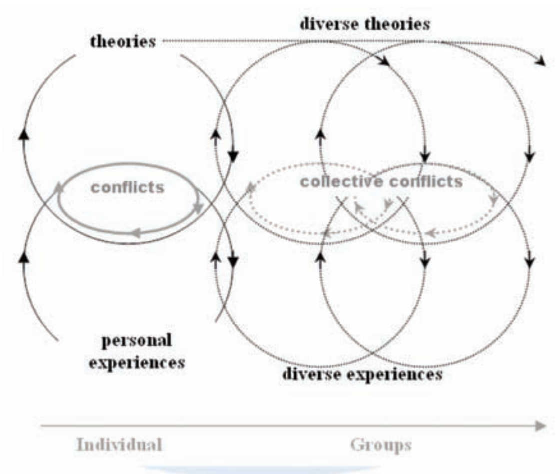
Compendium, FM and MSG can be used to externalise their ideas, combine different viewpoints, internalise new concepts and socialise new meanings. However, there are some challenges in order to leverage the spiral of knowledge to foster collective sensemaking from individual to groups.

- Could these tools help a learner identify and bridge a gap for sensemaking? "*Sensemaking moment is the point in time-space when a person experiences a gap while moving through time-space. (…) The person bridges this gap by experiencing questions and muddles that lead them to construct bridges consisting of ideas, thoughts, emotions, feelings, hunches and memories*" (Naumer, Fisher and Dervin, 2008:3).
- How do learners use these tools to create and share representations around some problem they need to understand? "*Sensemaking is the way people go about their process of collecting, organising and creating representations of complex information sets, all centered around some problem they need to understand*" (Russel, Jeffries and Irani, 2008:1).
- In what ways learners can apply these tools to identify common conflicts, clarify new concepts and negotiate a consensual understanding together in virtual learning environments? "*Learners are not naturally likely to argue spontaneously with each other, at least with respect to the subjects that they have not been in contact with yet and sometimes, interpersonal conflicts or individual contradictions are not sufficient to provoke the incidence of argumentation*" (Okada, 2005: 85). In order to make sense together by developing a consensual agreement through argumentative dialogue, learners need to identify a common problem (e.g. conflicts) by mastering concepts from theories that support their opinion and personal experiences (Figure 2).

CASE STUDY

"*CoLearn - Comunidade de Pesquisa sobre Aprendizagem Colaborativa* " (Community of research about Collaborative Learning) is a Community of OpenLearners from Portuguese-speaking Countries <http://colearn.open.ac.uk> in the OpenLearn – LabSpace. LabSpace is an open area in the OpenLearn for users creating and sharing mate-

Figure 2. Argumentative dialogue for sensemaking in collaborative learning environments (Okada, 2005: 88)



rials, and running their communities. CoLearn´s participants are educators and academic students whose interests focus on exploring knowledge media tools to facilitate collaborative learning. Based in different countries, they use FM to meet online, learn together and create OER. Their discussions are focused on diverse open learning issues such as game based environments, knowledge media and social software. Compendium Knowledge Maps are created on e-democracy, thinking skills and information literacy. Through MSG, they can see who is online, ask questions and get answers quickly. By exchanging instant messages, they can discuss problems with tools, share additional information on the Web, such as OER, knowledge maps, Web videoconferences and papers' URL about what they are studying.

Figure 3 shows the Labspace area of this community, and some information about one of its OpenLearners, "Lila" and her social learning network. On the left, there are three blocks: MSG Instant Messaging, FM and Knowledge Maps. In the MSG block, she can chat with 93 fellows from her list of 1419 contacts. She can also locate them in her MSG Google map. In this picture, we can see that she is one of the 17.041 OpenLearn users, in which 414 are online. Lila can access 11 FM Web-conferences for replaying. She can also browse or download a list of 62 knowledge maps.

On the right, in Lila´s Personal Profile, we can see that she is registered in six OpenLearn communities, and her interests are focused on information literacy, digital games applied to education, open learning,

Figure 3. CoLearn - Community of Portuguese Language Countries in the OpenLearn

culture, society and media, knowledge media tools and knowledge mapping for learning design. As an OpenLearn user, Lila can access all her forum posts, her learning journal and activity reports.

Whenever Lila is logged, she can chat with her peers through MSG, book a video meeting, manage and edit her events. She can download and install the Compendium software tool for knowledge mapping in order to create and share maps within her communities.

MAPPING KNOWLEDGE WITH COMPENDIUM

Compendium <http://www.compendiuminstitute.org> is a software tool for visual thinking, used to connect ideas, concepts, arguments, Websites and documents. The purpose of the Compendium application is to manage information, model problems, and map argumentation discussions. It can be used as an individual or group tool to develop new ideas, goals, logical concepts and collaborative scenarios. A key feature of Compendium is its ability to categorise information. It offers a set of different types of "nodes": question, idea, pro, con, reference, note, decision, list and maps views. This node classification allows one to better organise the structure of the map and understand the argumentation discussion more easily.

Figure 4 shows a map created by an OpenLearn user from the CoLearn community also interested in Information Literacy. It illustrates how to use Compendium to organise ideas and arguments:

1. Drag and drop a question-icon from the palette and type a question.
2. Create new nodes: for answers, concepts or data; for arguments, choices or possibilities; for supporting arguments; for counterarguments. If you want to make connections, by clicking the right button of the mouse over the icon, drag the arrow and drop it onto the other icon.
3. Pictures, sites and documents from the Web can be added into this map by dragging and dropping the media resource.
4. A number superimposed on a node (e.g. 2) means that it appears in more than one map. The same idea can play roles in multiple contexts and conversations which can be linked. When the mouse is over the number

Figure 4. Compendium's user interface for linking issues, ideas and documents

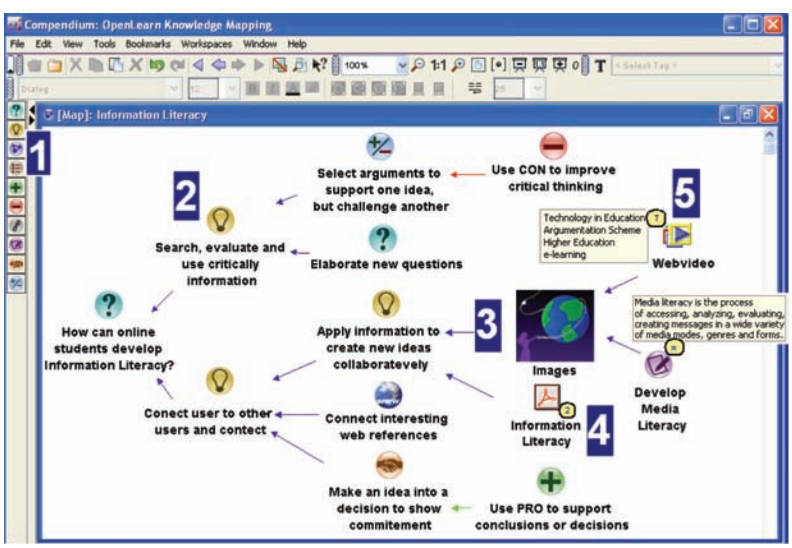
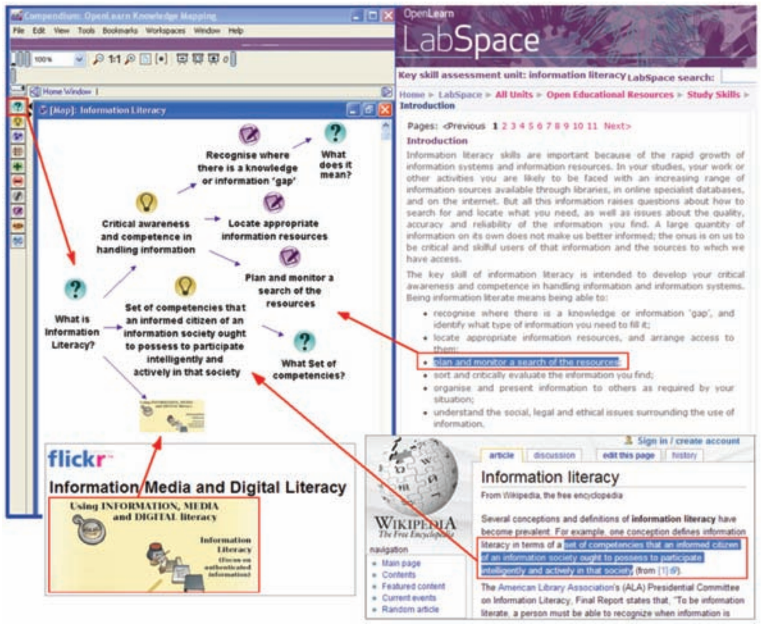


Figure 5. Compendium's user interface for linking issues, ideas and documents



you will see all maps related to that node.

5. User-defined keyword tags [T] can be annotated onto nodes to help when searching for related material across multiple maps, and include comments [*].

CoLearn community has been using Compendium to create knowledge mapping applied to studying an OER together, sharing new references and describing the meaning of concepts.

Knowledge Maps as a Strategy for Studying an OER Together

Knowledge Mapping can be used as a strategy to study online learning materials (Buckingham Shum and Okada, 2008). Figure 5 shows an OpenLearn participant who used Compendium to select key sentences from the OpenLearn Unit "Information Literacy" in the LabSpace and from other Websites such as WikipediA and flickr. By dragging and dropping the content into their maps, she collected relevant pieces of information from different sources. She externalised her interpretation graphically by combining their own comments, bringing arguments and raising new questions. She could identify concepts that they did not understand (e.g. what does it mean?) and also "recognise where there is information gap" (e.g. what competencies are they talking about?).

By socialising a map within their communities, their fellows interested in the same topic can browse it, visualise and reinterpret keypoints, access Web resources, download it and combine new contributions in order to internalise new meanings. They can also discuss about its content (questions, ideas and arguments) in a video meeting, MSG or forum.

Knowledge Maps as a Strategy for Sharing New References

Figure 6 shows a Compendium map to collect and share relevant information source, which was created by another openlearner interested in "Media Literacy". It shows interesting Websites and offers complementary references related to "Information Literacy". This Webmap with nine online references was accessed by other participants for downloading, editing and new uploading. Participants interested in this topic used these references to compare Media Literacy in the UK and their countries. These references were used to support new ideas, answer questions related to Media Literacy and raise new issues, concepts and arguments. Web maps can be described as hybrid way of mapping in the sense that learners can integrate diverse objects of their own – concepts, links, personal documents, organizers - and progressively evolve these maps into concept maps (Zeiliger and Esnault, 2008).

Knowledge Maps as a Strategy for Describing the Meaning of Concepts

Figure 7 shows how Compendium was used to describe the meaning of a new concept. This concept map indicates several keywords that were collected from different sources and connected to explain what information literacy means. Other openlearners can access this map, visualise how the concept information literacy was interpreted and access the reference sources by clicking in the icons. They can also download this map to represent new viewpoint and new ways to make sense of this concept by adding examples, resources, case studies and new keywords.

Concept maps is an effective way to represent and contrast learners' understanding of various concepts by allowing they share and build knowledge individually or in groups (Canas and Novak 2008). Through concept mapping learners make sense of new concepts by structuring their thinking and connecting their prior knowledge (Novak, 1998).

Figure 6. Studying the arts and humanities through a web map, http://labspace.open.ac.uk/file.php/1801/knowlegde_maps/1165338042/abujokas.html

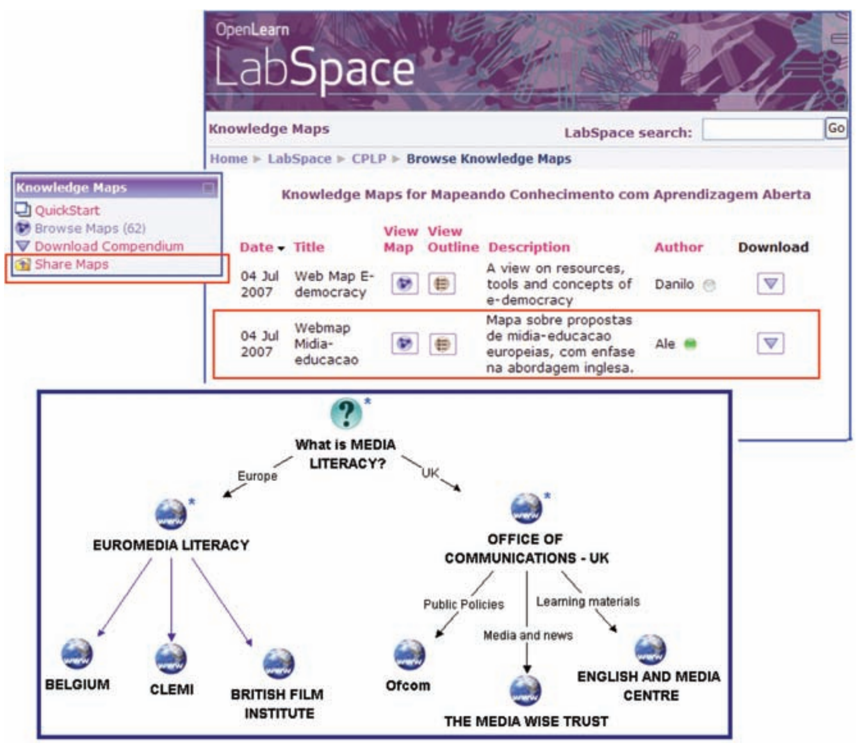
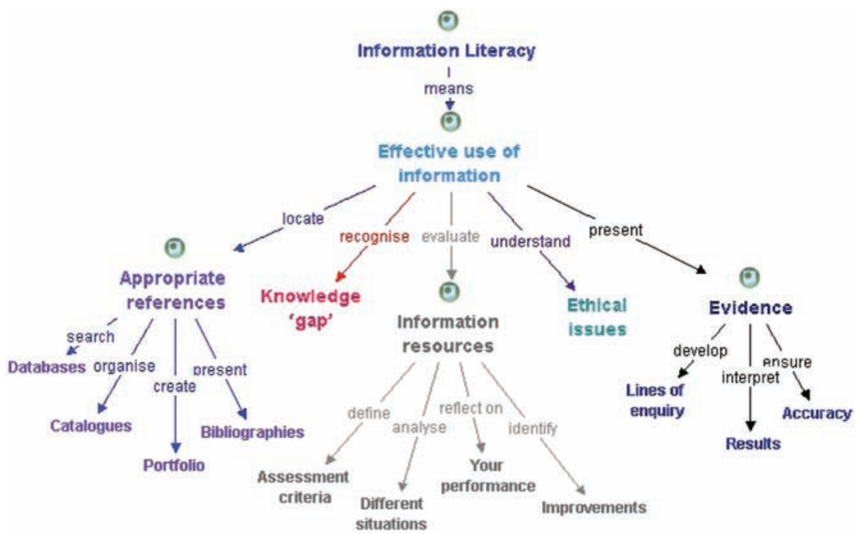


Figure 7. Studying the arts and humanities through a web map, http://labspace.open.ac.uk/file.php/1456/kmap/1199906929/il_cmap.html



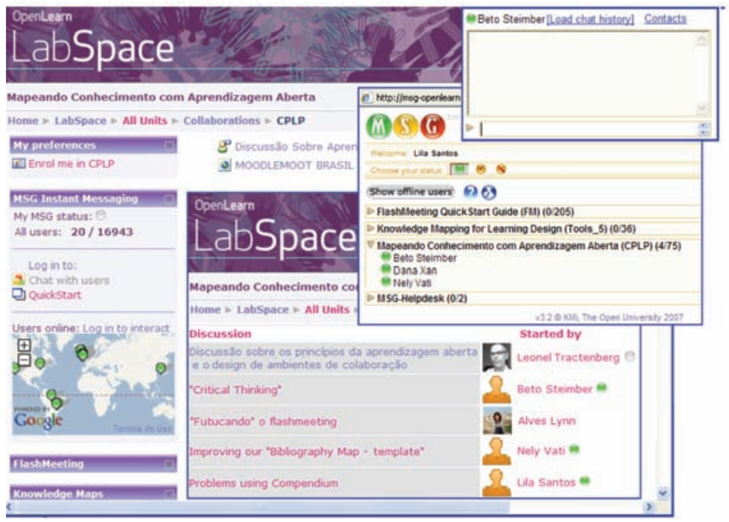
MSG: AN INSTANT MESSAGING APPLICATION WITH GEOLOCATION

Social presence can stimulate group awareness and the building of collective knowledge in online communities. Presence has evolved from just being 'online' or 'offline' to a range of preferences such as availability or location (Chakraborty, 2002). Websites, such as 'The World as a Blog', released in 2003, can provide real time blogging activity and the blogger's physical location, represented as a dot on the earth (Maron, 2003). This approach can be extended in communities of practice having a common knowledge objective, where members located in different parts of the world can support each other, and where knowledge use and reuse has a specific impact upon their evolution. Wenger (1998) described communities of practice as the interplay of four fundamental dualities: participation vs. reification, designed vs. emergent, identification vs. negotiability and local vs. global. Location and social presence display an aspect of the users' context, contributing to collective understanding.

MSG is a Web application for instant messaging that allows users to contact fellow OpenLearn users. It is an evolution of BuddySpace (Vogiazou, et al., 2005) that acts like a 'personal radar' that shows who is online and where. A key advantage of MSG over other instant messenger systems (e.g. MSN Messenger, AIM, GTalk etc) is the full integration into all OpenLearn units — meaning that throughout the site (e.g. in discussion forums) users can see who is currently online and can immediately 'click to chat' to the poster of a relevant forum message. Groups of contacts are automatically generated in MSG based on the courses users have enrolled on, enhancing in this way the creation of a sense of community with common knowledge goals and interests.

MSG also offers a presence map which allows users to find out where fellow users are located geographically and gives the same presence information and click-to-chat functionality as given in the OpenLearn units. The markers on the map are automatically clustered to avoid markers overlapping and obscuring each other. Clicking on a marker shows all the users at that location with their presence status and click to chat option if they are online. Additionally, users can easily search for users, update their own location and filter the map markers based on the groups and courses they have enrolled on.

Figure 8. The MSG block where you can click on contacts and chat with them



MSG, as Strategy for Finding Peers to Learn Together

Open learning can be sometimes a lonely experience. OpenLearners are located in different countries, access a course at different times and start from different areas. How can they find fellow students studying the same course when they are logged in the LabSpace? Figure 8 shows that Lila can contact her fellow students from the Google Map on the left bar (MSG Block) or from any Webpage in the Labspace such as the discussion. By keeping an eye out for the green and yellow 'presence status icons' throughout LabSpace, e.g. next to user names in a discussion forum, she can just click on it to chat directly to the person (e.g. Beto), even if she has not yet launched MSG.

If Lila, who lives in Rio, wants to find her peers who are in Sao Paulo and online, she can then access the MSG Presence Maps. Figure 11 shows that through the map, Lila can view who is currently online in Sao Paulo by clicking on the marker over Sao Paulo.

The box on the right in Figure 9 indicates that Lila is online, she received 8 new MSG messages and by clicking in this hyperlink she can read the

Figure 9. Multiple groups of MSG contacts

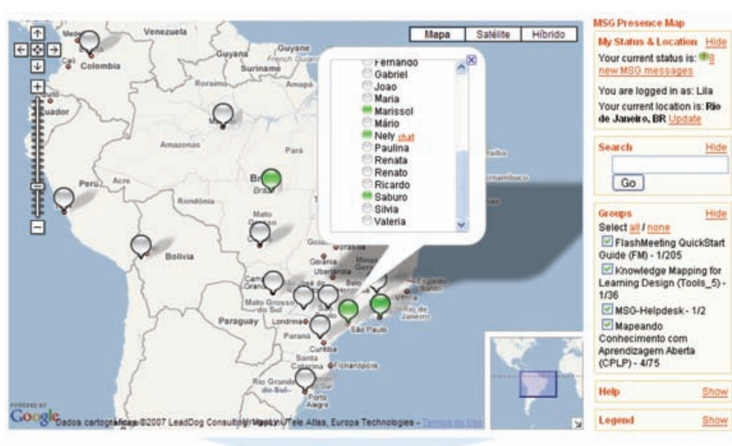
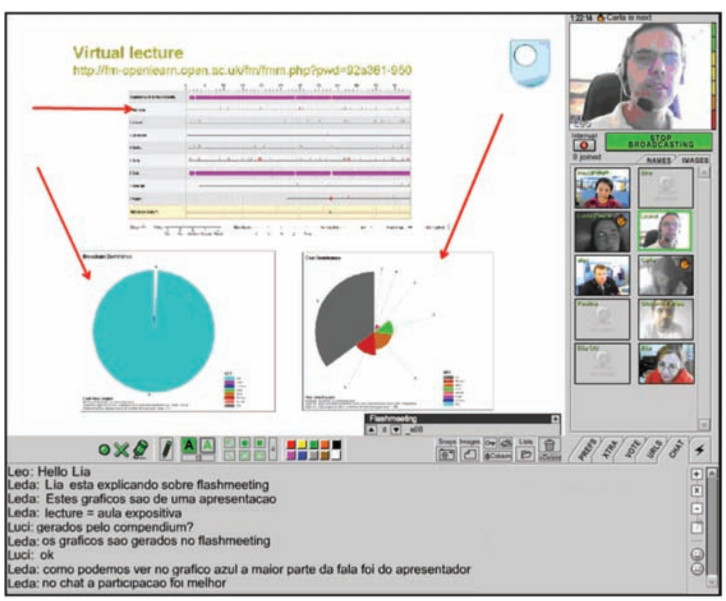


Figure 10. MSG displaying the availability of contacts of the same course worldwide

content. She can update her current location and also hide in case she does what to show it. She can search her fellows by name, locality or groups. Each group represents an OpenLearn course that she has enrolled on. She has 4 groups which shows the quantity of people logged in and online. For instance, in the group "FM QuickStart" there are 205 users and one is online. Lila can also contact people in Portugal and ask how they have been using knowledge media tools.

Figure 10 shows Lila from Rio de Janeiro chatting with Nely from Lisbon. Nely was searching the FM and used MSG to find a solution for her problem ("Hi Lila! I am looking for the FM Website…") and her fellow Lila helped her answering her question ("See this url http://fm-openlearn.open.ac.uk"). In this case MSG is useful to bridge quickly a gap that can be important in a more complex activity to develop understanding or foster the spiral of knowledge.

Figure 11. FM extract from CoLearn community



MSG, as Strategy for Mapping Social Presence

Presence is an indispensable social software function, featuring in instant messaging, video-conferencing and ambient video awareness tools. In Biocca et al (2001), presence is described as 'being there in other places' and 'being there with other people'. Mapping social presence in open sense making communities can give insights by providing geo-locations of the individuals who may be relevant with specific knowledge areas and can provide advice to others.

In instant messaging systems, a set of presence attributes may include time, context, availability, location, activity etc. A great variety of software supporting group interaction and location based social software applications, from providing awareness of friends being in vicinity to online community sites, helping users meet other users with similar interests. In the case of OpenLearn, MSG maps the location of members of the same community of practice, representing in this way the geo-location and impact of collective intelligence related to a specific course. In this way, the users can obtain a list of contacts, who may provide peer support during learning activities. Through MSG OpenLearners can identify the availability of contacts throughout the globe related to a specific learning resource.

FM: A WEB-BASED VIDEOCONFERENCING APPLICATION

FM (fm-openlearn.open.ac.uk) is a desktop videoconferencing tool, integrated in the OpenLearn environment. Any OpenLearn user can book an online video meeting and select the time, date, duration and number of attendees. The system generates a URL, which can then be circulated to the meeting attendees, who simply click on the link to gain access to the videoconference.

FM as Strategy for Social Learning through Group Discussion

The FM live communication tool allows learners to externalise their implicit knowledge into explicit knowledge by presenting their ideas during a video meeting either through the foreground communication channel (broadcast) or through the background channel (text chat). The application provides a 'push-to-talk', simplex audio system, allowing only one person to broadcast at any one time. Those who wish to talk can raise a symbolic hand and queue, whilst waiting for their turn to come, or click on the 'interrupt' button.

In the mock up example in Figure 11, Leo is broadcasting, while Luci is next and Carla is the last in the queue. Other communication channels in FM include a text chat function, URL sharing, a voting system, mood indicators, and a whiteboard which allows participants to upload slides, reflect on the content and annotate by drawing shapes or write text, visible to all participants. In this Web videoconferencing there are people from UK, Portugal and Brazil. While Lia from UK is explaining in English the graphics generated by FM, Leda is answering questions in the chat in Portuguese and translating important key ideas from English to Portuguese. All participants can visualise the graphs, interpret the content, ask questions and give feedback through different media: text, sound, audio, graphic and icons. In this way, users make sense by combining explicit knowledge from different media.

FM as Strategy for Individual Learning by Replaying the Discussion

FM events can be recorded and their replay, called FM Memo™, can be annotated, edited and discussed with their community or viewed by other people in the world. The replay is browsed by navigating through the names of the attendees on the right, or via the timeline on the bottom of the window, representing the length of each broadcast, with different colours to distinguish between participants. In this way, the FM Live Communication tool engages learners in internalising explicit knowledge through the replay function; users can replay the recording of the discussion in order to reflect upon it and analyse the content.

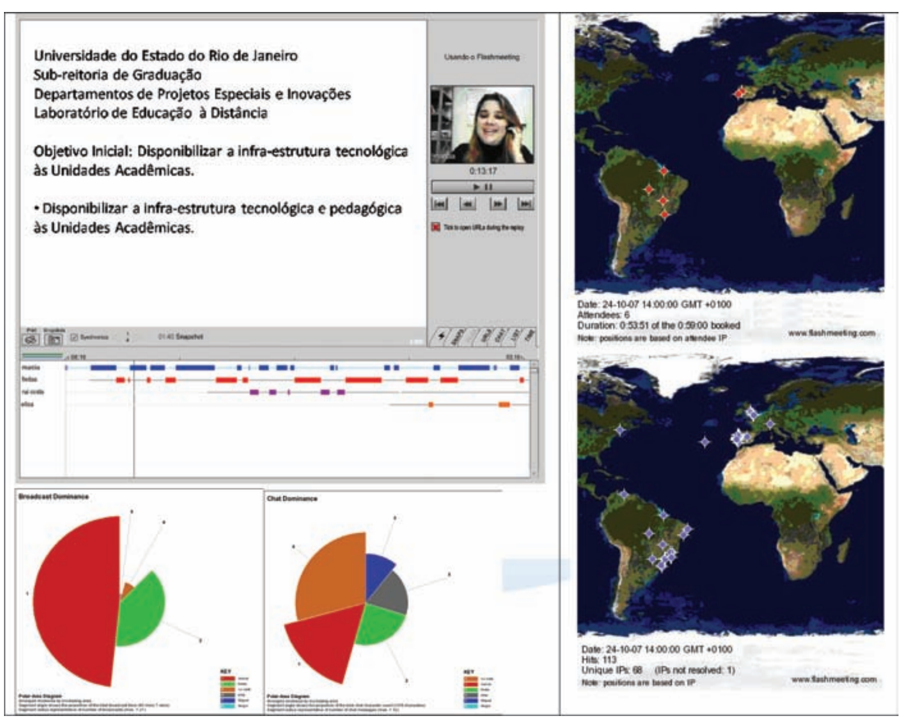
The example shown in Figure 12 portrays the replay of the broadcasts of 6 attendees from different cities in Brazil and Portugal. The whiteboard presents the purpose of their meeting, which is to discuss about technology and pedagogical methods applied to higher education. The time line below shows that the first two participants started to talk and the two following attendees in this list participated with their comments during the middle and at the end of this meeting. The other two attendees did not start broadcasting, they were probably only listening.

Automatically generated broadcast dominance diagrams (circle diameter=turns taken, circumference=total duration) and chat dominance diagrams (circle diameter=messages sent, circumference=characters typed) indicate the attendees' participation in the meeting (Scott et al, 2007). The first graph below, "broadcast dominance", confirms that there were two presenters, two active attendees and two listeners. The second graph, "chat dominance" presents almost similar participation among the six participants.

The meeting minutes are available online, providing different information in order to enhance the understanding of the event, remind attendees of what was discussed, or inform people who did not attend of the meeting content. The metadata generated after each meeting include the chat log, the number of attendees, a linear visualisation of individual broadcasts along the timeline of the event, the type of emoticons displayed, the time of raised hands, the URLs fired and others.

FM Memos can also be shared and made available through a publicly accessible Webpage for everyone who wishes to view and learn from them, enhancing in this way the collective knowl-

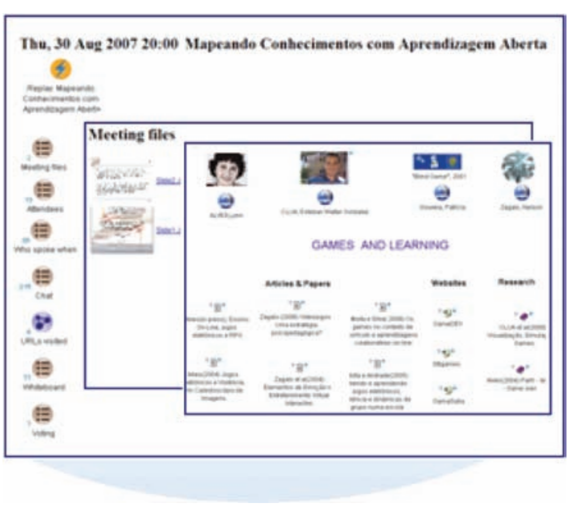
Figure 12. FM is a web videoconferencing application offering instant online meetings.



edge of new, reusable learning objects. In less than two years of existence, the FM-OpenLearn folksonomy hosts around 100 public events. In this perspective, the FM Live Communication encourages learners to socialise implicit knowledge by sharing their video meetings, allowing other learners to search and find events related to their interests and build knowledge through social awareness. Around 10 public events have been attended by the CoLearn community, such as series of interactive seminars held by experts on Moodle, video lectures on a variety of topics such as information literacy, elearning games and knowledge media tools. Amongst the rest of events, there are also Web-casts of conferences, interviews of e-learning experts, moderated project meetings, peer-to-peer student meetings and many others. These different kinds of events may contain different communication patterns, which can be interpreted in different sense-making representations, be it knowledge maps of the meeting or visualisations of the event shape.

In FM, the metadata produced after each meeting can be used to interpret the event in different ways. For example, the IP resolutions of FM users include information about the use of the

Figure 13. A FM map in Compendium representing Games webconference



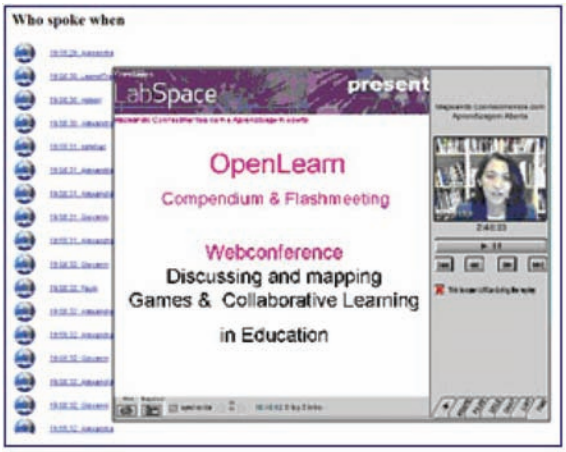
tool by different communities. Using people's IP addresses, their location can be plotted on a world map. In this way, maps can be generated to show the distributions of users for both the attendance of live meetings and replay access. For example, the IP resolution of the users connected to the live meetings shows how the tool is being used to connect people from the same social network or community of practice, while the IP resolution of the users viewing a public replay shows the learning impact of the event reuse in different parts of the world.

In Figure12 the map on the top shows 6 unique IP addresses from Brazil and Portugal that were connected to this live video meeting in the CoLearn community, while the map below shows the truly global use being made of FM recordings during the same month, with 113 unique IPs viewing FM recordings around the world, representing in this way the impact of the knowledge included in the replays of virtual events and transferred to hundreds of individuals around the world.

FM and Compendium as Strategy for Constructing Collective Knowledge

The FM Memos generate a set of metadata, available in XML format. This XML can be imported into Compendium and turned into knowledge maps as we can see in a virtual meeting about digital games applied to education. These maps can enhance the understanding of the event, as they include temporal and conceptual connections amongst all event elements, such as who attended the meeting and who spoke when (Figures 13 and 14), the URLs visited and the whiteboard images or interactions (Figures 15 and 16), text chat logs, annotations, votes and keywords. All these elements are nodes automatically linked in a knowledge map, which can be used to assist the replay users in structuring, acquiring and reconstructing the knowledge transferred during the discussions and argumentations in the meeting (Okada et al, 2008). In this way, learners can

Figure 14. Keeping track of who spoke when



internalise explicit knowledge of the community into implicit knowledge. The nodes are actually links back to the original replay as well; therefore a way of traversing the replay through different categories of indexed timestamps.

The knowledge maps of different kinds of FM events may differ in that they may present different map structures. For example, seminars can present richer maps in terms of URLs, broadcasts and chat logs, as they are more interactive events, involving the active participation of several attendees. Virtual lectures, on the other hand, with a main presenter broadcasting and her virtual audience interacting with chat, may include poorer argumentation between individual nodes. The structuring of the FM replay information in maps allows the users to browse the different parts of the event, based on the different event elements, such as individual broadcasts, annotations, URLs shared etc. Mapping the knowledge transferred in a virtual meeting enhances the combination of explicit knowledge in the form of questions, feedback and comments from different media.

DISCUSSION

In this initial study, the use of Compendium, FM and MSG was introduced around OERs, providing learners and educators with some strategies to foster open sensemaking communities. Table 2 shows a summary about how these knowledge media tools can be useful to develop understanding from individuals to groups.

Figure 15. Mapping the URLs visited along with their time during the event

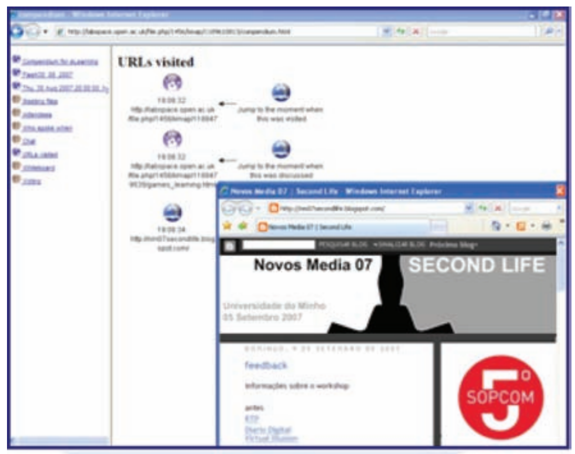


Figure 16. Mapping questions, ideas, pros and cons discussed on the webconference

Table 2. Knowledge media tools for open sensemaking communities

	How these tools help learners to	Compendium hypermedia mapping	FM a web videoconferencing	MSG Instant messaging
INDIVIDUAL GROUPS	identify a gap	Visualising questions not addressed and concept without connections	Raising questions through broadcasting, chat or Flashboard and unknown concepts	Raising simple questions through instant messaging.
	bridge a gap	Selecting relevant information resources	Getting peers' feedback through smiles, vote, chat or broadcasting E	Contacting who knows the answer for simple problems that need to be solved quickly
	develop and share representations around some problem	Bringing significant information in their maps and uploading the files in their community.	Preparing slides or Compendium maps and sharing them in WhiteBoard	Identifying simple problems that can be discussed in MSG
	identify common conflicts	Visualising questions and gaps in other's maps	Voting or highlighting in the WhiteBoard issues that the group are interested in	Meeting peers who are helpful to raise significant issues
	negotiate a consensual understanding	Mapping FM discussions representing the groups' argumentation around problems	Discussing Compendium Maps of previous meetings, which represents the groups' understanding, in the Whiteboard	Meeting participants who are helpful to solve problems

The combination of knowledge media tools for knowledge mapping, presence and live collaboration can assist learners in identifying and bridging gaps, developing and sharing representations around the same problem, tackling common problems and negotiating a consensual understanding. Learners can identify gaps by raising simple questions via instant messaging and visualising questions addressed for the first time and concepts without connections through hypermedia mapping. New questions can be raised during a live videoconferencing session.

Relevant resources organised in knowledge maps can help bridge gaps in sensemaking, while learners can locate and communicate with people who know the answer to simple problems via instant messaging and can get instant feedback in a videoconference through broadcasting, text chat, voting and emoticons.

Knowledge media tools can encourage the development and sharing of representations around a common problem. Learners can discuss simple problems via the MSG instant messaging tool and bring significant information in the knowledge maps, which can be accessed by their community, or prepare maps and slides to be shared in the whiteboard during a live video meeting.

Common conflicts can be tackled through visualising questions and gaps in fellow learners' maps, or finding contacts who may be helpful with the identifying problems via instant messaging, or through voting and highlighting issues in the whiteboard. The process of making sense is induced by issues that create discontinuity in the flow of experience engaging learners to collective interpretations (Weick, 1979).

Finally, consensual understanding can be negotiated by identifying contacts though MSG groups and maps, who may be able to solve problems. Moreover, the mapping of virtual discussions represent the groups' argumentation around problems and the discussion of Compendium maps of previous meetings via the FM whiteboard represent the group understanding.

In this case study, we analysed some examples, which show how these tools can be used to foster open sensemaking communities by mapping knowledge, location and virtual interaction. The sensemaking process in online environments can be developed by connecting sequences of enactment, selection and retention (Weick 1979) via knowledge media tools. In enactment, learners actively construct meaning by rearranging and labelling raw data into equivocal data to be interpreted in their maps or synchronous conversations . In selection, learners identify meanings that can clarify equivocal data by overlaying their prior knowledge or past interpretations as templates to the current experience. Compedium, FM and MSG can be used to provide explanations of what is going on. In retention, the community stores the products (maps, Webconferences and messages) of successful sensemaking that learners may retrieve in the future.

In this pilot study, it is important to stress this work will be extended through quantitative and qualitative research. A Web survey with follow-up interviews will soon be conducted about the uses of these knowledge media tools in the OpenLearn project. Although there are significant number of members registered, it is not yet possible to see widespread of open sensemaking communities around OER. Previous surveys indicated that individuals come to OpenLearn primarily for accessing the free OERs. It is not surprising that they do not as a rule share knowledge objects — or indeed, engage in a lot of collaborative learning activities. In order to start their communities, t**hey need to find peers with similar interests and have** social and intellectual commitment to learn content and tools together. Disseminating strategies and ways to apply these tools to foster open sensemaking communities may engage OpenLearn users in collaborative learning.

CONCLUSION AND FUTURE RESEARCH

Knowledge media technologies mark a profound shift in developing products, creating new strategies for learning, and sharing knowledge. Learners move from simply following information, instructions and tasks to discussing them, making sense of them, reconstructing and sharing meanings collectively with anyone in the world with similar interests. OpenLearn indicates a new way to interact and construct knowledge collaboratively from individual learners to social groups (Aigrain, 2003) and from global networks to local communities (Anderson, 2007). It offers an environment to actively support individual learners, educators and self-organising communities through the integration of Compendium, FM and MSG. In order to enhance social learning, these knowledge media tools can be used to:

- Create awareness that the user is part of a community
- Build new learning objects, leaving them open for sharing, reuse and remixing
- Manage personal or group information by dragging and dropping in any document or Website (a form of 'visual e-portfolio');
- Manage knowledge and learning by charting questions, ideas, and arguments as they arise;
- Share learning pathway maps over resources; to work through revision question templates;
- Browse or construct knowledge maps associated with learning resources and literatures, or dialogue maps which add value to online meetings.
- Identify social roles and improve individual behaviour and social interactions in open sense making communities
- Build knowledge through social awareness

The number of knowledge media technologies' users has been rising in this first year and a half of OpenLearn Project. During this period, the OpenLearn project has engaged a critical mass of over more than 1,000,000 users, taking advantage of the OER to learn at their pace and time. Our future research focuses on how students and educators can use the knowledge media tools as open sensemaking tools to foster their social learning networks and contribute to the open learning resources movement by developing their learning materials and new pedagogical strategies. Open Educational Resources, knowledge media tools and open sensemaking communities are essential to promote open learning mainly if OpenLearners can take part in this movement as active participants by valuing their authorship.

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KEY TERMS AND DEFINITIONS

Knowledge Mapping: A technique for organising knowledge, which aims to facilitate the creation and communication of knowledge through graphical representations. Beyond the mere transfer of facts, knowledge mapping aims to further create or transfer insights, experiences, attitudes, values, interpretations, perspectives, understanding, and predictions by using various complementary visualisations.

Knowledge Media Technologies: Means tools to support the processes of generating, interpreting and sharing knowledge using several different media, as well as understanding how the use of different media shape these processes.

Open Educational Resources: Educational materials and resources offered freely and openly for anyone to use and under creative commons licenses, which allows users re-mix, improve and redistribute on the Web.

Open Learning: A learning method for the knowledge acquisition based on open educational resources, free technologies and online communities. Open learning aims to allow participants self-determined, independent and interest-guided learning. It has been also offering opportunities for collaborative study and social learning.

Open Sensemaking Communities: Refer to open and self-sustaining communities that construct knowledge together by interpreting, reconstruct their understanding together and literally "making of sense" from an array of environmental inputs.

Peer-to-Peer Networks: Typically used for connecting people via largely ad hoc connections. Such networks are useful for many purposes, such as social and open learning, sharing content files containing audio, video, data or anything in digital format and realtime data.

Social Learning: Refers to the acquisition of social competence that happens primarily in a social group, virtual learning environments or online communities. Social learning depends on group dynamics, people with similar interests and disposition for studying together.

Social Presence or Co-Presence: Terms used in virtual learning, which refer to the ability of learners to project their personal characteristics into the online community by presenting themselves as 'real people' through the media of communication: picture, profile and via the "sense" of being with others.

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 357-380, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.15
Using Notification Systems to Create Social Places for Online Learning

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ABSTRACT

Context-aware activity notification systems have potential to improve and support the social experience of online learning. The authors of this chapter have developed a context-aware activity notification system (CANS) that monitors online learning activities and represents relevant contextual information by providing notification and making the learning activity salient to other participants. The chapter describes previous efforts to develop and support online learning context awareness systems; it also defines the critical components and features of such a system. It is argued that notification systems can provide methods for using the context of activity to support members' understanding of the meaning of activity. When designed and implemented effectively, CANS can turn course management systems (CMS) into technologies of social interaction to support the social requirements of learning.

DOI: 10.4018/978-1-60566-368-5.ch016

INTRODUCTION

Online learning in its various forms plays an increasingly important role in how students learn, how faculties teach, and how higher education meets the needs of its constituents. However, while online learning plays a powerful role in broadening access within and beyond campus sites, there is a growing concern that it may be diminishing the quality of teaching and learning by forcing instructors and learners to view courses through the narrow lens afforded by contemporary software systems. Today's approach to online learning is encapsulated in course management systems (CMS) of which Blackboard, WebCT and Sakai represent most popular applications. The CMS provide fairly effective ways for instructors to give and control access to course information (syllabus, assignments, grades) and instructional resources. They also present some facilities for direct interaction through discussion boards and chat rooms. The CMS approach helps manage the course and related information but is limited in supporting the interaction, coordination and cooperation between students and instructors. The authors of this chapter have developed a Context-aware Activity Notification System (CANS) (Amelung, 2007; Laffey & Amelung, 2007) as a mechanism for improving social ability in online learning (Laffey, Lin, & Lin, 2006). CANS is a software system that monitors activity within an information system, represents relevant contextual information (such as where, when or under what conditions), and provides notification to other participants about the activity.

In traditional face-to-face courses instructors and students come to a physical place where they mutually act out the course activities. Coordination and cooperation are facilitated by cues and structures in the context: such as, a bell ringing to signify it is time to attend to the teacher, the clock on the wall providing a common marker for knowing how long an activity should last, or students passing completed work forward at the end of a class period. Seeing how others use these cues and structures also shapes interaction. However, in online learning the CMS is a black veil between the instructor and students and among the students. Faculty and students are limited in their knowledge about what is happening in the course to the "words" spoken. Students do not see other students working; nor for the most part do they see each other's products. Instructors do not see students working and can only influence them with words. Similarly, students do not see instructors working outside of the formal presentations and feedback prescribed by the instruction. Seeing that an instructor has read your discussion post or looked at the file you uploaded to share with the class may encourage participation and develop a sense of an interpersonal relationship with the instructor.

Evidence of high dropout rates in distance learning attests to the problems that students may have with this form of education. Chyung (2001) found that online learners who dropped out perceived that their online learning environment was not engaging, had low levels of confidence while learning at a distance, and had low satisfaction levels for the instructional processes used in the online learning environment. The incidental learning that happens through working together, the social navigation that happens through observing others, and the motivation to keep learning that happens because of a sense of shared social experience are possible in a traditional classroom because members see and experience activity in context, but in online learning these outcomes are greatly constrained. However, there is potential for new social interaction technologies to improve the social experience and social support of online learning. These same approaches and technologies that have potential for supporting the social nature of online learning may also be important to online collaborative work and leisure activity. The ability to turn an online space into a social place is a challenge to the design and implementation of all forms of online activity and interactivity. This chapter describes one such social interaction technology, context-aware activity notification systems. These systems have the potential to make the activity of other members salient and to enhance the social nature of learning in an online space, in this case a course. To the extent that these notifications are provided in ways that are meaningful to the social roles and interactive tasks of being in a course, then the members will experience the online environment as a social place for learning and activity.

BACKGROUND

The goal of transforming course management systems from information space to social place is in keeping with the recognition that education is a social activity and that information access and use has a social nature. In *The Social Life of Information*, Brown and Duguid (2000) summarized a growing recognition that information systems need to both support use in social contexts and represent the social nature of accessing and using information. For example, a tech support information system should be organized by the practices that people do which cause them to need tech support and include meta data about who has provided the information, how frequently it is used, and what other resources were used by the folks who used this one. In this way, the users do not simply have a static piece of information related to the problem they are solving; they can make attributions about the information, such as the likelihood of it being accurate or sufficient. Being able to make these attributions gives the information contextual meaning and helps the user have a sense of how that information fits into practices within a community, such as the importance and value of the information or perhaps peripheral status of the information. In this sense, having the relevant contextual information is seen as important or necessary for making decisions and solving problems effectively (Palumbo, 1990).

By having a goal of transforming CMS in to a social place, we mean that the online system becomes a medium that represents both the explicit and tacit information of social activity and that the forms and objects of the system communicate possibilities for action (Harrison & Dourish, 1996). This emphasis on creating "place" foreshadowed Web 2.0 by emphasizing the value of supporting social practices rather than simply enabling information access and exchange. As discussed earlier for face-to-face classes, the awareness of what others are doing is necessary for social practice. What others do and how they use the elements of their environments stimulate us to action, provide feedback to our own actions, and support social navigation. *Social navigation* refers to the phenomena of people using what other people do as a guide for what to do (Benford, Bowers, Fahlen, Greenhalgh, & Snowden 1995; Gutwin & Greenberg, 1996).

By *context aware*, we refer to how we use cues from our environment to make sense of the situation and decide what to do. In education many of these cues represent the social circumstances and include the physical and historical circumstances that may have a role in shaping activity. Early work on context awareness emphasized the need to design computer systems in ways that accounted for the social contexts of the environments in which they were being used (Moran, 1994): for example, how the computer activity fits into the broader scheme of activity in which the computer activity occurs, is but one of the processes that shapes the meaning of the computer activity for the participants. More recent work has shown the value and role of context awareness for ubiquitous and pervasive computing (Moran & Dourish, 2001; Kaptelinin & Czerwinski, 2007). The potential and new insights for context awareness for CMS is that there is social activity and a social context "within" the CMS, and that the appropriate use of notification systems can change the information spaces of CMS into social places for collaborative and social learning.

Carroll, Neale, Isenhour, Rosson, and McCrickard (2003) investigated the role of notification systems in supporting collaborative awareness in a virtual school context. Their study found that three types of awareness information contributed to the productivity of synchronous and asynchronous collaboration: social awareness ("who is around"), action awareness ("what is happening to objects"), and activity awareness ("how are things going on"). Unlike some types of notification systems that simply and straightforwardly provide information about events, Carroll and his collaborators found substantial complexity in maintaining awareness for the long-term activities of their educational site. They also found that in some cases the relevant information for maintaining context awareness can be provided as notes about discrete events while in other cases the notes should be snapshots that aggregate series of events. They conclude that to coordinate and effectively work in the online cooperative world of educational settings, users (teachers and students) need sets of tools for: (1) managing objects in the learning process, (2) knowing when someone does something to an object, and (3) keeping track of objects over a span of time and work practice. Their work suggests the need for notification systems that not only convey information, but also put that information into the context of work practices and social roles.

Yang (2006) and colleagues showed how matchmaking between learner and service ontologies enables interactive matchmaking in collaborative learning environments. Learner profiles consist of entities, such as student accessibility preferences, calendars, and locations. Service profiles consist of knowing such entities as who is online, how to get in touch with classmates, and how to find relevant course materials. The goal is to augment collaborative learning by providing the student user with information relevant to educational purposes, such as whether other authors of a collaborative work are online for discussion.

Our interest in context awareness emerged from our development and implementation of an online learning system back in the late 1990's. As we used and studied the system, we noticed that users (instructors and students) were using what we called activity information to navigate the system. Our online system had an "activity monitor" that displayed recent activity of others in the system on the home page. We noticed how we were drawn to using the monitor to click through to see what had been done rather than using the normal navigation tools of opening the library or discussion applications and then navigating to the target. It became clear that students were doing the same. However, as the semester marched on, the performance of our activity monitor slowed as it had to handle more and more activity. The architecture and mechanisms of the monitor needed to be reconsidered and redeveloped. Chris Amelung, a doctoral student at the time, took on the redevelopment for his dissertation work and the result was the first implementation of CANS (Amelung, 2005).

CANS has a vocabulary of activity and monitors those activity events in a CMS, such as when a discussion board item is read, a resource is uploaded or an announcement is posted. CANS also has a registry of preferences which it uses to distribute notifications. Instructors and students can create reporters to establish and manage notification. For example, an instructor could create a reporter for the time period of a course unit that would keep him abreast of how students are doing and if any are falling behind. Similarly students could create reporters for a work group to know when others in the group have contributed or reviewed work, thus facilitating coordination of activity and keeping a sense of group work even when members never see each other. Notifications are currently packaged as e-mail digests, widgets (small applications that stay resident on a computer desktop), or web pages within the CMS.

NOTIFICATION IN COURSE MANAGEMENT SYSTEMS

The above discussion shows that context in educational settings is quite complex, social, and important. A variety of notification and awareness services are potentially meaningful, but the constructs upon which researchers are building systems of awareness for collaborative and educational purposes are still in formation. This section will examine the components of notification systems and identify approaches to design for context awareness as well as issues in creating a sense of place associated with the various components. It should be noted that almost all CMS have some notification functionality tied to specific applications within the system with possible aggregation for notification, but the objective here is to identify a comprehensive framework that can apply to the full course experience and not simply augment a specific application.

Monitoring

The most straightforward way to monitor online activity is by recording all mouse clicks or keystrokes. This approach is sensible if there is no a priori schema for differences among these actions. However, in CMS almost all acts can be understood by application and function. For example, a specific mouse click in a discussion board can be recognized as opening a message for viewing or as starting a reply or new thread. Thus, similar to the ontology constructed by Yang (2006) or the vocabulary constructed by Amelung (2005), the monitor can create a specific set of events to monitor, based on a framework for what would be meaningful to members and impact behavior. In the case of CANS a listener was created and tuned to certain events and not others. The listener needs to record the event and appropriate context information which may include actor, time and application specific attributes, such as the name of the thread being read.

Building the ontology or vocabulary for the system is a substantial task of marrying the specific functionality of the CMS to a pedagogical schema for knowing what is relevant and important for teaching and learning behavior. It is also important to keep in mind that CMS's are growing and evolving systems that add and modify functionality over time. The monitoring mechanisms must adapt and be able to include new functionality as changes in the CMS dictate. CMS such as Sakai have numerous applications and an institution may choose to activate or disable some of this functionality. Because CANS systems are applied across a variety of institutions, they must be sensitive to the local implementation and accommodate new functionality as they become available. In all aspects of the development of monitoring mechanisms that are attuned to CMS functions and are adaptable to changing functions, a critical concern is that the monitoring process does not negatively impact the performance of the CMS.

Storage

Since almost all implementations of CMS are sensitive to system performance, how data are handled is a concern. One form of notification, streaming or tickertape type applications requires no substantial storage. The data is usually limited in scope and distributed as a stream to anyone who signs up for it. CMS usually require more complex forms of notification. As suggested by Carroll, there is a need to keep track of information over a span of time and for aggregation to answer complex questions, such as which students are behind on an expected activity during a particular unit of the course. The CANS system stores data on a secondary server to the CMS. This allows minimal impact on CMS performance, having data available for a variety of reporting functions and requests, and affording the opportunity to merge activity information across multiple online systems. However, for notification systems that seek to also enable dynamic interactivity with the notifications, such as comparing today's level of activity with that over the last three days, then hybrid storage forms may be required to accommodate both massive storage and quick retrieval within sets of data.

Processing

Processing refers to matching event information to requests for notifications. The simplest form of this is to program for all users to get the same information. Under some circumstances this may be reasonable, but in online learning there is considerable variety in user roles, how users want to work and the interdependency of information. Subsequently, customizing outputs to users and contexts seems necessary. In CANS administrators can establish what information will be monitored for their site, and instructors can establish what information within the set enabled by administrators will be monitored for their course. Users can then create reporters which allow one time requests for certain types of reports: such as, what was the activity level in my course for this past semester or subscriptions to information reports such as receiving an e-mail note each morning of the semester reporting on the activity of the previous day.

Representation

Representation has two considerations. First, what is the mechanism for delivering the notice? In many cases notification outside the CMS is desired or required. External notices can be provided via e-mail, external web pages, widgets or even phone calls. In some cases notice within the CMS is desired. Awareness information could be embedded within an application. For example, posts in a discussion board or files in a resource section can be labeled with frequency of reads. Additionally, within CMS awareness, information could be provided within a special application that allowed requests for custom reports of archived data as well as interaction with the data. For example an instructor may want to see when during the course of an assignment students actually used the resources made available to them, and then once the findings are available the instructor may want to sort by attributes of the data. The second consideration for representation is how the notice should be displayed. Figure 1 illustrates a text-based digest of information currently used in CANS. This form is effective for communicating both general information about the level of activity and detail about who did what. However, as the amount of information increases, the effectiveness and efficiency of this form decreases. Figure 2 shows a visual representation that provides a quick summary for a large amount of information but requires interactive capabilities for drilling down into the data for the user who wants more detail. Figure 3 uses social comparison for organizing the data and shows how the choice of representation impacts the meaning of the information. In this case users see how their activity level compares to the activity level of a high performer and to the class average.

We have discovered that an important issue in representation is identity. What identity does the notice represent? For example the representations can include names of the actors or not. Under some circumstances, having your name on a list that shows who has done the most activity can bring social pressure to motivate more activity. In teaching, this is a tool that an instructor can use to motivate students. However, students are likely to not want such a list and some may feel it is a violation of their privacy. Under some circumstances, university policies or government regulations may even be issues to consider. Additionally there is always the *law of unintended consequences* to

Figure 1. CANS e-mail notification

CANS notification digest for Thursday, December 7, 2006

History of the Internet
https://sakai.university.edu/portal/site/history_of_internet

Discussion
John Smith posted "When was the Internet invented?" 18:18:03
Robert Jones posted "What is Internet 2.0?" 15:50:10
Robert Jones posted "Re: When was the Internet invented?" 15:47:52
Susie Que posted "Re: When was the Internet invented?" 15:42:35
Susie Que posted "Re: What is Internet 2.0?" 15:37:03
Robert Jones posted "Re: When was the Internet invented?" 15:36:22

Resource
Robert Jones viewed "Orientation Activity" 18:13:05
John Smith created "Orientation Activity" 17:02:45
Robert Jones viewed "Welcome to the Class" 10:01:35
Susie Que viewed "Wecome to the Class" 09:35:22
John Smith created "Welcome to the Class" 09:34:29

Chat
Susie Que created 16:16:14
Robert Jones created 16:15:21

This automatic notification message was sent to users of the CANS Email Digest
To unsubscribe, send an email to request-cans@university.edu

Figure 2. Visualization for large group

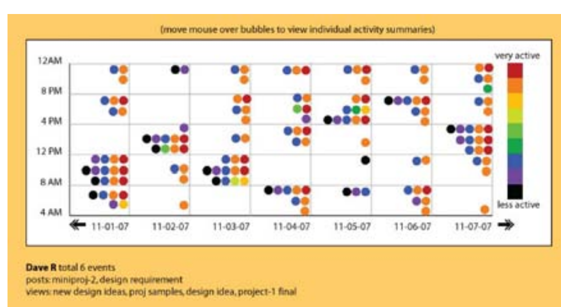
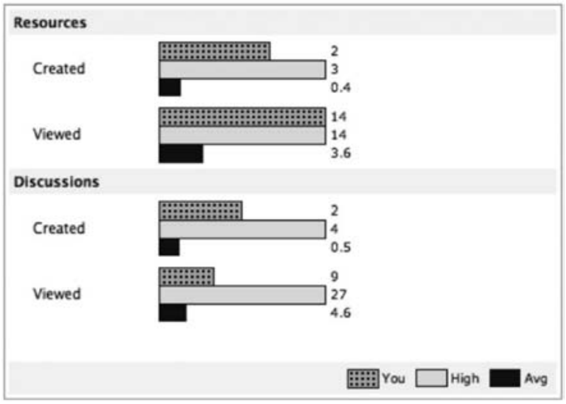


Figure 3. CANS social comparison digest



consider. An instructor may want to motivate students to further effort, but may engender activity that simply tries to cheat the notification system by opening items without reading them. Our best judgment is to provide a variety of ways to represent identity so that the circumstances of the institution and course and the pedagogical approaches of the instructor can determine the form taken. One approach as is illustrated in Figure 3 is to keep the members anonymous. Comparison information is provided but it preserves the privacy of the individual members. However, the form shown in Figure 3 requires an individual representation for each member, so the benefits of both comparison and privacy come at the cost of added design and processing. An alternative identity to basing notification on who has done what is to use system objects as the design center. For example, rather than pointing out who has read a discussion board message, the system can report that a particular message has been read 5 times. This approach may meet the need of supporting social navigation without risking privacy concerns, but may impact the social nature of the course differently than when the members are the design center for activity notification. As with many of the points discussed in this chapter, this is an issue for further research.

Management

Educational coursework and the participants in the coursework have great variety. No one size or form of notification will suit all types. For example, the type of notification system that fits a small enrollment graduate course being taught online is likely to be inappropriate for a large enrollment undergraduate on-campus course. The online graduate course may benefit from a high level of student-to-student awareness and personalization, but the same approach in the undergraduate class may be overwhelming with the amount and detail of information provided. Similarly, different institutions or instructors may wish to manage privacy concerns differently. For example, while in some cases knowing the name of who has read a discussion board post may benefit group interaction, in others it may be seen as a violation of one's privacy. Thus the capabilities of the system must be customizable by those who implement the system and then again by those who use the system.

CANS allows management in a tiered fashion. The CANS implementation for a site or multiple sites allows the course management administrator to set permissions for monitoring and notification functionality. Within this set of permissions an instructor or course manager can set permissions for how the course will work. These permissions then provide the functionality that members use to create reporters and notification representations. Figure 4 is a prototype for how permissions may be managed in the Sakai implementation of CANS. Within Sakai, members have roles that correspond to having access or having rights to maintain sites and collections. The system administrator can set the permissions that will be the default for the roles in each course. Instructors can reduce permissions within their courses but not add those restricted by the administrator. Items such as id.open prescribe whether a member in the role can see the personal identifier for the actor opening an object in Sakai. With this schema members could be given permis-

Figure 4. Setting monitoring and notification permissions in CANS for a Sakai implementation

sion to know who posted something but not who read it or vice versa.

FUTURE TRENDS

A few years ago the dominant experience of being online was accessing information or making transactions. Today, especially for youth, being online is a social experience. Taken from another perspective, social activity is increasingly mediated by technology and the Internet. We interact with colleagues, friends, family and absolute strangers through e-mail, chat rooms, shared documents, video conferencing, and 3D virtual environments. As we become socially networked via technology, we will also need forms of social information that fit these new environments and relationships.

Attending to the behavior of others and using that behavior to help shape our own behavior and serve as a basis for the types and levels of relationships we form with others is a natural part of human everyday experience. Context awareness and notification tools for online environments can facilitate the attention and sense making that happens rather intuitively in natural settings. But, how to make this happen in ways that resonate with us when we are online constitutes a design challenge and an area in need of further research. Our experience suggests that these tools are likely to come in many forms that are appropriate for the nature of the communities or relationships being formed in online spaces.

For example, online auctions such as eBay provide mechanisms to keep track of the status of your bid in an auction based on what others are doing. The designers of eBay recognized that what motivates a person to place a higher bid in a traditional auction is hearing another person make a bid higher than your last one. Similarly, the pace of bidding and other contextual factors influences bidders. Designing a user experience that makes these circumstances of one's auction activity salient in an online space has substantially impacted the use and ways of using eBay and other online transaction systems. The task then is to design context awareness and notification that are appropriate to the task, community, and individuals involved in online spaces.

One of the key challenges we see for our design efforts for context awareness in teaching and learning was foreshadowed by Carroll, Neale, Isenhour, Rosson, and McCrickard (2003) when they discussed the need to keep track of objects over time. Most events are not just moments in time. They have a past and a future as well as a present. When the stock market ticker shows the current price, it also shows the change from the last price. For most activity this sense of trajectory is also a key part of making sense of the information and being able to use the activity information to make choices about one's own behaviors. One way of addressing this need is to provide more and more data so that users can use what is relevant in their eyes. For example, the e-mail digest of Figure 1 can become more verbose about each event and show more events. However, this method rapidly runs into diminishing returns as the data fairly quickly overwhelm us and become noise. Visualization as in Figures 2 and 3 are part of the solution to making more information available and valuable.

Our experience suggests that there are two aspects of visualizing data in context awareness that have potential for making information more salient for users and their choices. The first is having visualizations that fit the context. In a sense we mean context aware representation. For example Figure 2 is a useful way of representing information for a large class but may be irrelevant to the needs of a smaller class. Our second key aspect is interactivity. We want the ability to ask questions of our data representations, such as sorting and filtering information. Similarly we want the ability to compare information. For example, an instructor may look at a display of yesterday's activity that shows 2 or 3 students with a very low level of activity. The instructor may want to then see what happened over the last week to see if the same pattern is evident.

The CANS project faces challenges of integrating activity information into the core teaching and learning activities of CMS. Current capabilities allow notification through e-mail digests. The next steps include embedding information into the CMS home pages and applications so that notifications can provide both peripheral awareness and be embedded in learning tasks. Embedding information into the CMS is of course a technical challenge that will require innovative solutions; but if we truly hope to move from information space to social place, the embedding will require that we understand how the activity information relates to teaching and learning practices. This requires a socio-technical solution for connecting a member to his or her group and points to the need for improved methods of designing systems. Similarly, institutions of higher education are concerned with regulations about releasing information about students, and students are concerned about maintaining a sense of privacy and security in their work. These issues require political-technical solutions for connecting members to their community.

While the future of notification systems promise ubiquity, rich media representations, integration across systems, and customization to improve meaning and salience, the future also demands technical solutions that fit social customs, motives and regulations. It is important to remember that just because information can be provided and may be useful does not mean it should be provided. The application of context awareness in the service of making information systems more social requires interdisciplinary thinking and research across social psychology, organizational development, learning technologies and computer science.

CONCLUSION

The preceding discussion has briefly presented a rationale and framework from prior work that shows the value of making online learning more social and the potential for using social interaction technologies, such as context-aware activity notification systems. The authors identified the components of such a system and highlighted some of the design and implementation complexities and issues. The chapter has also highlighted that while context awareness is a natural and necessary part of human activity and human learning, there is much work to be done to make it a powerful and integral part of course management systems.

Although making social information available, salient, and meaningful in online systems and for online learning seems a natural progression of system capabilities in a Web 2.0 and beyond world, little is known about how to do so in ways that provide the information as natural components of a social place for activity, optimize the beneficial effects on teaching and learning, and maintain comfort levels of institutions and individuals for privacy and security. Efforts such as the research and development underway for the CANS project are needed to identify the best fit of information to the social nature of online learning and to identify the best technical solutions for efficiency and useful features for processing, representation, and management of activity information. The challenge is clear, however, as the online lives of students outside of their courses become ever richer and more social with new interaction technologies. If the online experience of courses through CMS fail to keep up with the increasing sociality of being networked, online learning will miss its potential both as a medium for learning and as a transformation of society that can increase access to higher education.

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KEY TERMS AND DEFINITIONS

Context-Aware Activity Notification System (CANS): A software system that monitors activity within an information system and represents relevant contextual information, such as where or when or under what conditions, and provides notification to other participants about the activity.

Context Awareness: In a general sense, it means the salience of physical, social, historical or other circumstances that may have a role in shaping activity. The term has been appropriated within a movement toward ubiquitous computing (moving computing beyond the desktop and into the world of activity) to indicate awareness within the computing system of physical conditions outside the system, such as location or user attributes.

Course Management System (CMS): A software system that simplifies the tasks of managing course content and interaction to help teachers organize and facilitate instruction. Typically systems provide security and some process support for teacher and student work.

Online Learning: Multiple terms including e-learning, networked learning and cyber learning, as well as online learning, are used to refer to educational practice that takes place via networked computers. The general benefit is to allow learners to learn from any place (at a distance) and anytime (asynchronously).

Social Ability: A person's capacity to associate with fellows and to use the members, resources and tools of the social context to achieve something of value. Used to represent a sense of competence for social interaction in online environments

Social Navigation: A construct that represents being aware of what others are doing as a primary guide for one's own actions. Research on social navigation has shown that people move in an information space based on where other people are, what they have done, or what they have looked at.

Social Place: A construct used in human-computing interaction to refer to designing the information space to represent cues and markers for social practices.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 170-180, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 3.16
Social Aspects of Mobile Technologies on Web Tourism Trend

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ABSTRACT

This chapter analyzes how the development and use of mobile and Web technologies are changing the way to search information, to plan, to buy, and to travel. The new technologies are changing several aspects of our life, such as the way in which people work, buy, learn, travel, and how they relate to each other, and so on. The tourist sector certainly represents one of the most dynamic markets, able to capture innovations and opportunities provided by the Web, in such a way that gets to be an out-and-out model of e-business. Internet access now is not restricted to personal computer. In fact the use of mobile devices is becoming increasingly important. The chapter's goal is to analyze social implications of Web applications and mobile devices and how they are improving the attitude of the customers both the fruition of tourism services and to development of sustainable tourism.

DOI: 10.4018/978-1-60566-156-8.ch027

INTRODUCTION

The widespread use of Internet and Web technology in every aspect of our daily life has brought great change in the consumers habits in any field but mainly in the tourism sector. Every year, million of tourists approach to Internet in order to find tourist information: vacations, flights, guides, last minute, cruises, destinations and routes. This situation is changing the concept of tourism. In particular, tourism was defined by the World Tourism Organisation as "the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, holidays, business, health treatment, religion and other purposes".

A new concept of "intelligent tourism" is spreading, based on all those innovative technological solutions offered by Web that allows achieving information on cultural, artistic and other kinds of natural interest.

The Web imposes itself more and more as relevant reference and indispensable resource in the tourism sector both for customers and tourism companies, thanks to undisputed advantages such as:

- Speed for information exchange,
- Improvement of interaction among people located in different places,
- Improvement of information sharing, knowledge and services availability for all the users.

These above three aspects are very important because they are producing the markets globalisation and the spatial and of temporal boundaries break down. Moreover the information and knowledge production and sharing improves both quality development of social inclusion. Moreover, the success of the Web and mobile technologies in the tourism sector is given by very competitive prices, but also by the ability to differentiate the offer, by the improvement of possibility to reach the market niches and by proposing new services with a good usability degree. The user is not a passive subject and when s/he visits a business site s/he knows that s/he will not be able to find negative aspects of a choice. This has brought to the creation of virtual communities where users share their own travel experiences with other tourists and where the potential tourist consumer finds relevant information. The tourist seems in fact to prefer descriptions and testimonies of other people that have already visited that place.

In the next sections we introduce the passage from the old economy to the new economy in tourism sector, in particular we describe how the advent of e-commerce has marked the passage from traditional travel agencies to Internet. In succession we describe the different tools tourist used for Web and mobile and their social aspects. Finally we describe the new scenarios of tourism using the new technologies and how the mobile devices can develop the sustainable tourism, increasing both tourism demand and tourism supply.

FROM TRAVEL AGENCIES TO ONLINE TOURISM E-COMMERCE

The tourism initially involved an elite activity. In the last years it has beenbecoming a mass phenomenon shared by million of people all over the world, and it has been becoming one of most relevant economic sector of most countries. Data provided by World Tourism Council (1997), in fact talk of seven hundred million of arrivals of tourists all over the world. The tourism represents the 7% of the total occupied people and the 2% of global gross domestic product. It is a dynamic phenomenon, mutable and complex, it can be defined as a "social fact", it changes with transition of tendencies, of orientations, of necessities and needs of society.

In the past tourists had to go to the travel agencies, i.e. in the physicals commercial places where to plan and buy a travel. These agencies execute activities of reservation and selling of single tourism services or services packages confectioned by Tour Operators. This means that people, have to go to a physical place to use such services. The choice of the agency can be limited by the physical distance. Moreover services obtained depended by operators, by their personal skills and by their limited information.

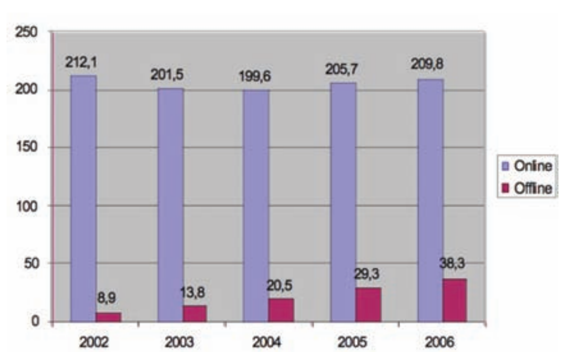
When tourists visit different locations guidebook can be very useful. The paper guidebooks more frequency used by tourist in the old economy. Even if they are still now the principal tool used by travellers, because it is easy to consult and information is well structured, they have a lot of limits. Information in tourist paper guidebooks can be outdated because items written many years before could not be updated, hotels and other tourist activities could be ceased (Schwabe, 2005). Actually the new Web and mobile technologies can provide more timely and complete information than paper guidebooks. In fact user can obtain an updated answer to her/his question, more than a paper guidebook and improve the information quality and consequently the travel quality.

Thanks to technology innovation of the last thirty years, not only users have obtained several advantages but also the tourist companies. The most innovative ones in fact, can actually be able to redefine their own organization structure and relationship with partners, optimising the operating costs and improving the quality of services.

Information and Communication Technologies (ICT) have allowed tourism companies to increase their efficiency and their market value. In fact ICT offer the chance to share data-bases with other organizations and other customers' information resources and services. Besides ICT allow to optimize other internal functions, either lowering costs and by expanding services to offer (Poon, 1993).

In latest three decades the tourism sector has been characterized by three technological phases: Computer Reservation System in the 70s, Global Distribution System in the 80s and Internet Revolution since the second half of 90s. (Buhalis, 1998). The first two have allowed to create, to develop and to globalize availability of services by travel agencies, who have exclusive access to automatic booking systems. The last phase has allowed the customer to perform bookings by themselves, redefining the entire business tourism system, modifying the same tourism fruition and improving the tourist experience. (Stipanuk, 1993).

Figure 1. Value of tourism European market: Comparison online offline (Reference: Mele, 2007)



The first change registered in tourism market according to these technological evolutions is a great increase of e-commerce. On-line tourism is one of the most meaningful achievement cases of the e-commerce in the world. The tourism products in fact have ideal characteristics for e-commerce, they can be represented in Web site utilizing potentiality of multimedia and hypertextual communication. Some studious, such as Werthner and Klein, assert in fact, that tourism is considered as one of more important field of application in the World Wide Web.

Some statistic data can help to understand the Internet impact on tourism sector. According to research of Eyefor Travel Research (2007), the tourism e-commerce field represents about the 30% of Web purchases. In 2005 the on-line booking represented the 33,6% of the worldwide tourism market, in 2006 the market quote of travel agencies is of 36,6%, it goes over with the 37,5% by on-line market. However the United States remains on the top of e-commerce for tourism services creating a gap with other countries.

In Figure 1 it is possible to see how the online market is very important and relevant respect to offline market. In Europe the off-line canal is traditionally the one preferred by consumers but it is loosing more and more market quote to vantage of on-line tourism, the online selling since 2002 to 2006 are increased constantly of 43% per annum. Data in the next table is showing the Internet relevance to improve relation between demand and supply operating on promotion and vending of tourism services to consumers. The trend of on-line tourism market (Figure 2), in fact,

Figure 2. Trend in European online travel market (Reference: Mele, 2007)

YEAR	TOURISM MARKET (SELLING)	ONLINE SELLING %	ONLINE % SELLING INCREASE
2002	221.036	4,04	77
2003	215.303	6,4	54
2004	220.094	9,3	48
2005	235.017	12,4	43
2006	247.16	15,5	30
2007	253.506	18,4	22
2008	259.723	21,1	17

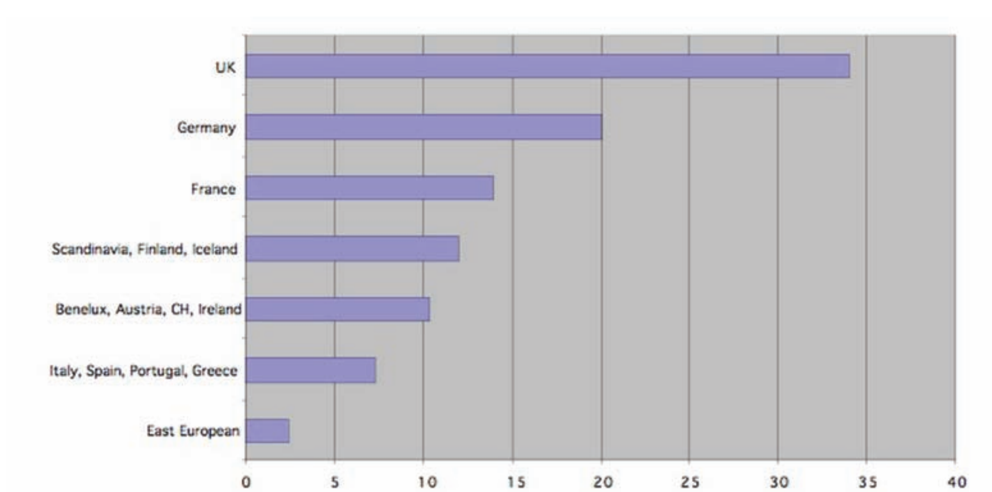
shows an yearly increase on-going ascent of 30% in 2006 respect to 2005. Among reasons of this increase there are different factors; first of all the raise of Internet utilise, then the coming of low cost companies and last the expansion of large band-width and of electronic credit card.

Analysing the European countries scenario of on-line travel market, United Kingdom is the best one with 34% thanks mainly to large presence of low-cost flight. In the second position there is Germany with 20% of on-line travel market. On the bottom of it there is the Southern Europe, the reason of this gap is also due to socio-cultural factors. The UK consumers in fact, are used to buy everything on the Web, thanks to wide presence of large band-width and frequent usage of electronic credit card. In Southern Europe there is distrust to buy in Internet especially by people more traditionalists. There is a cultural distaste to use credit card because they fear to be deceived. Moreover, there is a short access to the large band-width. It's noticeable that the Web diffusion depends on structural and cultural factors linked to countries' policies and economies. In Figure 3 is represented the European scenario of on-line travel market 2006.

Regarding the service typologies the purchases more frequent on the Web in the European online market are occupied by: Air travel 56%, following booking hotel and travel packages 16%, train 8%, car renting 3% and finally car ferry 1%. Increasing also others segments as holiday houses and cruises. Another data about European scenario is about selling channel: in 2006 the direct sellers accounted for 69% of online sale and intermediaries the 31%. This is way low-coast companies sells flight tickets directly to consumers by their sites, avoiding intermediaries actions.

The new trend of tourism is also influenced by duration and kind of holiday. In particular short trips, especially in the weekend, are growing. The Online Travel Agencies (OTA) have understood (exploited) this tendency and created the Dynamic Packaging, that allow travellers to organize the travel about their needs.

Figure 3. Geographic status of the European online travel market 2006 (Reference: Mele, 2007)



As reported by travel weekly (www.travelweekly.co.uk) "Dynamic Packaging is the practice of selling holiday components separately rather than in a single package." OTA have to create the Dynamic Packaging to compete with the prices and flexibility offered by online retailers. In general, we can affirm that tourist behaviour shows the wish to adapt vacation to his/her own needs, adopting consequently travel solutions.

The business travel are the most purchased on Internet due to several advantages: convenience, best prices, speed and availability of tools to search travel and services, possibility to change default packages for personal needs, possibility to choice the hotel franchising, the renting society, possibility to read on one page all options about flight and so on.

After to have analysed the transition from offline to online market tourism, in the next section we will describe the new online tools for Web and mobile that improve the quality of tourism services fruition.

NEW TOOLS FOR WEB AND MOBILE INTERACTION

New technologies in hand (at disposal) of tourists have deeply enhanced the tourism information quality. We know that Internet usage is still increasing dramatically, mainly through personal computers and mobile devices. So far, much of this growth has come from new Internet users. Another aspect to consider is that in the short to medium future, users will be accessing the Internet more frequently using a variety of other mobile devices for different purposes and some of these will be quite surprising.

Users can use advanced tools such as wikis, blog, personal spaces, mush-up and their own passage to mobile devices to organise their travels and relate to each others.

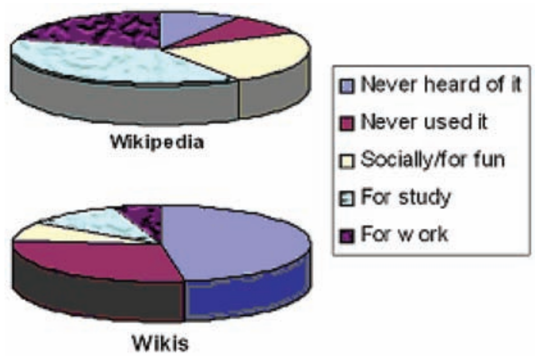
Wiki is a Web-based application that allows users to add content and also to edit content supporting collaborative writing, opening discussions, interaction and Web-authoring (Desitlets 2005). At the same time it also allows to delete every content of a new page or another already written by others, to restore an old version, to avoid risks of damages by hackers or non-collaborative members. Thanks to wiki everybody can write everything about a place, a city or a country, and can read everything, or improve what is already written.

Wiki is the most important example of collaborative online community, and applied to a tourism site give to every traveller the chance to share their own experience and to collaborate with other members, activeness and loyalty to the site is guaranteed. The Web site www.wikitravel.org represents an example of a collaborative and updated online global travel guide.

Another kind of Web application important for tourism is represented by personal pages (that can be part of a social network). Technically they are more simple than wikis, in fact they only represent a page created and modified by only its owner. But their technical ease allows users to concentrate on their own contents, and besides they can also build their own buddy network by adding other user's personal pages to their "friend list". Every page becomes in this way an host joint to a bigger network, and every user can discover new paths by starting from the page of a friend. A personal space usually includes blogs: diaries of text or pictures in chronological order (such as Blogspot), personal pages where the contents are more static and includes every kind of multimedia items (such as MySpace) or every other thematic social content (list of Web links, list of news, musical tastes, and so on).

It is easy to understand that Internet promotes the making of thematic sub-network such as travel blogs. In the blog every author talks about her/his own favourite topics, and it's easy to quote other's news or opinions in this way; for example, a list of travel blogs links each other to compose a thematic travel network. In fact, new Internet users do not

Figure 4. Different types of usage of wikis and wikipedia (Reference: White, 2007)



utilize only one tool at time. They use a wide set of Web tools: they write their daily thoughts on a blog, post their best pictures on a photo blog, collect their favourite Web sites on social bookmarks, and so on.. Every kind of new Web application has one special feature that makes the difference among the infinite offer of Internet; however there is the necessity to do not neglect the role of the "pass the word" in the choices of potential tourists. After the vacation, contacts are kept by email and messenger, different opinions are compared on forum, suggestions before leaving are read online, the best offers and discounts are accessible everywhere and every time. In fact, the advanced tools do not swap tools such as emails or forums.

It is important to have an idea about how Internet users relate to wikis and blogs. (Fig. 3-4). About wikis, David White (2007) reports in his research, that most users not know what they are, but when talking about Wikipedia (the famous free encyclopaedia created and continually updated by its users) he reports that nearly the 80% have used it for study, work or simply for fun (see fig. 3). Instead about blogs, users have been asked about their own blogs, other blogs and institutional blogs. What emerged is that only the 20% write their own blog and nearly the 75% read other's blog to work, to study but the most of them is for fun; but if we talk about blogs run by institutions or company the percentage decrease to 45%.

We can easily see that blogs are more used than wikis for fun because they are easier to use and similar to personal diaries then more appropriated to socialise, they are more used by young target under 18 then from 18 to 34 years, less by adult public. Instead Wiky are more complex and reference target is heterogeneous, they are in fact more used for study and for work.

The question is: what does make new Web tools really powerful? This question find its answer in the fact that one of the main goals of Web operator is actually of giving to every content a real meaning; this is the goal of the semantic Web (also called Web 2.0). The simple text of any content over the Internet can always be misconceived by search engine and other Web applications; the goal of semantic Web is giving every object (a picture, a paper, a clip and also papers) a real meaning, and this is possible by linking one or more keywords to that particular object. In this way it is possible for every user to find e.g. pictures of a "puma" without obtaining sport wear brand "Puma" images. The same text, can now have two or more meanings! That's the reason of users' vitality for social networks and new collaborative Web tools, which represent the first step to give texts, pictures, video clip or every other object a real meaning. Moreover, tagging is a new emerging way to categorise, share and search information based on meaning of keywords that facilitate tourists in their choices.

Once contents of every kind are meaningful, becomes important accessing these information and the Web tool that helps user to do that is: RSS (Really Simple Syndication). RSS is a new file format used to communicate information by following a syntax. It is used to spread news, new blog posts and new multimedia object, and it is read by software (Web based or not and also called "aggregator"). Thanks to RSS provided by almost every kind of site, users can read news about their favourite site without visiting every single site. Users can also rearrange their own subscribed feeds to obtain thematic news, by adding labels or tags, the same kind of keywords we talked about Web 2.0. It is easy to understand that the use of RSS allows everybody to improve their own information needs, besides it represents a tool available by every kind of technological device, from a desktop computer or even a small cell phone or a palmtop.

This technology has several positive impacts also for tourism supply. Many companies have adopted RSS feeds in their Web sites to keep a communication with their customers and enhance their search engines optimisation. It is difficult keep update offers and purposes because they are short life. This technology is characterized as a demand-pull rather than a supply push model. (Sigala, 2007). Furthermore, information flows about travels, special offers or more interesting places are real time provided on computer's monitor by a special software (Web-based or not) called "aggregator".

We have already talked about sites that offer the chance to upload pictures, tagging them with keywords (giving these pictures a real meaning), organizing them by creating albums or slideshows; but now the new scenario is about people, or travellers, who can take pictures with digital camera and/or smart phones and immediately send to these to online services. For travellers this means they can prove their skills and their travel experience; for all the other Internet users means to have the chance to find pictures from all over the world, especially when some special happening occurs. This new trend allows old media such as newspaper and television news to report flash news by showing images or video clip, taken from (respectively from Flickr or YouTube).

Another very important field on mobile devices applications for social activities (and consequently for tourists) are organizers and planning sites. They allow to set a calendar of events (to be shared with other users or customers) that can be subscribed, edited and shared. For example Google Calendar allows a hypothetic travel or service agency, to set a special calendar of event about new destinations, prices updates or happy-hour promotion. The users and customers can subscribe this particular calendar, and they can even receive on their own cellular phones SMS reminders that advice about expiring offers or new item added in that particular moment. These mobile technologies make available tools to plan the complete travel and the localization of the places of interest. Among these technologies we find the Internet mapping: the digital interactive maps that supply information on the hotel proximity, restaurants, stores, services, monuments, situated historians, archaeological sites. It is also possible to know the territory classified in different topics (sport, well-being, wine and food, information on traffic, weather forecast). The customer can generate personalized itineraries, search useful services and visualize more specific information on places of interest.

Newer technologies also allow mixing different applications (usually Web-based applications) to each other, to obtain a completely new one with new different functions. These are called "mash-ups", and they represent the newest scenarios in new Web technologies. The most famous mashups are those regarding Google; the Mountain View company in fact, has built a global system of satellite maps covering the whole world, and thanks to GPS devices, users can add new information such as pictures, short videos or information of any kind, exactly relating to a place on the map. In this way tourists can share information of any kind, in a very simple and funny way. Tourists can create their own path by describing with words, by drawing the route on a digital map, by adding digital pictures relating to a special point on the map. So they can create thematic itinerary and share for other tourist, just as every other digital tool we previously described.

Almost every Web 2.0 site involves the chance to interact with the site itself and other users too. The whole Web based application (and so, also online tourism market) is going towards Web 2.0 and so called Mobile2.0, this means that collaboration among users and participation is fundamental for the content site. The future of the e-commerce plays a very important role in the field of the collaboration and sharing: friendships, fellow traveller, socialization are carrying elements of each kind of travel. The main use of mobile devices by tourists is photo and video sharing whit others by personal blog or site.

Portable mp3 devices also give another chance for the tourists. In fact, they allow tourists to bring with them, in a very low weight, a large amount of video or audio files, such as thematic guides. Some operators have also started to provide their customers, with mp3 devices already filled by guides about the subject of the travel (a museum tour, a walk in the historical centre of a town, and so on).

The main reason that allows to tourism to benefit from the use of mobile technologies is the new services to travellers on the move. An example of this technology is the location – based Services.

The term *location-based services* (LBS) refers to information services that are accessible through a mobile handset and based on the current geographic location of the mobile device (Antikainen, H., 2006). The most commonly used is the satellite-based Global Positioning System (GPS). The conventional application areas of LBS include mapping, tracking, routing and logistic, electronic yellow pages, data collection and public safety (Beaulieu & Cooper 2001, Maguire 2001, Veijalainen et al. 2001, Zipf & Malaka 2001).

The primary functions of LBS for tourism are usually regarded as being the localization of persons, objects, and places, search of restaurants, shops, hotels, or points of interest in proximity and information about traveling conditions. Currently, mobile services facilitate the reservation of last-minute trips, rental cars, and hotels; and they provide information about changes and delays of flights and trains, offer guides on restaurants, events, and sightseeing opportunities at the destination (Berger *et al.* 2003, Eriksson 2002).

In the last years mobile devices such as mobile phones with embedded camera, palmtop, notebook and last but not the least GPS systems, have enhanced the use and the production of personal sites and blogs. In fact they allow everybody to post, not only reviews of a new bed & breakfast but also the pictures of the rooms or a short movie showing the landscape.

This brings to birth of the mobile virtual communities. In the next section will be analyse the social aspect of virtual communities.

SOCIAL ASPECTS OF VIRTUAL TRAVEL COMMUNITY

All these new tools that we have described are changing the way of people to interact and to communicate among them. In fact, the users can use these tools and meet new people in a virtual community that is a virtual place where people can speak (textual chat), can meet (video chat), can discuss about different matters (newsgroup and forum), can play and can exhibit themselves (personal home page and free Web).

The first sociological definition of "virtual community" was given from Rheingold in 1993 where he defined the virtual communities as: "…social aggregation that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form Webs of personal relationship in cyberspace. A virtual community is a group of people who may or may not meet one another face to face, and who exchange words and ideas through the mediation of computer bulletin boards and networks".

The first element of a virtual community is the absence of territorial boundaries due to its missing physical dimension; it changes for anyone the perspective to interact with other people according to their own needs and interests enhancing the real interaction and communication possibility. Whatever reason motivates a user to join network, sooner or later, s/he will need or curiosity to interact with other.

The advantage of Web is that it encourages humans to establish "weak" relationship with unknown people; this enables the communication also among persons that have different social characteristics. Moreover the on-line communication usually is uninhibited favouring sincerity in the discussion. The impact in the real social life is not decried but reinforced. The networks represent an aggregation form similar to society in which we live: weak and strong relationship, need comparison and exchange.

This form of social aggregation is not ground on politic, ethnic, linguistic, religious affiliation but volunteer cooperation between individuals that share the same interests, hobbies and goals.

It is easy to understand that Web community has become a term who involves any group of people who communicate online. These people can share different goals, interests or hedonistic pleasures. The term "online community" is also used to mean community network. One of the fields where all these concepts are successfully applied is the online travel community. This is a virtual community where backpackers, globetrotters, and other adventurers from all over the world to join together at different online platforms to exchange information, experiences, and plans in their favorite pursuit travel. In fact, in the travel and tourist industry, Internet encouraged more and more people to join into virtual communities to satisfy their needs, to fulfil their asking tips and suggestion before having a "real" travel.

Recently also travel organizations have realized the power of the new technologies for the core of their activity and the importance of virtual travel communities for their own marketing actions, by broadening their borders.

The travel and tourism virtual communities represent an ideal place without space and time, where people can meet experiences and different worlds. The travel is in its own nature delocalised in respect to point in which oneself is; for this reason it needs a strong communications and information exchange.

The travel experience is rich of emotional and relational contents that for this nature can be shared in the community. A person accesses a virtual community for different reasons: to search information and services, to contact different kind persons, to find partners to share experiences, amuse (oneself). All that is very compatible with tourism that is an "experience reality" and that needs of aggregation places.

Wang, Yu and Fesenmaier (2001) study, analysed needs of online tourists communities related to tourism organization marketing.

They have identified three main classes of needs: functional, social and psychological one. Functional needs include: transaction, information, entertainment, convenience and value. Social ones include: relationship, interactivity, trust, communication and escape among humans. Finally, psychological needs are include: identification, engagement, and sense of belonging, relatedness and creativity. In their work they pointed that since tourism is traditionally studied referring to geography location and space, it is noticeable that tourism-market organizations lack skill in how an online community can be used as a marketing tool. In fact, we cannot forget technological evolution about Internet since the last 15 years. They also predict growing of community concept as the Internet becomes more and more widespread with the new global economy. The network technology has allowed people to be more connected to each other.

People can obtain a lot benefits by joining themselves to the community depending on the different nature of communities and the various characteristics of community members (i.e. many people want to make efficient business transactions and interact with others people; many other rather want to have fun, meet fellow traveller and to express their own opinions; many other still want to develop a sense of belonging, to express their cultural and economic interests and establish relationships).

In 2004 Wang and Fesenmaier expanded their theory with a further study on modelling participation in an online travel community. In particular, were examined the relationship between members' needs and their level of participation in a virtual travel community. In their work they added to the user's needs identified in their previous papers, a hedonic need (including entertainment, enjoyment, amusement and fun). According to them, members participate in on line travel communities to satisfy four fundamental needs: functional needs, social needs, psychological needs and hedonic needs. In this latter work the authors also analyse the role of demographic differences in the behaving of tourism online consumer. It was hypothesized that users' needs in a VTC are not constant but can change with demographic characteristics such as gender, age, education and so on. For example female members usually attach more relevance to hedonic needs, while male members are more significant to membership duration. Other important results of their analysis are about differences according to different ages. For example they observed that groups who are aged 56 or more, versus young members are less attached to functional needs. The aged 20 or younger attribute greater importance than the older groups to social and psychological needs. Differences are also found between members with different education level and their respective needs.

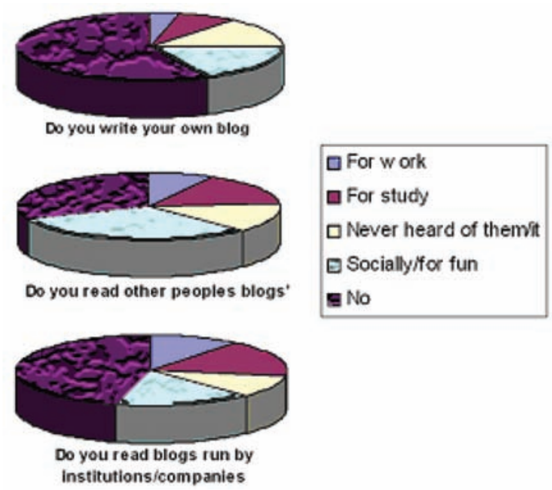
All virtual travel communities have some common features. Communities mostly provide a warm, trusting, and supportive atmosphere. When members share information, they do it with great care and responsibility. They rely on each other more than they do on outdated travel guidebooks or on second-hand and static information from conventional travel literature. They also have to attract a lot of members and give them benefits and satisfactions to be successful. This aspect is very important for tourists because they need to solve a wide range of problems, starting from the pre-visit, the post-visit and of course the travel itself. Before the new technological and digital tools, the traveller could only trust a travel agency operator, but now s/he can find help to choose her/his destination, to solve the most common problems during the planning of the travel (medical suggestions or documents needed), and obviously buying the cheapest flight rate; every question asked by the traveller finds an answer from a user already experienced in that way. But not only, virtual communities are also widely used by tourists to enhance their journey; in fact as seen before, mobile devices allow users to access the infinite Web without sitting in front of the computer at their home, and heavy guidebooks are now substituted by light mp3 reader or other mobile devices. Finally, tourism virtual communities are important after the travel itself, in fact if a traveller has made use of others' resources, it is now the time to contribute with his own by uploading pictures, writing a review or an itinerary, answering to other's questions, or by simply writing his personal blog to share with friends, but sooner or later someone will find his writing and they will find it useful.

Every user approach a community to search something for himself. This usually is the first step in a lot of other cases, and it is important because the user identifies himself with the community; after this first step her/his loyalty is guaranteed, and it is very easy that s/he will become also a content creator contributing to the growth of the community.

NEW SCENARIOS ABOUT TOURISM AND NEW TECHNOLOGIES

In the early section we analyse the technological and cultural changes trigged by Internet in the tourism fruition and the motivations that encourage the users to belong to a virtual community. All the different modalities used by tourists to plan, buy and do their own vacations, can be classified in off-line, on-line and mobile approach; we can represent them in a pyramid (fig. 5).

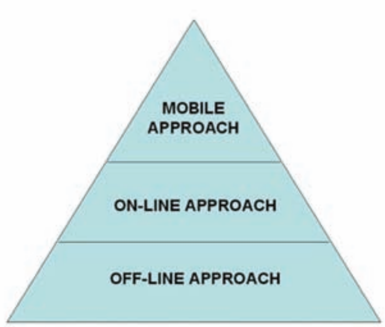
Figure 5. Different types of usage of blog (Reference: White, 2007)



The bottom of pyramid is occupied by off line approach; they firstly appeared in chronological order and are the most used by people because they are largely widespread and accessible to the large part of the tourists. Moving upward we find the online technologies more powerful but less widespread and less accessible to users. On the top of the pyramid there are very advanced technological tools (such as mobile devices) but fewer diffused than the other, in fact the pyramid tightens.

It's easy to imagine that in the future this pyramid will probably completely reversed. The traditional paper guidebooks will probably be

Figure 6. Tourism technology evolution



less utilized and available to tourists while online tools on advanced mobile devices will be largely accessible and commonly used.

The objects in the pyramid of Figure 6 are sorted to help us to simply keep in mind evolution of tourism tools. The basis of the pyramid contains "old economy tools" such as paper guidebook and travel agency. Indeed, they are the most common tools used by travellers, and are concrete objects based on an economy made of selling of products (the paper book itself) or services (travel agency). The next step is represented by the rising of the Web technology; in fact Internet has deeply changed everything, and of course economy too. Everything was concrete in the old economy has now become immaterial and "made of bits". People have Web pages to browse using a computer instead of such a book to read in several contexts. They contain forums, blogs, personal pages and wikis. Then, over the Web era, the top of the pyramid contains technological mobile devices. They are obviously the most advanced tools among the all previously described, and we also have to point that they have to be used jointly with the previous one. In fact, all Web applications will use mobile device so users will have access to information from anyplace and anytime.

In this way, what we have hypothesized about the future of this evolution (the previously described rotation bottom up) is already in progress, because mobile devices of every kind are used much more than other Web tools. This is causing tourism to benefit from use of mobile technologies about new services to travellers on the move.

Every new technology that we described, can be used to enhance tourist's experience, and they can also be a great chance for local administrations or local tourist promotion organizations to improve their tourism appeal and promotion between appropriate operators.

Mobile technologies give great opportunity to increase the value of territory and to develop sustainable tourism. The virtual community is in fact one of the most effective business models and provides great opportunities for both tourism organizations and customers. (Armstrong & Hagel, 1996).

Users more and more approach to mobile virtual communities to search new and unique contents, uncontaminated places, not commercials and far from mass-tourism. The new tools can allow promoting a sustainable tourism with respect of people and places.

People are searching more and more a high quality environment, but environmental resources on which tourism is based are limited. That's why it is very important to invest in a sustainable tourism. This kind of tourism is defined by the World Tourism Organisation as "tourism which meets the needs of the present tourists and host regions while protecting and enhancing opportunities for the future." A fundamental characteristic of sustainable tourism is that it creates safeguard and respect for the environment and local traditional culture. Moreover it recognizes the centrality of hospitality.

Tourism is a worldwide phenomenon that is very important for the socio-economic development of a lot of countries. It can contribute to the progress of a country but there is the risk it causes environmental degradation and loss of local cultural heritage.

Through digital mobile communication, the natural and cultural heritage that characterize the geographical area, could be communicated in an integrated way to tourist to guide him/her, also by geo-referenced information, toward their own fruition and knowledge with the other purpose, to contribute, through tourism, to the developing of minor tourist centres and their own neighbouring zones. The tourist communication can be made using a Personal Digital Assistant (PDA) or a Smart Phone and thanks to GPS system, it is so possible not only to localize the tourist on the territory, but also the cultural heritage of the location, by sending to users, on their wireless devices, the geo-referenced information with geographic route to reach that particular cultural heritage. The information sent to tourists can be personalized, integrated, complete, clear and multimedia: it can be communicated by text, but also map, video clip, 3D images and audio files.

Social innovations consist of tourists that can reach also places that are not necessarily promoted by tourist book guides or catalogues and they can be reached by messages concerning particular events at the particular time in that place.

Local administrations will have the opportunity, to promote and improve their own territory, to reinforce the sense of belonging and share memories and experiences. The promotion of these cultural aspects of a country will give the chance to have a positive impact on local economies and particularly on the tourism sector.

Promotion of a territory can produce added value to the economy of a place. To promote the local typical products, the local artisan products, to characterize thematic itineraries, fairs, that distinguish a country, is very important to improve the productivity, to create new job and new opportunities and to stimulate the development and innovation. The promotion of a territory is an important moment in the economic development of a community.

Thanks to the use of virtual communities, moreover, local people can enter in contact with people from all over the world and can attract tourists interested in culture and nature of their country.

The use of mobile technologies for sustainable tourism will remove the risk of cultural marginality or isolation because they represent an opportunity for cultural exchange and a possibility to integrate local knowledge into social, economic and cultural development. The importance of natural and cultural safeguarding is confirmed by increased demand of tourism, that joints attention for nature with the interest for intangible culture.

The intangible culture refers to a set of non-physical characteristics, practices, representations, expressions and skills that characterizes cultures, people and places.

The protection and safeguarding of cultural tradition: social practices, typical products, performing arts, rituals and festive events, language, knowledge and practices concerning landscape, has played an important role in the cultural politics and programmes at all levels (local, regional, national, European and international) in recent years. Furthermore people's interest to knowledge and their research of tourism that improves these aspects will remove the risk that a large number of cultural traditions can be lost.

Mobile technologies in the tourism sector represent an important opportunity to improve the vitality of a community. Its bring economic, environmental, image benefits. For example it can stimulate performing of traditional events and festivals that otherwise could be lost. Moreover mobile technologies can stimulate the development of the tourism in marginal regions and can reduce emigration from local areas. They can improve job and earning perspectives of the local population and improve the quality of the tourism activities and the related skills. Moreover they can improve the quality of life of the local population due to the creation of facilities and services, upgraded infrastructure, health and transport improvement, restaurants, food, and so on.

CONCLUSION

In this chapter we explained how mobile technologies have modified tourism sector and how they became important for the tourists themselves and for the global economy.

We have provided a description of the main social implications of the Web technologies earlier, and mobile later. We have analysed how users approach tourism Web applications; they firstly use (for example) Internet to buy low cost flight or to plan trips, later they start writing their blog, sharing their pictures or reviewing their trips, and in this way they start contributing to build a virtual community that will be used by other users for advices to buy their tickets, to plan or share their trip or just for fun. That's why all this, is now called social network.

The next step we have analysed is the coming of mobile devices that have revolutionized the way that tourists enjoyed their experiences. In fact, it is obvious that Internet, as described above, helps tourists before and after their trips, but now, thanks to mobile devices, the high potential of Internet is brought straight to their hands to facilitate the fruition of tourism. Mobile technologies can improve accessibility, information and service provisioning and safety for both tourists and tourism resorts.

Then we have hypothesized a pyramid representing on the bottom the old economy of a travel agency or a paper guidebook, in the centre all the new economy tools belonging to the Internet world, and on the top the mobile devices. Anyway analysing the future scenario we have also described the rotation of the pyramid because in the near future mobile devices will be more accessed and utilised than old economy tools, and what was rarely diffused in the past, will be commonly used.

Finally we focused on the issue of sustainable tourism a new way to travel respecting environment and traditions, by merging information sharing and new technological devices.

Thanks mobile devices several small places and particular events far from commercial routes can be promoted by local administrations and discovered by tourist, contributing both sustainable tourism and development of small place's economy.

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KEY TERMS

Mobile Interaction: The relation between users using mobile devices, it allows users to communicate and to access Web applications from any place.

Mobile Technologies: A parent category for mobile telephony, mobile computing, and miscellaneous portable electronic devices, systems, and networks.

Online Tourism: The purchases, the selling or the consultation about services tourism on Internet, both Web and mobile technologies.

Social Network: A community of people who share interests and activities, or who are interested in exploring the interests and activities of others. Each user create contents and uses others' contents.

Sustainable Tourism: A tourism which meets the needs of the present tourists and host regions while protecting and enhancing opportunities for the future.

Virtual Travel Community: A group of people that primarily interact via communication media such as forum, blog, chat room, instant messaging and that are interested in sharing information about tourism or travel.

Web Interaction: The relation between users and Web applications in order to search information about their own needs or for fun.

This work was previously published in Handbook of Research in Mobile Business: Technical, Methodological and Social Perspectives, Second Edition, edited by B. Unhelkar, pp. 293-303, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.17
Cityware:
Urban Computing to Bridge Online and Real-World Social Networks

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ABSTRACT

In this paper, we describe a platform that enables us to systematically study online social networks alongside their real-world counterparts. Our system, entitled Cityware, merges users' online social data, made available through Facebook, with mobility traces captured via Bluetooth scanning. Furthermore, our system enables users to contribute their own mobility traces, thus allowing users to form and participate in a community. In addition to describing Cityware's architecture, we discuss the type of data we are collecting, and the analyses our platform enables, as well as users' reactions and thoughts.

INTRODUCTION

The formalised study of network graphs is considered to have begun by Euler's famous solution to the Seven Bridges of Königsberg problem in 1736 (Biggs et al., 1986). In his solution, Euler represented the four landmasses and seven bridges of Königsberg, now Kaliningrad, as four nodes and seven links respectively. Thus, he was able to prove that no route crosses each bridge only once. Graph theory has greatly advanced every since, mostly focusing on mathematical proofs and theorems on graph topology, trees and cycles.

While graphs have been used to explore relationships between social entities for over a century, it was not until the 1950's that this became a systematic, and ultimately scientific process. Some of the first studies to engage in social network analysis are the kinship studies of Elizabeth Bott (Bott, 1957) and the urbanisation studies pioneered by Max Gluckman in Zambia (Gluckman & Aronoff, 1976). Similarly, Granovetter's work (1973) lay the foundations for the small world hypothesis, suggesting that everyone is within six degrees of separation, while Wellman's work gave some evidence of how large-scale social changes have affected the nature of personal communities and the support they provide (1979). Since then, social network analysis has moved from being a suggestive metaphor to becoming an analytic approach, with its own theories and research methods.

DOI: 10.4018/978-1-60566-152-0.ch013

In the 1970's, Freeman developed a multitude of metrics for analysing social and communication networks (e.g. 2004), thus boosting commercial interest in the area due to companies aiming to optimise their procedures and operations. In the last decade, the identification of mathematical principles such as the small-world and scaling phenomena (Barabasi & Albert, 1999; Watts & Strogatz, 1998), underpinning many natural and man-made systems, have sparked further interest in the study of networks.

The systems design community has also been interested in the study of social networks as well as online social networks. Typical research topics in the area include the effect of social engagement on behaviour (e.g. Millen & Patterson, 2002), the issue of identity and projected identity (Lee & Nass, 2003), as well as the design of socio-technical systems (Herrmann et al., 2004). The recent proliferation of online social networking system such as Facebook, Dodgeball and MySpace, has provided researchers with platforms for carrying out research into online social behaviour, and a journal devoted to this topic (http://www.elsevier.com/locate/socnet). In the Urban Computing domain, such studies have looked at the effect of social incentives and contextual information on the use of public transportation (Booher et al., 2007), the relationship between users' online profiles and their online behaviour (Lampe et al., 2007), the various trust issues that emerge from using such systems (Riegelsberber & Vasalou, 2007), how such systems can help strengthen neighbourhoods (Foth, 2006), and the development of systematic grounds to base our designs (Kostakos et al., 2006).

To make inferences from online behaviour datasets, researchers still have to collect data from the real world and relate it to the online data. Thus, while social networking websites make it easy to capture large amounts of data, researchers still need to employ interviews, focus groups, questionnaires, or any other method that enables them to relate online with real world data.

In this paper we describe the development of the Cityware platform, which aims to bridge the gap between online and physical social networks. It allows users and researchers to explore an amalgamation of online and physical social networks. The key strength of our platform is that it allows the collection of vast amounts of quantitative data, both from the online and real worlds, which is immediately linked, synchronised, and available for further analysis. Furthermore, our platform enables both end users and researchers to gain a better understanding of the relationship between online and urban social networks. Here we describe the architecture of our platform, the types of data it makes available to users and researchers, the typical user-oriented scenarios that are beginning to emerge, and our planned research-oriented scenarios.

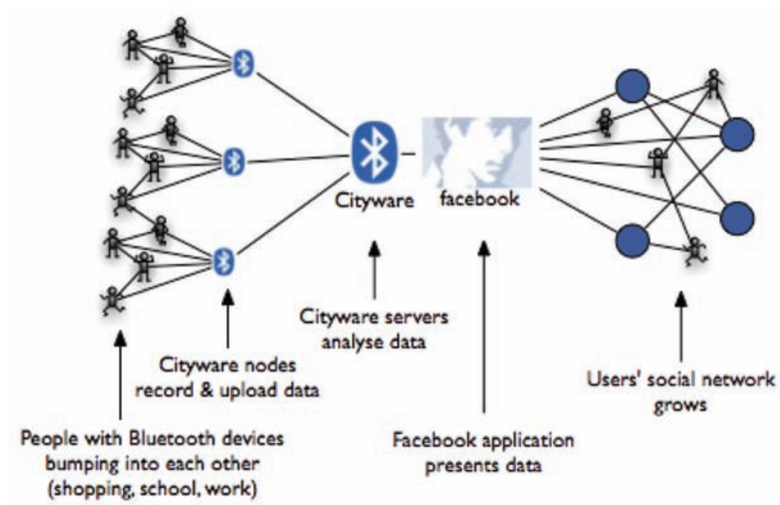
CITYWARE

Our platform is a massively distributed system, spanning both the online and physical worlds. Its architecture uniquely allows it to expand and contract in real time, while also enabling live data analysis. The main components of the platform are: people's Bluetooth-enabled devices, Cityware nodes, Cityware servers, Facebook servers, Facebook application. An overview of this architecture is shown in Figure 1.

Infrastructure

In many ways the most vital element of our platform is people's Bluetooth enabled mobile devices, such as mobile phones, PDAs or laptops. For any data to be collected, users must have switched on their Bluetooth devices, and set them to "discoverable" mode. From empirical observations, we know that, at least in certain cities in the UK, about 7.5% of observed pedestrians had Bluetooth switched on and set to discoverable (O'Neil et al., 2006). More crucially, however, Bluetooth

Figure 1. Overview of the cityware platform



matches very closely to people's movement, as it typically has a short range (10 or 100 meters).

The presence of discoverable Bluetooth devices is captured via the deployment of Cityware nodes. These nodes are computers that carry out constant scanning for the unique identifier of Bluetooth devices, thus recording details about the devices in the immediate vicinity. The advantage of this approach is that the users' mobile devices do not need to run any special software; simply enabling Bluetooth is adequate.

Initially, we deployed a small number of nodes as part of a pilot study. However, we also released open-source software that allows users to turn their Windows, Linux, and Mac OS X computers into nodes. Additionally, we modified the open-source application WirelessRope (Nicolai et al., 2005) to make it compatible with our platform, thus enabling mobile phones themselves to become Cityware nodes. So far, our platform has attracted nearly a thousand individuals for Europe, America, Asia and Australia who have set up their own nodes and are uploading data to our servers.

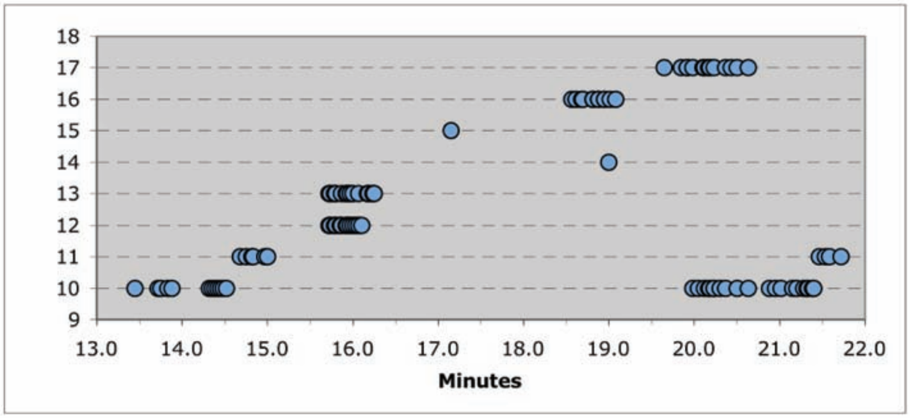
Analysis

The method we use to scan for Bluetooth devices generates discrete data about the presence of devices in the environment. A visualisation of our data, which we have termed timeline, can be seen in Figure 2. Here, the graph represent a specific scanning site, and each dot represents a discovery event, i.e. a point in time (x-axis) when the Bluetooth scanner picked up a specific device in the environment. By applying filters, we can see that, for example, device 16 was present in the environment between approximately 18.5 minutes and 19.5 minutes.

To study the patterns social interaction in our data, we first need to identify instances where two or more devices were present at the same place and the same time. For example, in Figure 2 we see that devices 12 and 13 encountered each other. Such encounters are effectively opportunities for networking, both social and wireless. We developed filters that analyse our data and give us instances of devices encountering each other at each Cityware node location. These results take the form of records:

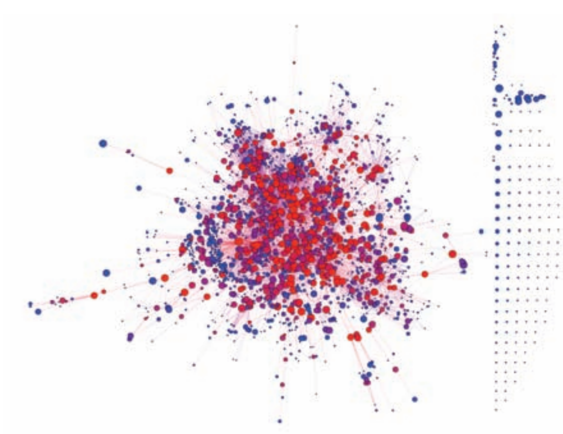
device1_id, device2_id, date, time, duration, Cityware node location

Figure 2. A timeline visualisation of our Bluetooth gatecounts. Each device is given its own timeline (dashed lines) and each discovery event is plotted as a circle on the timeline



At this stage in our analysis we have a long list of such records, describing which devices encountered each other and by which scanner. For example, in Figure 2 we see that devices 12 and 13 encountered each other at 15.5 minutes and were together for approximately 1 minute. This list of encounters is a textual representation of the patterns of encounters across the scanning locations. To further study the patterns and structure hidden within this list, we transform it into a social network graph as follows: assuming that each device from our dataset becomes a node in the social graph, then the list of encounters indicates which nodes are connected. Proceeding in this manner, we are able to generate a social graph per Cityware node, as well as a social graph containing data from all Cityware nodes.

Figure 3. A graph visualisation of the encounters that we recorded by one Cityware node



For illustration purposes, in Figure 3 we show the graph generated from one node's scan data, located inside a pub. In this graph, each observed Bluetooth device is represented as a node in the graph, and connected nodes indicate devices that encountered each other at some point. We note that the scanner (i.e. Cityware node) is not represented in this graph. By visual inspection we can verify that most devices are linked to the main core, whilst some devices are islands. The latter indicates cases where a device has never encountered any other device. Additionally, the size of nodes represents the total amount of time that a device has spend in this location, while the colour of the nodes (blue to red) indicates the betweenness of a node (from 0 to 1 respectively).

One of our initial observations is that due to the sheer number of nodes in the graphs, the visualisations themselves help little in analysing our data because of the visual clutter. However, by transforming our data into graph form, we are able to run a number of well-established analysis algorithms (e.g. centrality measures, community detection, etc.) using existing software such as

Pajek, Ucinet, and iGraph. It is the results of these analyses that we present users through our Facebook application.

User Interface

Our platform relies on the Facebook system (http://www.facebok.com) to present data to users. Facebook is an online social networking website, where people upload profiles and explicitly link themselves to others via annotated links (e.g. flatmate, work-mate, went to school together, etc.) Our user interface has been deeply integrated with the Facebook system itself, matching its look and feel and using a number of Facebook's capabilities, such as the ability to display a list of the user's established friends, and the ability to send notifications using the Facebook mechanisms. A screen-shot of our user interface is shown in Figure 4.

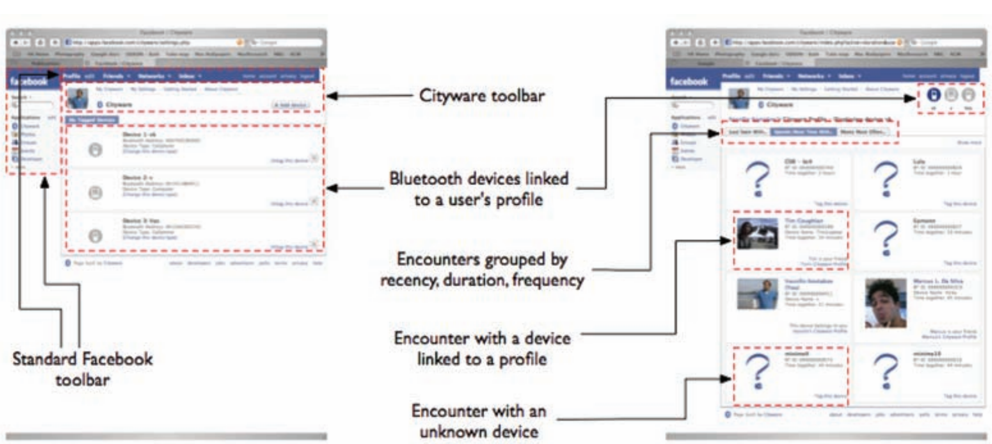
To use our system, users must have a Facebook account, and additionally they must decide to add the Cityware application to their Facebook profile. This can only be done by logging on to Facebook and ticking the Cityware application from the list of available applications. The next step in using our application is for users to register their devices. This involves typing into our system the Bluetooth identifier of their device. Users may associate more than one Bluetooth device with their Facebook profile.

Once this link has been established between Bluetooth data and a users' Facebook profile, our system is able to display the user's encounters, sorted either by recency, duration, or frequency. These encounters represent an ego-centric textual representation of the social network captured by the scanners (e.g. Figure 3). Given that each user represents a node in this graph, our Facebook application enables users to see their graph "neighbours", and their "neighbours neighbours" in three distinct ways: who they met most recently, who they spent most time with, and who they meet most frequently.

For each encounter, our system displays the Bluetooth name of the device (as recorded by the Cityware nodes). If a user recognises a device as belonging to someone they know, they are able to "tag" that device, thus linking it to a Facebook account and to that account's owner. If this happens, the owner of the newly tagged device is notified via Facebook's own built-in mechanisms.

The end result is that users are presented with a list of encounters that have taken place in the real world, with some of those encountered devices being linked to Facebook profiles. For such devices

Figure 4. Screen-shot of the Cityware user interface



our system can display the owner's picture as a well as link to that person's profile.

Our platform's distinctive characteristic is that it provides information that both end-users and researchers can use. This is because end-users see and explore data that is directly related to them (i.e. who they meet, and related statistics), while researchers have access to the "big picture", thus being able to explore and understand aggregated behaviour. Additionally, the self-registration and tagging mechanisms provide the crucial links between online and real-world networks. Effectively, our system enables users to annotate our dataset, thus enriching it with all the information that users make available via their Facebook profiles.

USER FEEDBACK

Facebook has its own built-in discussion board mechanisms to facilitate public and private conversations. These are accessible only by logging on to Facebook. These mechanisms have proven to be invaluable for collecting and categorising user feedback. A community has begun to form around our platform, with members using the discussion board to help other users with technical difficulties, suggesting design ideas, and holding debates. The size of this community is about 4000 people, including those who are running Cityware nodes and those who have added the Cityware application.

Prominent amongst the discussion topics is troubleshooting. Many users have posted questions in relation to the node software installation, making sure the software runs constantly, how bluetooth works, as well as how Cityware works. Fellow users have responded to these queries, suggesting that a peer-support community is being formed around Cityware.

While Cityware was officially released in late July 2007, it was not until mid-August that it became widely popular, mostly due to a web article published by the BBC (Waters, 2007). Since then, we have observed an interesting phenomenon amongst users of Cityware. As if feeling somehow "connected" or part of the same social group, our users are eager in establishing new nodes all over the world. A big part of the online discussion evolves around users proudly stating that they have established "yet another node", thus making their town or city part of Cityware. Additionally, users are eagerly posting messages requesting to know if there are any nodes near where they live. This enthusiasm is not different from what has been observed in other recent social phenomena (c.f. Rheingold, 2002).

A further interesting aspect of the feedback we have collected has to do with the context in which users are setting up nodes. While some users have reported establishing nodes in their homes, others have done so in their workplaces. Furthermore, some users of our application own shops and establishments (such as nighclubs) in which they have installed Cityware nodes. A feature that was heavily requested by users was the use of a map to visually locate Cityware nodes. Since we had not developed such functionality, we instructed users to mark their nodes on the public website http://www.wikimapia.com. This enables users all over the world to locate, as well as mark, Cityware nodes, post comments about them, or even attach pictures.

Privacy is a much-debated topic amongst users of Cityware. While some users are being critical of Cityware's privacy implications, many are supportive. We should note that the discussion board is not public, but rather only for self-selected users of Cityware, and as such may not be representative of the general public. Certain users have expressed concern about people being tracked about a city, and having their preferences and routines being inferred by a malicious party. In response, other users commented that anyone can at any time opt-out of Cityware by switching Bluetooth to "invisible". Additionally, it was highlighted that authorities can track people who simply own a mobile phone, regardless of Cityware. Furthermore, users commented that location is not being made available by our system, but nevertheless could be inferred. Another user noted that people are already disclosing information about themselves via their Facebook profile, and that Cityware can expose only that information. A good synopsis was offered by a user who wrote: "There are two groups of people here – one group that willingly submits to this, and the other group, that are totally opposed to any tracking/recording." This comment very well reflects our understanding of user's reactions towards our system. We feel that the reactions are mixed, with some feeling very positive and others very negative towards our systems, but no consensus having been reached at the moment.

RESEARCH POTENTIAL

While end users of Cityware are enjoying the functionality of our system, we are quite interested in the research possibilities that our platform has enabled. To quickly summarise some properties of our system as of late 2008: 3000 people have added Cityware to their Facebook profile, 450 nodes have been registered, while roughly 100,000 unique Bluetooth devices have been recorded by all Cityware nodes over a period of 4 months.

The dataset being collected by Cityware nodes is extremely rich as it describes people's visiting and encounter patterns across space and time. While comparable datasets, such as the Crawdad project (Crawdad, 2007), are available to the scientific community, it is only when such quantitative data can be linked to qualitative data that interesting research possibilities open up. While Cityware collects large amounts of quantitative data on people's movement and encounters, it also has access to the extremely rich qualitative data that people make available through their Facebook profiles.

Typically, Facebook users provide a wealth of information on their profile, including their demographics and preferences. More crucially, however, users annotate their relationships with people they know. Friends can be marked, for example, as colleagues, house-mates, or relatives. Additionally, a relationship can be annotated with dates, locations or organisations that may be relevant.

By combining the wealth of user-supplied qualitative data with the large amounts of quantitative data collected by Cityware nodes, we can begin to explore new research approaches to social metrics, system design, security, and even epidemiology. The logical next step for our research would be to compare people's movement and encounters with the qualitative data provided by users. For example, we can begin to empirically understand how people spend their time: with friends, family, or colleagues? Do these patterns change over time, seasons, or countries? Additionally, we want to explore if "friendship", "house-mate", or any other type of relationship systematically manifests the same Bluetooth patterns. This would lead the way for developing context-aware systems that can automatically classify a user's social network into friends, colleagues, etc.

Furthermore, such systems can make use of increased amounts of implicit, rather than explicit user input, which can enable them to adapt their behaviour appropriately and in certain cases understand and predict user needs. Hence, another area we are exploring related to making use of such data to make predictions about the users' behaviour, and accordingly adapt any software they may be using. At the moment we have distributed node software that runs on mobile phones. This software could act upon predictions about user behaviour and adapt any of the phone's functionality. Crucially, user feedback about the validity of predictions can easily be related back to our servers for further analysis.

A further research strategy is to explore the usefulness of our system for enhancing the security and privacy of users. We can conceptualise our dataset as a world map of relationships between users, annotated by users. This map may be used to inform users of security-related decisions they face (such as making a wireless payment) when entering a new context, such as a restaurant in a city they are visiting for the first time. Our servers can identify user comments about such a place, but more importantly assign weight to such comments based on the user's "social proximity" to the authors of these comment.

Finally, the data collected by Cityware is an invaluable source for understanding how mobility and encounter patterns can help in the diffusion of ideas, innovations and viruses (Kostakos et al., 2007). This could be achieved by exploring aggregate diffusion patterns over time, and exploring how different types of information (e.g 1Kb vs 1Mb) or viruses (biological / digital) would spread through the network of encounters and people. We note that this data is a result of public observation, hence we argue that the data can be readily used by the observers. Thus, local or national governments can use such data to develop and evaluate immunisation strategies to combat biological viruses. Similarly, telecoms operators and handset manufacturers can assess the effectiveness of their infrastructure against digital viruses that can spread via the Internet, GPRS, SMS/MMS, and Bluetooth.

CONCLUSION AND ONGOING WORK

In this paper we have described the Cityware platform, how users have reacted to it, and the potential for research strategies that it has enabled. As part of our ongoing work we are developing visualisations that both end users and researchers can utilise for better understanding the various patterns and properties of our dataset. We are also considering the development of software that will allow users to automatically geo-tag their data if they have a compatible GPS receiver. Furthermore, we are in the process of correlating aggregate encounter patterns with user-specified properties of those encounters. Finally we are examining the potential viral spread through users' encounters, and relating viral spread to user-specified qualitative data.

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KEY TERMS AND DEFINITIONS

Aggregate Patterns of [Behaviour/Encounter/Diffusion]: On an individual level each person behaves in distinct and unique ways, having specific objectives in mind. Yet, when analysed at an aggregate level, communities and cities exhibit non-random patterns that emerge from the combination of each distinct person's activities. Such patterns are known as aggregate patterns, and can describe how people encounter each other, or how information is diffused and spread through the community.

Bluetooth Identifier: A unique 12-digit hexadecimal number used by Bluetooth components for identification.

Massively Distributed System: A real-time computer system with large numbers of physical and logical components spanning great geographic distances.

Social Network: A structure that represents social relationships. The strutter typically consists of nodes and links between the nodes, and the nodes represent people while the links represent a specific type of relationship such as friendship, marriage, or financial relationship.

Urban Computing: A research field focused on the development of computer systems that are to be used in urban space. Typically, such systems entail fixed, mobile and embedded components.

This work was previously published in Handbook of Research on Urban Informatics: The Practice and Promise of the Real-Time City, edited by M. Foth, pp. 196-205, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 3.18
Improving the User Experience of a Mobile Photo Gallery by Supporting Social Interaction

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ABSTRACT

Today, image gallery applications on mobile devices tend to be stand-alone and offline. For people who want to share photos with others, many add-on tools have been developed to connect the gallery applications to Internet services to enable photo-sharing. The authors argue that photo-centric social interaction is best supported when the gallery application is fully integrated with an Internet service. In this case, no additional tools are needed and the user's image content is fully synchronized with the service. They designed and implemented a service-integrated mobile gallery application with a corresponding Internet service. Moreover, they conducted a field study with 10 participants to compare our application with a state-of-the-art gallery application combined with an add-on photo-sharing tool. Their application was preferred by most participants and it was especially appreciated because of the user experience. Above all, the results show that social activity increased amongst the participants while using our application.

INTRODUCTION

People are starting to use their mobile devices as their primary cameras because the quality of mobile cameras is improving (Nokia, 2008). As most mobile devices are also capable of connecting to the Internet, they can be used to publish photos to photo sharing Internet services and also browse and comment the photos hosted by those services. However, photo sharing on mobile devices still tends to be a laborious task and on that account users might not be able to share their mobile photos at all.

Nowadays, users are able to share their photos on their mobile devices by using applications that are essentially upload tools for certain Internet services (Kodak EasyShare Gallery, 2008; Meaning, 2008; Pictavision, 2008; Radar, 2008; Share Online, 2008; ShoZu, 2008; Yahoo! Go, 2008). The upload tool applications are usually add-ons to existing gallery applications offering functionalities for separately uploading and downloading images and their data. However, the image gallery application and the user's image collection are not fully integrated and synchronized with the service. Also, the upload tool applications require account creation and configuration of settings before they can be used. In the mobile context, users who might be on the move and have only a limited and possibly fragmented time to spend on a task is unable to use a mobile application that is hard and slow to use and configure. Furthermore, the upload tools might be developed by a different party than the developers of the gallery application or the corresponding Internet service. This might result in a mismatch between the available functions and features on the mobile gallery application and the Internet service. Thus, the upload tool applications cannot guarantee a deep integration of the gallery application and the service.

Mobile image gallery applications continue to be stand-alone and offline, even though many mobile devices today are connected to the Internet with a flat-fee, always-on network connection. The gallery applications have not yet utilized the opportunity of integrating directly with a corresponding Internet service and having user's images in sync with the service. If the gallery application was deeply integrated to the service, it would enable users to share images in real-time on the go in an easy and fun way. Users would not need to configure or separately synchronize their image collection when they want to communicate using images. Hence, we argue that as the overall user experience improves via the deep integration of a mobile gallery application and a corresponding Internet service, it also facilitates the social interaction among the users of the Internet service.

In this article, we introduce a mobile gallery application that aims at offering great user experience by being fully integrated to a corresponding Internet service. The application provides an easy and fun way for users to share and interact with photos in real-time. We tested the application in a field study of 1+1 weeks (a test period of 1 week for each application) by comparing it to a state-of-the-art mobile image gallery application combined with an Internet service upload tool. The goal was to investigate whether the social interaction is best encouraged when users are using a mobile service-integrated gallery application compared to state-of-the-art applications and tools existing on the market today.

RELATED RESEARCH

Mobile image sharing has been an important topic in the research literature. Many imaging application have been developed around the topic of mobile image management and sharing process, but we are not aware of any research on seamlessly integrating personal image management and photo sharing between a mobile device and a corresponding Internet service and how that would affect the user experience and social interaction. Instead, the previous research on mobile imaging applications can be divided into two groups: studies on the usage and management of personal images and studies on sharing images. The studies on personal images have revealed many ways to help users to organize and locate their photos (Ames & Naaman, 2007; Bentley et. al., 2006; Frohlich et. al., 2002; Gurrin et. al., 2005; Jacucci et. al., 2006; Naaman et. al., 2004; Wilhelm et. al., 2004). They have also shown how to enable image browsing (Harada et. al., 2004; Khella & Bederson, 2004; Pauty et. al., 2005; Wang et. al., 2003) or displaying (Liu et. al., 2003) in an effective way on a mobile device in terms of user's personal image collection. The research on mobile image sharing has been focusing on how to improve the image sharing process (Ahern et. al, 2007; Ahern et. al., 2005; Counts & Fellheimer, 2004; Sarvas et. al., 2005). The mGroup project (Jacucci et. al., 2006) studied the collective creation of mobile media in terms of instantaneous messaging, while the Zurfer project (Naaman et. al., 2008) concentrated on consuming and viewing shared mobile images.

However, earlier studies have emphasized the importance of ensuring that the basic features of a system for managing photos should be efficient, reliable, and well-designed (Ahern et. al., 2007; Cooper et. al., 2005; Cui et. al., 2007; Frohlich et. al., 2002; Kirk et al., 2006; Kuchinsky et al., 1999; Rodden & Wood, 2003; Shneiderman et. al, 2006). The user interface of a digital photo album demands more than using a file manager type of solution derived from a PC. Nonetheless, most of the earlier research has not been focusing on improving the user experience but to include "easy to use" functions on mobile devices, in other words, enhancing the usability. Users' emotional satisfaction should be a key part of enhancing the user experience of digital photo albums (Balabanovic et. al., 2000; Harada et. al., 2004; Jin et. al., 2004). Indeed, there are a couple of projects that considered user experience also an important aspect. In the Flipper project (Counts & Fellheimer, 2004), one of their design goals was to provide a minimal set of features, but maintain focus on photo content. In the Zurfer project (Naaman et. al., 2008) their design goals included enabling simple and easy access to the user's own photos and their contacts' photos. The design also aimed for intuitive and playful interaction with the content. Our focus was also to design a mobile application and photo sharing service in such a manner that the enjoyment aspects of use and the whole user experience were the first priorities.

Earlier studies in the human-computer interaction community have developed definitions and models for user experience that have incorporated such aspects as pleasure, beauty and hedonism (Forlizzi & Battarbee, 2004; Hassenzahl & Tractinsky, 2006; Jordan, 2000; Norman, 2004). Hassenzahl (2003) has presented a model that takes into account both pragmatic (individuals' behavioural goals) and hedonic (individuals' psychological well-being) attributes of a product. This model defines aspects of user experience such as the subjective nature of experience per se, perception of a product, and emotional responses to products in varying situations. Roto and Rautava (2008) built on the earlier studies on user experience definitions and defined user experience elements that take into consideration the brand promise of Nokia. They defined user experience elements to be utility, usability, social value and enjoyment, which can be used when evaluating user experience. We have taken these aspects into account in the user evaluations.

PHOTO SHARING APPLICATION

To create a mobile gallery application that would be fully integrated with a corresponding Internet service, we defined the requirements for the application and implemented a functional prototype of the system.

Requirements

The requirements for a mobile photo sharing application were derived from our user studies and evaluations of current mobile photo sharing applications (Vartiainen et. al., 2008). They were also in line with previous research (Naaman et. al., 2008):

1. An easy way to register to a photo-sharing Internet service
2. An automatic uploading and backing up images to the Internet service
3. An easy way to browse images from the user's own collection or other users' collection
4. An easy way to publish images
5. An easy way to add and modify titles and

descriptions of images
6. An easy way to add and view comments

To meet the first requirement of simplifying and facilitating the registration process, we investigated ways to minimize the registration effort. After several brainstorming sessions, the identification number of the device was decided to be used as an initial user name. Thus, a user account (including the user name and password) would be created to the service without any user input except from asking the permission to use network connection. Afterwards, the user would be notified of the successful registration. Typing text with a mobile device can be a laborious task, especially when some users may not use any dictionary, or if the task requires text entry without any typographical errors. That is why by removing the need for any input, we would lower the entry barrier for the user to start using the application. The user could easily change their user name into something more descriptive by using the Internet service from a PC later on.

The captured images would be transparently transferred without requiring any user interaction to fulfill the second requirement of backing up users' images. As a result, a user would have a feeling of having his image collection always present on the device and in the service. The application would not only be an offline gallery or a tool for uploading images to a online photo sharing service, but a fully integrated photo sharing application that is always in sync with the corresponding service.

To satisfy the third requirement of browsing images, the photo sharing application would have two modes: one for browsing local (user's own images) and another for online (published by others) images. When the user would start the application, a main menu would immediately indicate the two modes for local and online browsing. We wanted to minimize the amount of steps that would be required to show the latest image in both modes full-screen: The first selectable item in the main menu would be "Latest" in both modes. As the first item in the menu would be selected when the application was started, the user would be one click away from his latest image and two clicks away from the latest public image. After clicking on a menu item, the user would be taken to an image browsing view, where he could browse his/public images with the left and right arrow keys.

Finally, an image menu was defined to meet the fourth, fifth and sixth requirements of letting users to publish and add/view titles, descriptions and comments of images. This menu would be accessible when browsing the images and would show the options that were relevant for a particular image. The title, description and comments of an image would be in sync with the corresponding Internet service: Whenever the user decides to change a title or description or add a comment either on the mobile device or in the service, the changes would also appear in the other end. This would in turn improve the user's perception that the application was fully integrated to the service and the content appeared to be common in both ends.

Implementation

The photo sharing application was implemented on the Nokia N95 mobile device using the Symbian S60 platform. The device had a display with a resolution of 320x240 pixels and hardware graphics acceleration with OpenGL ES. The N95 device also worked in the High-Speed Downlink Packet Access (HSDPA) network, where the data transfer speed can be up to 3.6 Mbit/s.

Figure 1 shows a screenshot of the main menu of the application. The left side of the view displays all the options that were available in the current mode. On the top, the text "My Images" explains that the current menu relates to the local, user's own images. The arrow beside the text indicates that by pressing the right arrow key, the user moves to the other mode of the main menu used for accessing "Public Images", namely online

Figure 1. The main menu

photos published by other users of the service. The background image was the current image in the selected photo set. When the application was started, the last captured image was shown as the background image.

For local images, we decided to create screen-size thumbnails to make image browsing faster and decrease memory consumption. For online images, we used the Web service to fetch the latest images published by other users of the service and cache them to the device memory. The service would also send only screen-size thumbnails of the images to make the transfer fast and save network bandwidth. As our target device supported HSDPA and we had a cache implemented, fetching the online images could be done in real-time without any disturbing waiting periods.

The image browsing view is shown in Figure 2, which shows the image full-screen. The left and right arrow keys were used to browse to the next and previous image, respectively. Figure 3 shows the image menu that was used to show functions that were available for the selected image. The image menu was activated with a joystick press in the image browsing view. When the user selected to publish an image, modify the title or the description or add a comment, the changes were sent to the service automatically. The synchronization also worked the other way around: the service notified the mobile application of changes on the service-side. The update messages only contained textual data, not the image itself. The commenting view is shown in Figure 4. The commenting view was activated from the image menu. Comments were always up-to-date with the service.

Figure 2. The image browsing view

Figure 3. The image menu

The second part of the implementation was the Internet service that included a Web user interface that users could use to access the same information as with their mobile devices. The Web user interface also offered the same functionality as the mobile application: the user could view and publish his images, add and modify titles and descriptions of images, browse images published by other users, and view and add comments.

USER STUDY

We conducted a field study of 1+1 weeks to compare our service-integrated mobile gallery application with a state-of-the-art gallery application combined with an add-on tool for photo sharing. The study included two groups each containing five participants who used our application and the combination of the gallery application and the upload tool for seven days each. The focus of the study was on the overall user experience of implemented features and how that would affect the social activity within the group during the testing periods.

Application for Comparison

The state-of-the-art gallery application used for comparison was the default Gallery application in the Nokia N95 mobile device. The upload tool used with the Gallery application was a mobile Symbian S60 application developed for posting images from a mobile device to a photo sharing Internet service. It was available on the market and used with the Flickr service (2008) during the study. We will later refer to the combination of the Gallery application and the upload tool as the “Gallery application”.

Figure 4. The commenting view

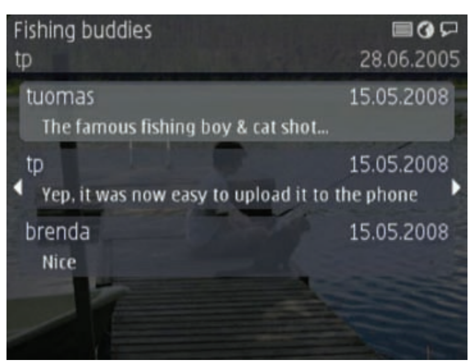


Figure 5. The upload tool used for the comparison

The upload tool was a stand-alone application that offered a way for user to browse, upload and publish images (Figure 5). The user could also view images published by others. The upload tool also included functionality to view and add titles, descriptions and comments. The commands were accessible via a tool bar that was visible when browsing images. Furthermore, the upload tool enabled publishing of images directly from the Gallery application by adding a command to the application.

The upload tool needed to be configured to use the Flickr Internet service for publishing images. If a user did not have an account to Flickr before starting to use the service, he needed to create the account by using a Web browser. After the configuration, the upload tool was ready to be taken into use. The user could set the upload tool to automatically poll Flickr at certain intervals and download the latest public images from his contacts and all other users of the service. The updating could also be done manually.

While our application was a prototype, the Gallery application was a more feature complete product. Especially, the tool was able to show a list for user's contacts in the Flickr service and the user could directly access the contacts' images using the list. Our application did not yet have this functionality implemented. The participants were asked to ignore the features (especially the feature for having contacts in the service) that were available in the upload tool and Flickr but not in our prototype application. However, this did not always happen as seen in the results of the user study.

Participants

We used two groups in the field study both including five participants that were friends with each other and daily in contact. The target was to follow social interaction in a group of friends who all use the same mobile application and corresponding photo sharing Internet service. The participants were students from university ages ranging 19-25 years. Two of the participants were female and eight of them were male. We decided to recruit students as they belong to the target group of social Internet services and are already actively using such services.

The participants did not have technical background, but some had interest towards technology and considerable IT skills. Seven of the participants described themselves as PC power users while the rest were basic users. Half of the participants had a smart phone, the other half a basic phone. Nine participants owned a digital camera, and five used their phone also as a camera. None of the participants were users of the upload tool application used for comparison nor the Flickr Web service, but they mainly used Facebook (2008) and e-mail to share images.

The participants were paid a small reward after the test period and they did not have to pay the data costs during the test period. We did not reveal the origin of either application during the study.

Procedure

Group 1 used the Gallery application first and switched to our mobile photo sharing application after seven days. Group 2 used the applications in the opposite order. We chose to conduct the field study in this way to ensure that the testing order of the applications did not affect the results. The participants were not given instructions on how to use the applications, because we wanted to simulate the situation where real users take a mobile photo sharing application into use for the first time. The participants were given Nokia N95 devices, which had both applications pre-installed.

We sent one or two tasks to the participants by text message every morning. Together with the message, we sent a multiple-choice question, which they had to answer before the next morning. The questions formed a set to evaluate the usability aspects of the applications. Below, you can find an example of a task:

Discuss about images and add comments to images that other users of the service have published.

How easy was it to comment images on a mobile device? 1=Very hard .. 5=Very easy

We selected 6 goal-oriented tasks for each period. The tasks included basic use cases for a photo sharing application: Registration, uploading an image to the service, publishing images, browsing published images, commenting and replying to comments. The tasks were the same for both periods.

In addition to the daily task feedback, the users were asked to keep a diary about their experiences with the applications during the test period. This was to gather their insights during the whole test period as well as experiences about their own use cases and challenges. We also logged data on the service-side including the number of published images and comments made by a user to measure the social activity within the participant groups.

After testing each application, we asked the participants to fill out a Web questionnaire including closed and open questions about the application. The Web questionnaire included three parts: In the first section, we asked rating questions about the general use; in the second section, we had rating questions about other aspects of user experience than usability; utility, social value and enjoyment (Roto & Rautava, 2008); and the third section included open questions, where we asked the participants to list three best and worst things in the application and improvement ideas.

After both periods, we asked the participants to choose which application they preferred to use for photo sharing in the future. We also organized a 2-hour focus group session separately with each of the two groups to discuss about their experiences during the testing periods.

RESULTS AND DISCUSSION

As described in the previous section, we collected various types of feedback from the study participants. In the following sections, we discuss the results related to the user experience and social activity. To analyze the statistical differences between the means of the ratings, we used a two-tailed T-test, with alpha = 0.05.

Preference

After using both applications for 7 days each, we asked the participants to evaluate which application they would prefer to use in the future to publish images with their mobile devices. We used a 7-point scale, 3 meaning strong preference for either application and 0 meaning no preference. 7 out of 10 participants preferred our application very strongly and 8 participants in

Figure 6. The preference of the application

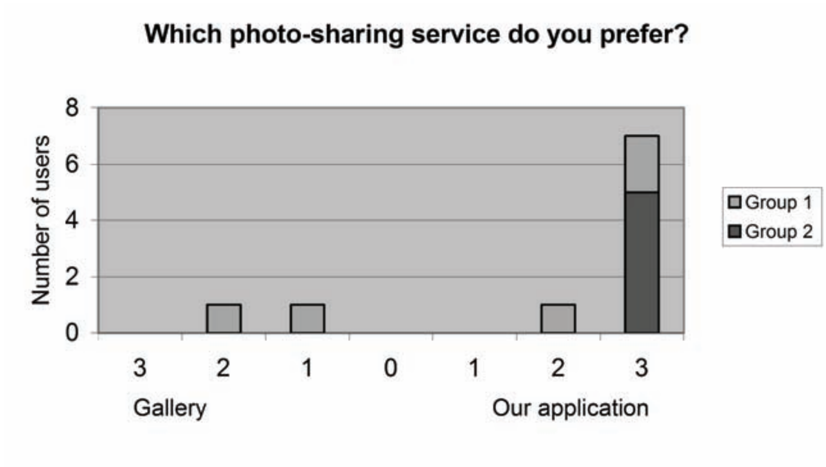
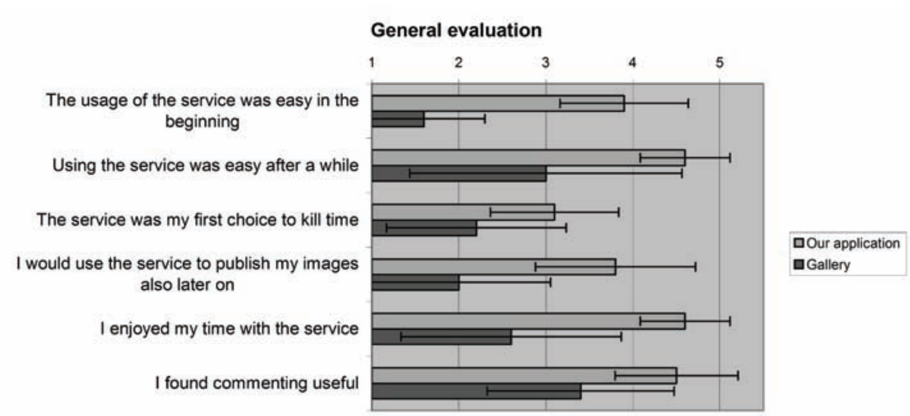


Figure 7. The overall evaluation with standard deviation



total (Figure 6).

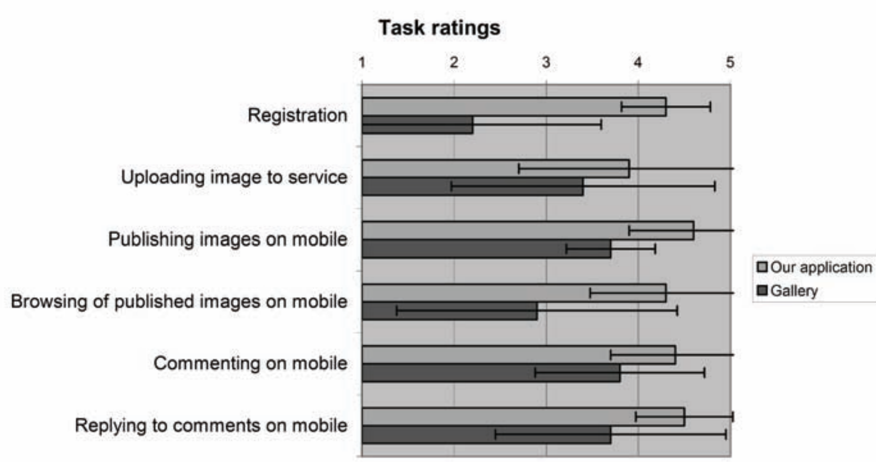
All users who first used our application (Group 2) clearly preferred it, whereas the preference distribution of the group, which started with the Gallery application (Group 1), varied more. The reason is that the Gallery application had a feature for adding contacts to a list, and the participants could easily check the latest images from their contacts. Our application did not have this feature yet implemented as it was still a prototype. The participants, who used the Gallery application first, had used this feature right from the start and missed it in our application. One participant commented that he chose the Gallery application because the lack of this feature in our application but otherwise he would have preferred our application.

Overall Evaluation

The results of the overall evaluations are shown in Figure 7. We used a 5-point Likert scale, 1 meaning that a user disagrees with the statement and 5 that he or she agrees. The questions aim at evaluating the overall experience of the applications.

The results show that our application was preferred in all questions. Especially, the start

Figure 8. The results of the task ratings with standard deviation



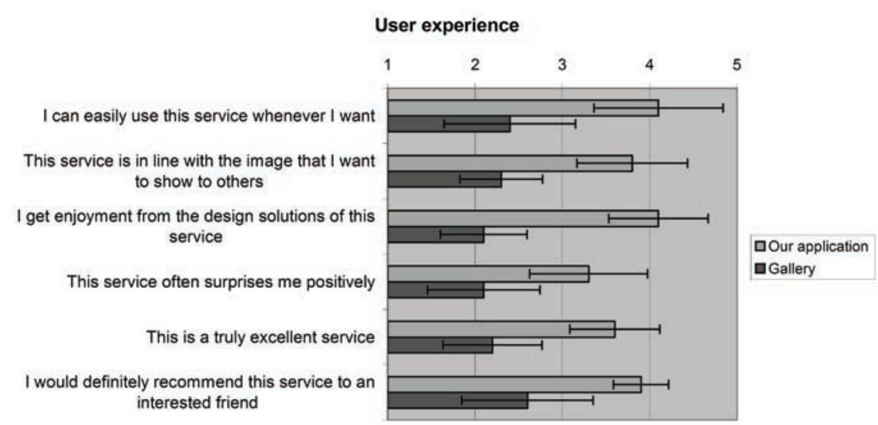
of use was significantly easier in our application (p=0.00001): The automatic registration was very easy and the instructions were helpful. In regard to the Gallery application, the participants commented that the registration to Flickr was too laborious to do on a mobile device. Most of the participants spent 1-2 hours to complete the registration on their mobile devices.

Compared to the Gallery application our application also scored significantly better in the questions "Using the service was easy after a while" (p=0.011), "I would use the service to publish images also later on" (p=0.0005), and "I enjoyed my time with the service" (p=0.0003). As the participants enjoyed their time with our application, they would gladly continue using it also in the future. The participants commented that they were pleased with the fast uploading of images, although it surprised some of them that all images were transferred to the service and not only the ones that they will publish. Image browsing, both with own and online images, felt very fast and commenting also proved to be more useful in our application as indicated by the significant difference in the score to the question "I found commenting useful" (p=0.001).

Although the Gallery application was very hard to configure in the beginning, the basic usage afterwards was quite simple and easy. However, as the image collection was not in sync in between the Gallery application and Flickr, the participants commented that they needed to manually upload all the images that they were going to publish. In addition, when they wanted to check the latest photos that other users had published, the online image collection was not always up-to-date since it is dependent on when the automatic update was done. If the automatic update was done only occasionally or not on at all, the participants needed to manually update the online image collection. The manual update sometimes took too long for the participants to actually view the latest images if one had only a couple of minutes when, for example, waiting for a bus. This irritated the participants and lowered the scores of the Gallery application in the overall evaluation. The same applies also for commenting. Even though the comments were easily accessible, the hassle with updating the content lowered the usefulness of commenting.

The question "The service was my first choice to kill time" indicates that photo sharing is still not the main use case for the participants to kill time. This is quite natural as the participants commented that they were not normally using such services with their mobile devices. Still,

Figure 9. The results of the user experience evaluation with standard deviation



our application scored significantly better in this question as well (p=0.029).

Usability Evaluation

After executing one of the daily tasks, the participants gave their ratings about how easy it was to complete the task indicating the usability factors related to the task. The results of the task ratings are shown in Figure 8. A sample rating question was presented in the Procedure chapter.

Our application scored significantly better in two tasks: "Registration" (p=0.002) and "Browsing of published images on phone" (p=0.039). As explained in the previous chapter, the registration in our application was simple and completed with one click while in the Gallery application, the registration process was complex. The participants highly appreciated the easiness of our solution and rated it high. The browsing of published imaged on the phone scored well in our application because the online image collection was always up-to-date when the user accessed it. In the Gallery application, the user needed to check, if the collection was recently updated. In the worst case, he needed to do the updating manually and wait for several minutes to see the latest online images.

Also, the task "Publishing images on mobile" (p=0.004) scored clearly better in our application as the image collection was always in sync between the mobile application and the service. There was no need for separately uploading an image before it could be published but the user could just publish it immediately. However, some participants had problems with uploading due to network problems, which in turn lowered the score for the task "Uploading image to service" (p=0.244, not significant).

On the contrary, the Gallery application did not offer any information whether the image was already uploaded to the service. Many times the sending was interrupted and had to be reinitiated, as there was no automatic resending. Furthermore, the participants commented that the uploading was quite easy but irritatingly slow. The participants needed to update every section manually if they wanted to get up-to-date information. In addition, comments were not always up-to-date as the updating occurred at certain intervals or only manually. This resulted in the participants adding comments to a discussion, which was not up-to-date, and the comments ended up being in a "zigzag" order in the discussion. In our application, the participants felt that they could trust that the discussion was always up-to-date with the service, and they could immediately reply to a comment. However, our application had limitations regarding the commenting view: It was sometimes slow to view comments and there was not any notification about new comments. This affected the scores for "Commenting on mobile" (p=0.140, not significant) and "Replying to comments on mobile" (p=0.137, not significant).

User Experience Evaluation

The results of the user experience evaluation are shown in Figure 9, where the ratings evaluated the social, utility, and enjoyment aspects of user experience. The results show that our application scored significantly better in 5 out of 6 questions. Even though our application also scored better in the task ratings measuring the usability of the main features, a clearer difference is shown in the ratings and participants' comments related to user experience.

Particularly, the easiness of use ("I can easily use this service whenever I want", p=0.016) and the design solutions of our application ("I get enjoyment from the design solutions of this service", p=0.0004) attracted the participants as clearly indicated by the results. The participants listed the ease of use and simplicity as one of the key design solutions of our application. They would rather have less well-designed features than many that are hard to use. The participants enjoyed the use so much that they would even recommend it to an interested friend ("I would definitely recommend this service to an interested friend", p=0.018). This seems to be an important aspect in social Internet services as the participants commented that it is important to have their friends using the service.

Furthermore, the participants considered our application and service to be rather excellent ("This is a truly excellent service", p=0.013) and support the image that they want to show to the others ("This service is in line with the image that I want to show to others", p=0.003). The participants explained that they highly appreciated the visual looks of our application and they described it as "stylish", "modern" and "beautiful". Our application also managed to surprise the participants positively from time to time ("This service often surprises me positively") and they commented that our application was fun to use but the difference was not significant in this question (p=0.066).

On the contrary, the Gallery application did not score well in these questions: Although it was quite simple and usable after a while, it did not manage to attract the participants or get them excited. The participants commented that it had unnecessary features and the essential functions were sometimes cumbersome and slow to use. They had problems of figuring out how the Gallery application works as a whole and what was needed to be done to carry out a task. The participants wanted a mobile application to be fast and smooth to use, as they might not have many minutes to accomplish a task on the go.

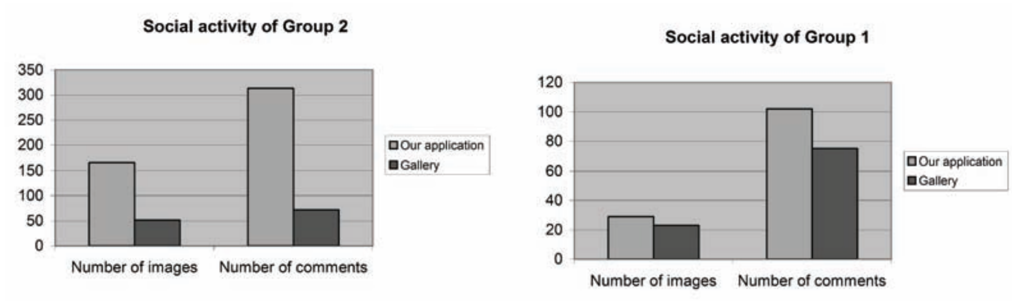
The user experience evaluation also explains why our application was strongly preferred by the participants compared to the Gallery application, which was not evident in the general or usability evaluation. The participants took pleasure in using our application even though they also got things done with the Gallery application. Our application enabled the participants to enjoyably interact with each other in real-time on the go, while the Gallery application still required the participants to take care of many tasks (e.g. uploading an image, syncing the image data) before they could concentrate on the actual communication.

Social Activity

Lastly, the results of the social activity within the participant groups are shown in Figure 10. The figure shows the number of published images during the test periods. It also indicates the number of comments that the participants added to the images. The number includes new comments and replies to existing comments.

The results reveal that both of the groups were more active when using our application. Group 1 which switched from the Gallery application to

Figure 10. The results of the social activity



our application published 26% more images when using our application. Also, the group added more comments to images when using our application: the number of comments increased 36%. The figures for Group 2 are even more convincing: Their activity when using our application for publishing images was 325% higher than when they used the Gallery application. Group 2 also added 420% more comments when using our application.

The activity figures show that the groups had different dynamics: Group 2 was clearly more socially active than Group 1. However, the results show that the activity was higher within both groups while using our application. In addition, the social activity was not dependent on the order in which participants used the applications and services. This is an interesting aspect as usually people might first become very enthusiastic about a new service or application but the excitement subsides over time. In this study, the usage of a photo sharing service on a mobile device was a relatively new method for the participants, which means that they were excited about it during the first period. Still, Group 1 increased their activity after switching from the Gallery application to our application.

CONCLUSION

In this article, we introduced a mobile photo sharing application that is fully integrated to a corresponding Internet service; thus, offering an easy and fun way to share and interact with images. In particular, we put special attention on making the user experience of the implemented features as positive as possible. The research goal was to find out whether social interaction is best nourished when users are using a gallery application that is deeply integrated to the Internet service compared to a solution existing on the market today, which uses an add-on tool to enable photo-sharing.

To evaluate our application, we conducted a field study with 10 participants to compare a state-of-the-art gallery application with an Internet service upload tool to our solution. The results of the study show that 8 out of 10 participants preferred our application and it also scored better in more detailed usability and user experience ratings. Our mobile application was especially appreciated because of user experience and speed. The gallery application used for comparison scored reasonably well in general and usability related questions but not in the user experience evaluation. This means that the usability or general evaluation did not reveal how satisfied the participants were with the service nor did they explain the participants' application preference. The state-of-the-art gallery application combined with the upload tool was missing the enjoyment aspects of use, which are essential for a mobile application used for social communication. The participants of the study were more socially active when using our application, which indicates that better user experience encourages users to use social Internet services more actively.

ACKNOWLEDGMENT

I would like to thank Davin Wong, Janne Kaasalainen, Toni Strandell, Timo Pakkala, and Tuomas Tammi for their support in authoring this article. Financial support from Nokia Foundation is also gratefully acknowledged.

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This work was previously published in International Journal of Mobile Human Computer Interaction, Vol. 1, Issue 4, edited by J. Lumsden, pp. 42-57, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 3.19
Social Support for Ontological Mediation and Data Integration

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ABSTRACT

Most organisations store their data in several databases with no flexible mechanism for integration and access, and with no common vocabulary in place. Maintaining local vocabularies while realising distributed access is a challenge that most organisations face regularly. For several years, the Semantic Web community has been developing algorithms for mapping data models (ontologies). Nevertheless, ontology mapping remains to be a great challenge, and humans are always expected to verify the results of existing automatic mapping tools. The spread of social web demonstrate the possibility of using collaborative techniques for reaching consensus and fostering user participation. While a number of prototypes for collaborative ontology construction are being developed, collaborative ontology mapping is not yet well investigated. In this article, the authors describe an approach that combines off-the-shelf ontology mapping tools with social software techniques to enable users to collaborate on mapping ontologies.

INTRODUCTION

Most public and private organisations own a vast capital of information, stored in many distributed databases, using various departmental vocabularies, and are usually subject to frequent change and update. Realising a persistent integration and access to such data is usually a major challenge, especially when there is a need to integrate with external data sources, such as in coalition forces scenarios, or in government.

The UK, in its e-Government agenda, has identified Ontologies and sharing as crucial issues, and recommended the Semantic Web as an enabler technology (Alani et al. 2007). B2B is another example of cross organization scenario that would benefit from data integration. Traders can in fact achieve a higher level of exposure of their businesses by sharing structured data and SW research initiatives are helping in delivering ontologies for defining offerings, services and products (Hepp, 2008).

In the academic domain, the Linked Data initiative (Bizer et al. 2007) has been very successful so far in guiding the exposure and sharing of data in semantic formats. Over 17 billions of triples are currently available as Linked Data, covering a wide range of domains, such as Wikipedia, FOAF files, census data, scientific publications, social websites data, and much more (Hausenblas et al. 2008). However, this growing community has little support for mapping the data it is publishing and sharing.

Enhancing information sharing and reuse requires providing communities with common spaces, tools and technologies for the dissemination and integration of structured information from different sources. There are many cases where organisations invested in building monolithic data models to subsume their entire information asset. However, such top-down models are very costly and time consuming to build. Furthermore, they are often hard to deploy and impose on data owners for various reasons, such as difference in coverage, inflexibility of the model, and its disproportionate scale (Alani et al., 2008).

The Semantic Web (SW) brings hope to easing the above problems by providing the technology to develop and share ontologies to represent data sources, and to map them together to facilitate integration and access, without the need to adhere to a common terminology. The Semantic Web offers hope to solve a number of problems that have been haunting the digital information world for many decades. Problems such as lack of shared understanding, differences in terminology, lack of machine understandable information, difficulty in integrating distributed information sources, high reuse costs, are all quite common problems.

Using the web as a common framework for data publishing helps in providing communities with a worldwide shared information space, and adopting standards from the SW (Berners-Lee, 2007) enabled the process of data exposure and linking. Ontologies provide a formal interpretation of data semantics that can be used for supporting information exploitation.

Defining an ontology or a knowledge base and mapping it properly to related resources is usually a costly and time consuming task. If ontologies are meant to reflect the views of a specific community over a specific domain and support their knowledge sharing tasks, then the community itself should be empowered to express, agree, bridge and formalise their definition by social means in order to support such tasks (Shadbolt et al. 2006).

There is currently an increasing interest in exploring new methods for constructing such knowledge in more social and collaborative ways, and several tools have recently been developed for this purpose (Noy, Chugh, and Alani, 2008). These tools tend to focus on supporting communities to create instance data or to build domain ontologies collaboratively. However, generic tools for collaboratively mapping these shared resources are not widely available.

In this article we describe OntoMediate, a system for supporting communities in sharing, mapping, and extending their ontologies and knowledge bases. More specifically, OntoMediate allows the following: **align** local ontologies to shared ones; **exploit** social interaction and collaboration to improve alignment quality; **reuse** user ontology alignment information for enhancing future automated alignments and **query** heterogeneous data sources.

In the following section we will briefly explain ontology mapping and existing automatic techniques for producing mapping results. In section 3 we will describe a number of tools for collaborative knowledge construction, highlighting their goals and main characteristics. Section 4 is dedicated to describing OntoMediate; our tool for community-driven ontology mapping. OntoMediate is briefly compared with other related tools in section 5. A small-scale evaluation of the system is described in section 6. Various remaining issues and challenges are discussed in section 7, followed by future work and conclusions in sections 8 and 9 respectively.

ONTOLOGY MAPPING

Previous to the Semantic Web and ontologies, data integration efforts focused on the physical and syntactical levels. Such integration lacked semantics and meaning (Uschold and Gruninger, 2004). Ontologies offer to make this tight physical bridging between systems much more flexible.

A key step towards semantic integration is ontology mapping (Kalfoglou and Schorlemmer, 2003). Other names for ontology mapping include alignment, fusion, merging, integrations, etc. All these names refer to the action of bridging between the representations (i.e. concepts, relations) of one ontology to another, to enable knowledge communication and sharing across the two.

Goh identified three main sources of semantic heterogeneity (Goh, 1997): **confounding conflicts**, where information items seem to mean the same things, but they are actually different; **scaling conflicts**, where different standards or references are used to describe the same thing and finally **naming conflicts**, where it is possible to use synonymous or broader names for the same thing.

Ontologies provide a framework to encode conceptualisations of domains that, once created, help to create a shared understanding, enabling communication between computer (or even human) agents. One common use of ontologies is to bridge between different data stores to facilitate data exchanging supporting therefore inter-operability that can be done at different scopes and levels. Inter-operability can also be used to integrate ontologies that represent different domain, to enable communicating inter-disciplinary information.

Ontology Mapping Techniques

The three main approaches for automatic ontology mapping be summarised as follow: instance based (Isaac et al. 2007), lexical based (Magnini et al. 2002) and structure based (Euzenat and Valtchev, 2004). Instance based approaches requires that a set of instances are classified with both the two ontologies to map. Then, using such coverage information, alignments are proposed using the probability of two concepts to include the same set of instances. Lexical methods analyse the lexical labels and descriptions of ontology entities and compute a similarity measure based on string similarity. Lexicons and thesauri can help such methods to take into accounts synonyms but hey are bounded to map ontologies whose textual documentation is in the same language. Finally, structural methods rely on structural similarity of the lattices of the two ontologies to map for computing an ontological similarity between entities.

Although many efforts have been devoted to propose robust and precise methods to solve the issue of automatic mapping of ontologies, so far no solutions have been found and such task still remain heavily driven by users.

COLLABORATIVE SW TOOLS

In this section we will describe a number of prominent tools for community-driven construction of knowledge, in the form of ontologies, taxonomies, or knowledge bases.

Investigations into enhancing user knowledge through collaboration and sharing go back to the early nineties (Patil et al. 1992). SW has taken this approach further by providing the tools and languages to construct networked semantic representational layers to increase understanding, integration, and reuse of information. The rise of Web 2.0 approaches demonstrate the effectiveness and popularity of collaborative knowledge construction and sharing environments that adopted a lighter version of ontologies, where the emphasis is put on the easiness of sharing knowledge rather than on creating or adopting static formal ontologies (Correndo and Alani, 2007). Harnessing Web 2.0 features to facilitate the construction, curation, and sharing of knowledge is currently pursued by different communities.

Collaborative Protégé (Tudorache and Noy, 2007) is an extension of the Protégé ontology editor from Stanford Medical Informatics department for supporting collaborative editing of ontologies. Collaborative Protégé provides some features for collaborative ontology editing, supporting discussions and conflict resolution by capturing changes, proposals, votes, ratings, and comments in annotation properties. Recently, Noy and colleagues (Noy, Griffth, and Musen, 2008) extended a repository of biomedical ontologies (**BioPortal**) to allow users to submit and share mappings between any of the ontologies in this library. Their system focus on capturing metadata information about the mappings: who created them, when, which mapping algorithm was used, comments about quality, etc. OntoMediate however, is more concerned with providing a generic tool for collaboratively mapping any ontology. It also provides the community with discussions and voting facilities, as well as querying services for the mapped resources.

Hozo (Kozaki et al. 2007) is a server based tool developed by the University of Osaka for supporting the development of networked ontologies in a distributed environment. The main focus of the tool is to ensure consistency among interdependent ontologies when they are simultaneously developed by different users. The tool allows then to lock ontologies for editing, broadcasting ontology modifications and the possibility for a user to accept or reject such modification.

OntoWiki (Auer et al. 2007) is a web based tool for collaborative editing of information maps that supports a number of visualisation widgets for different kind of instance data. The aim of OntoWiki is to provide an intuitive and collaborative tool for the editing of RDF content that supports knowledge engineering in a distributed (web based) environment. The user can browse the taxonomy tree of the concepts and freely adding or editing concepts' instances. OntoWiki also provides a number of typical Wiki features for enhancing social interaction. These include change tracking, commenting, access logging to estimate popularity, and provenance capturing.

DBin (Tummarello et al. 2006) is an application that allows a group of users to share structured content using RDF as a content language and a P2P network as a content provisioning infrastructure. The tool provides a set of reusable widgets that handle RDF data (e.g. for visualising maps or URLs) and is supported by a framework for RDF data sharing in a P2P network.

BibSonomy (Hotho et al. 2006) is a social tagging system developed by the University of Kassel and the L3S research institute of Hannover. BibSonomy helps in organising and sharing resources such as bookmarks and publications. BibSonomy introduced the possibility to add an informal notion of *isa* relation between tags in order to provide a taxonomic structure that can be helpful when retrieving information. Bookmarked resources can be made private or shared among the whole community. When shared, the bookmark and all associated tags can be searched by others and used by the system for future tag recommendations.

SOBOLEO (Zacharias et al. 2007) is a web based collaborative tool for the engineering of taxonomies developed by the Research Center for Information Technologies of the University of Karlsruhe. The tool allows users to maintain a shared taxonomy, using SKOS concepts[2], and to use such concepts for tagging internet resources. The tool has a collaborative taxonomy editor for changing the hierarchical definition of the concepts.

There are few approaches similar to OntoMediate that address ontology mapping within communities. Zhadanova and Shvaiko (Zhdanova and Shvaiko, 2006) proposed to use similarity of user and group profiles as a driver for suggesting the reuse of ontology alignments. The focus of that work was on building such profiles to personalise reuse.

In OntoMediate, we are exploring the use of collaborative features (discussions, voting, and change proposals) to facilitate the curation and reuse of ontological mappings by the community, to facilitate a social and dynamic integration of distributed knowledge bases. The use of collaboration for achieving consensus on terms' semantics is largely justified because of the social nature of ontologies. In order to mediate possibly conflicting description of concepts, user feedback is taken into account and discussion within the community is therefore fostered. Our approach is novel in the way it addresses the task of mapping ontologies, by extending and enhancing automatic mapping tools with a more comprehensive community support. In our approach, mappings are seen as a resource, built and shared by a community. The community is able to investigate, argue, and correct the individual mappings, using various supporting services provided in OntoMediate.

ONTOMEDIATE

In OntoMediate we are studying how social interactions, collaboration and user feedback can be used in a community to ease the task of producing and sharing ontology mappings (Correndo et al. 2008). The system is a Web application developed with J2EE and AJAX technologies; it manages RDF ontologies that are parsed using the Jena API[3] while the persistence of system entities is assured by Java Persistence API (JPA). The system is composed of four main subsystems:

- Ontologies and datasets manager: provides services for managing users' ontologies and data sources;
- Ontology mapping environment: provides services for automatically mapping ontologies (extendible APIs for integrating different algorithms);
- Social interaction environment: provides services for creating, discussing, and voting on mapping proposals;
- Data integration support: provides a service of query translation using mappings managed by the community.

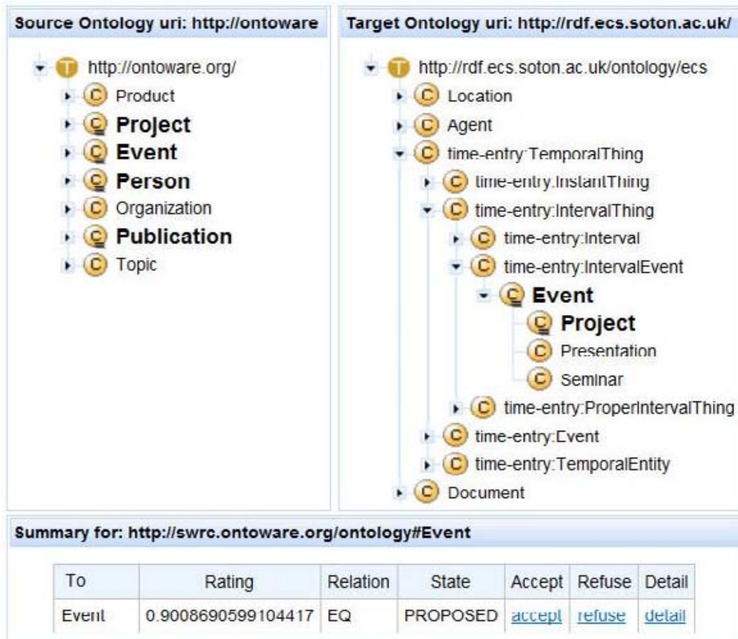
Ontologies and Datasets Manager

This component is responsible for receiving ontologies and managing their storage. Users can submit and remove ontologies and knowledge bases and choose whether to share them with the community or not. Sharing them will allow others to browse, map, and query these submissions. If they are not shared, then they are kept hidden from the community, and only their owner can use them. The system currently supports different storage types for the ontologies and datasets:

- **URL:** only the URL is stored and the ontology is accessed (read only) remotely;
- **Cached file:** the file is uploaded to the system and stored on a file server;
- **Jena RDBMS:** the file is uploaded to the system and stored in a relational database using the Jena database back-end;

Once an ontology is registered with the system, it will be added to the list of available resources, and its owner (and everyone else if the ontology is shared) can browse using a flexible frame-like interface. The browser shows the hierarchy of concepts, as well as detailed information for the focused concept (selected concept). The detailed

Figure 1. Ontology alignment environment



information includes: labels, superconcepts, subconcepts, equivalent concepts, concept description (from the *rdfs:comment* annotations), properties and their constraints.

Ontology Alignment Environment

Networked data environments require that different data vocabularies are mapped as well as the underlying data they represent. That is why OntoMediate allows users to align personal ontologies to models that have been shared within the community. Full automation of ontology mapping is hard to achieve (Kalfoglou et al. 2004), which is why OntoMediate extends automatic mapping tools with community support. This component of OntoMediate caters for the processes of submitting, sharing, and mapping of ontologies. It also provides functionalities for browsing the ontologies and their mappings.

Our system provides an API that enables automated ontology alignment tools to be plugged into an underpinning infrastructure. It also maintains a data structure for storing any parameters needed by a particular mapping tool (e.g. threshold values or tool options). The API allows for easy integration of new mapping tools, when they become available, by means of wrappers. Some tools have been already integrated with our system (e.g. INRIA Align (Euzenat, 2004) and Falcon OA (Jian et al. 2005)). These tools allow the system to support the alignment task by proposing some initial candidate mappings to the user.

Once the automated mapping tools are activated, the results are presented to the user for review. The ontology mapping interface is split into three main panels (Figure 1). The left panel is for showing the source ontology, and the right panel is for the target ontology. A smaller third panel at the bottom is used for summarising the mappings found for the focused source concept. Users can click on any mapping to display a more detailed view with a description of the mapped concepts shown side by side. This should aid us-

Figure 2. Ontology view showing an ontology hierarchy and related user feedback

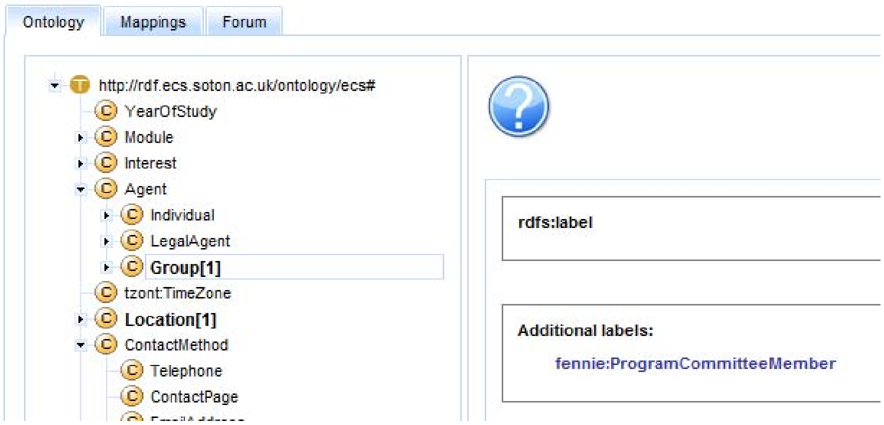
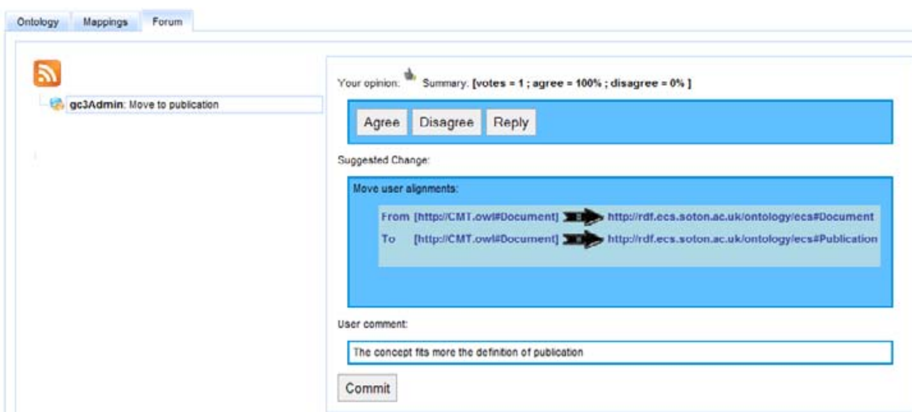


Figure 3. Forum view showing an ontology hierarchy and a change proposal



ers in their review of such mappings. Users can then review and create new mappings between properties and concepts by using a drag and drop technique.

Social Interaction Environment

This component allows community members to interact with each other to improve the quality and quantity of mappings. Users with similar data or interests can participate in such collaborative efforts and benefit by creating a better linked knowledge network.

The aim of this social interaction is to exploit community feedback in order to enhance the overall quality of ontology mapping and to reach agreement. The Social Interaction Environment displays three views to the user: an **Ontology** view (Figure 2); a **Mappings** view and a **Forum** (Figure 3).

The Ontology view displays the hierarchy of the selected ontology. In this visualisation, the number of incoming mappings, and the number of related messages or posts in the forum, is displayed in brackets next to relevant concepts.

Users can switch to the **Mappings** view to see more information about the mappings to a concept when that concept is clicked. Users can then inspect a summarised description (i.e. sub-concepts, superconcepts, properties, etc.) of the two focused concepts and decide if they should be mapped or not. Alternatively they can initiate a discussion thread in order to change this mapping. Any change proposal is composed of a thread post that describes in natural language the content of the proposal, and a formal description of the operation to discuss. The proposed change may affect a number of mappings and thus may lead, if the proposal is accepted, to the relocation of such mappings to a different target concept.

The **Forum** view is dedicated to the discussion of the users' proposals (see Figure 3). Each time a user proposes a change using the mappings view or the user view, a new thread is created in the forum and other users are free to debate the proposal, *reply* to the proposal with a new one or simply *agree* or *disagree* with it. Once a proposal reaches a critical mass (e.g. when the majority of users affected by the change have expressed their opinion) it will be endorsed, or submitted to an administrator in order to assess it and take a final decision.

Data Integration Support

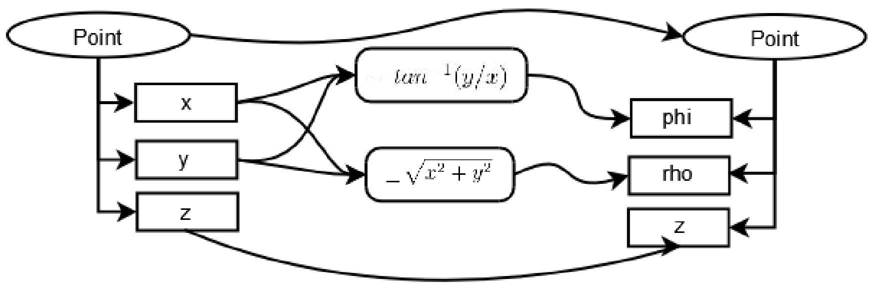
The features described above allow a community to maintain a network of ontologies, data sources and their mappings. In order to integrate data from sources described by different ontologies, the collaboratively maintained mappings must be exploited for translating queries and data. For this reason we developed a *Data Integration* service for the translation of RDF data and queries. The provided service takes a SPARQL query and a set of dataset's URIs as input, and then runs queries against those datasets, translating the queries whenever needed. The results obtained from the separate datasets are then merged together in a single homogeneous result set.

In OntoMediate the ontological mediation is achieved by means of query translation. Similarly to the approach adopted by Euzenat and colleagues (Euzenat et al. 2008), the alignments managed by the users and the topology of the data network are both exploited to translate queries and results from one ontology to another. In the case of OntoMediate, the shared ontologies are used to define the SPARQL queries that translate between the terms of one or more local ontologies for accessing the user data. Moreover, since the results need to be described with the same ontology used for the query in order to be understood by the issuer of the query, the translation mechanism developed enables the results to be translated back into the source ontology.

Currently, ontological relations are used to define equivalence among concepts and object properties. Mappings among datatype properties make it possible to define *n:1* relations and complex value transformations, by means of scripts, needed to bridge different encoding systems. A typical example where such complex transformations are needed is when different information systems decide to encode point coordinates with two different expressions (e.g. is_1 with Cartesian and is_2 with cylindrical coordinates). The notion of *Point* is easily mappable between the two ontologies (i.e. $is_1{:}Point \equiv is_2{:}Point$, see Figure 4) but the information described within the two concepts are not always directly mappable. In order to be able to translate a point from a Cartesian system (x, y, z) to a cylindrical system (ρ, φ, z) we need to be able to describe value transformations (i.e. $\rho = f(x, y) = \sqrt{x_2 + y_2}$) as well as multiple dependencies between entities. For representing such mappings, the usual representation by quadruple (Euzenat, 2005) $\langle e, e', R, n \rangle$ has been extended: the source entity e is replaced by an ordered set of entities E and a scripting function s is associated with the mappings. The representation of a mapping in our system is therefore a quintuple: $\langle E, e', R, n, s \rangle$.

Our translation algorithm visits and rewrites the algebraic description of a SPARQL query. This implementation exploits the features provided by Jena API for: rewriting the RDF triple patterns present in the original query; obtaining a query that matches the target ontology; retrieving the required instance set; and rearranging the result set to fit the source ontology. Such query translation functionality is then used to offer a service, accessible as a standard SPARQL endpoint.

Figure 4. Complex mapping between entities



COMPARISON

As already described in section 3, there exists a number of tools for involving a community in authoring an ontology, populating a knowledge bases, sharing knowledge, etc. The major difference between those tools and OntoMediate is that the latter is focused on ontology mapping. However, some of these tools are complementary to each other, and all have roles to play in the cycle of knowledge creation and sharing. For example, Collaborative Protégé or OntoWiki can be used to author the ontologies, or use Hozo if the ontologies are being built up from joining existing, and possibly conflicting, ontology parts. These ontologies can then be populated with instances in DBin, or used by Bibsonomy or Soboleo for annotating web pages with tags. Once such ontologies and knowledge bases are created, they can be mapped inside OntoMediate. Mappings produced in OntoMediate can be uploaded into BioPortal[4].

Table 1 summarises the main similarities and difference between OntoMediate and the above tools.

USER EVALUATION

An initial small scale user evaluation held within our university has provided some feedback about the usability of the system. Four users, knowledgeable about academic domain and SW technologies, have used OntoMediate to align four different ontologies about conference domain to the ECS ontology[5] about academic domain. The chosen source ontologies are relevant to the conference domain and are part of the data sets provided by the OntoFarm project.[6] They were: CMS; ConfTool; Crs and Ekaw. The domain is not exactly the same in order to allow users to issue ontology mappings as well as edit the ontologies.

One positive remark on the evaluation is that the ontology alignment editor interface has been found usable and effective although the process of alignment in this scenario should be supported by a wizard based interface that can guide the user trough the needed steps. The social interaction environment has been underused, mostly because the interface, focused on the ontology hierarchy and not to the items of interest (alignments, posts, proposals) failed to ease the access to the needed information. Such design decision didn't help users to review the relevant items, forcing them to browse the hierarchy for retrieving them. It is noteworthy that the possibility to use the RSS channels associated with forums for an offline access to their content have not been used. On the other hand, social tools like Facebook,[7]usually provide such channels along with the reader in a common interface minimising the adoption effort by users. A feature that has been requested by the evaluators was to express dis/agreement on alignments without being forced to provide healing actions.

Table 1. Comparison of tools

	Collaborative Protégé	BioPortal	Hozo	OntoWiki	DBin	BibSonomy	SOBOLEO	OntoMediate
Automatic mapping Does the tool map ontologies automatically?								✓
Manual ontology mapping Can users issue mappings between ontologies manually within the system, and share them with the community?								✓
Personal space Does the tool distinguish between personal spaces (only accessible to their owners) and public spaces shared by the community?			✓			✓		✓
Ontology editing Does the system support collaborative editing of ontologies or taxonomies?	✓		✓	✓	✓	✓	✓	✓
Discussion Is there support for the community to discuss any relevant issues?	✓	✓					✓	✓
Voting Can users flag their agreement or disagreement with proposals?	✓			✓				✓
Distributed data querying Does the tool provide an engine for querying distributed datasets?								✓
Query translation Are ontology mappings, if they exist, taken into account when querying? are the queries rewritten in accordance to these mappings to enable cross-ontology querying?								✓
Importing/exporting mapping Can users import or export mapping results?		✓						✓
Web interface Is the tool accessible online through a web browser or does it need to be installed?		✓		✓		✓	✓	✓
Instant messaging Does the tool support instant messaging between community members?	✓						✓	
Change history Is the history logged and made accessible to the community to trace back changes?	✓		✓	✓	✓			✓
Concept annotation Can users associate ontology concepts or properties with annotations?	✓			✓	✓			

DISCUSSION

Collaborative ontology mapping has a great potential in enhancing data retrieval quality and in sharing results of automatic mapping tools. The system presented in this article supports users in their ontology mapping activities by giving them access to automatic mapping tools, allowing them to review, correct, and extend mapping results and issue new ones manually, share mappings with the community, discuss and vote on various issues, etc. Collaborative ontology mapping is a brand new domain, and it lays out various new challenges to be overcome.

- **Context:** Ontology mapping is inherently difficult, and can be influenced by various issues. For example, some mappings can be user or context dependent, in which case a mapping that has been approved by some users may not necessarily suit others. Also, the community might fail to reach a consensus on certain mapping suggestions. It is necessary to allow for conflicting or contradictory mappings to co-exist (Noy, Griffth and Musen, 2008). In such a case it will be useful to provide users or application developers with filters to help them choose which mappings to use, for example based on authorship, source, mapping tools, etc. (Noy, Griffth and Musen, 2008).
  Mapping popularity can be used to weight each ontology alignment. The degree of popularity of a specific alignment can be taken into account when displaying alignment suggestions to the user. Storing user profiles to personalise mappings has been proposed elsewhere (Zhdanova and Shvaiko 2006).
- **Error propagation:** When reusing mapping results, it is important to prevent error propagation. It is important to build a user interface in such a way to discourage blind reuse of mappings. OntoMediate allows the community to flag, discuss, and democratically change incorrect mappings, but this is of course dependent on users spotting erroneous mappings. If a mapping is reverted, it will be important to readjust its popularity accordingly.
  In addition, mappings that receive repeated change proposals or become subject to long and intense discussions may be regarded as controversial or debatable mappings. Such mappings may also need to be handled with care when used or reused suggesting that administrators should create appropriate ontological descriptions to better characterize those particular local concepts.
- **Complex Mappings:** OntoMediate uses off the shelf automatic ontology mapping tools, and hence the complexity of its mappings is largely based on those of the mapping tools. The current implementation of OntoMediate allows users to manually map entities expressing simple one to one mapping. More complex mappings, such as mapping a union of classes or linking properties by means of transforming functions, is not currently supported. However, it has been reported that when engineering ontologies collaboratively, complex OWL constructs are often not required (Noy, Chugh and Alani, 2008).
- **Alerting the community:** When loading a new ontology to the network, or changing some existing mappings, it will be important to inform interested users of such change. Rather than flooding the community with messages and alerts, a more personalised communication approach can be adopted. Sending RSS feeds or alerts can be restricted to only the users who have mapped to, voted for, or recently discussed or queried a particular mapping.
- **Added value:** Ontology mapping is a not an easy task, and hence users will not expected to link their ontologies without a clear added value. The ultimate goal of OntoMediate is to facilitate distributed querying and integration of knowledge bases within a community. Therefore, in addition to displaying concept mappings, it will be important to also display contextual information regarding the knowledge that each ontology brings to the community, in order to encourage users in extending their mapping asset.
- **Scale:** The approach we focused on in OntoMediate is based on a small to medium size

community, sharing interests and goals that can benefit from integrating their data. In OntoMediate, it is presumed that an overall administrator can act as the ultimate curator of the system. For such an approach to scale up to the Web as a whole, the wisdom of the community will have to be the final ruler. Wikipedia is a fine example of how this can work, and the Linked Data initiative is a first step to creating a wide network of linked semantic data (Bizer et al., 2007). However, demonstrating added value will be more difficult once the community grows large and diverse, and hence it will probably breakup into sub-communities with similar requirements.

- **Versioning**: Noy and colleagues (Noy, Griffth and Musen, 2008) highlight the problem of managing ontology mappings when new versions of those ontologies are uploaded in collaborative ontology mapping environments. They argue that some mechanism must be put in place to associate mappings with ontology versions, and to notify users of such version-dependencies.

FUTURE WORK

Next we plan to provide OntoMediate as a tool for supporting ontology mapping within the Linked Data community. This will give the system a large user base, and will thus help us to launch a much larger user experiment to further test the validity of the approach, and the usability of the services and features that it provides. Additionally, we will next focus on building the capability to allow users to perceive, and query, the integrated knowledge bases, thus increasing added value.

CONCLUSION

In this article we presented OntoMediate; a prototype for supporting ontology mapping and data integration with community interactions, where users can collaborate on mapping their ontologies, and manually-driven mapping can be stored and shared across the community, and used for distributive querying. To the best of our knowledge, OntoMediate is the first tool of its kind that is entirely designed for supporting communities to map and integrate their ontologies and datasets.

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ENDNOTES

1 This work was partially funded by a grant awarded to General Dynamics UK Ltd. and the University of Southampton as part of the Data and Information Fusion Defence Technology Centre (DIF DTC) initiative.

2 http://www.w3.org/2004/02/skos

3 http://jena.sourceforge.net

4 Users can only upload mappings to BioPortal if the mappings are for ontologies already in BioPortal.

5 http://rdf.ecs.soton.ac.uk/ontology/ecs

6 http://nb.vse.cz/~svabo/oaei2008

7 http://www.facebook.comamet

This work was previously published in International Journal of Virtual Communities and Social Networking, Vol. 1, Issue 3, edited by S. Dasgupta, pp. 21-36, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 3.20

Getting to Know Social Television:
One Team's Discoveries from Library to Living Room

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ABSTRACT

This chapter presents results from an ongoing social television project, in the context of other research in the field. The authors give a detailed description of the STV prototype used in their research, and summarize their studies, which provide the findings explained in the rest of the chapter. Three major research focuses are identified, namely evaluation and validation of Social TV systems, communication modality comparison, and detailed observation of user behaviors. Based on the findings in these areas, the authors list three major open questions and challenges for the field: multi-user support, new equipment requirements, and the creation of distinct and unique social television experiences. Finally, the chapter suggests that the emphasis within social television may be moving from research to design, implementation and deployment.

DOI: 10.4018/978-1-60566-656-3.ch010

INTRODUCTION

Over the course of this decade, social television has gone from a marginal idea to a major focus area within the field of interactive TV (ITV). As members of an ongoing Social TV project in Motorola's applied research division, we have studied the issues around the subject extensively. In this chapter, we aim to discuss some of the things we have learned about social television, point out a few major unanswered questions and unsolved problems with social television, and offer a perspective on where social television is headed. Throughout, our own research and experiences are used as a jumping-off point, complemented by findings from the growing literature on the topic.

The main part of this chapter is devoted to three big questions that have attracted much attention. We look at attempts to evaluate the effectiveness and appeal of social television experiences, and find that their potential has been largely validated, although some important misgivings remain around privacy, disruptions, and systems that do not offer full freeform communication. We next examine comparisons of different communication modalities, primarily text, voice and video. Our findings indicate that contrary to previous, inconclusive studies, text is a better communication option than voice in the context of in-home social television, while video does not appear to be a suitable option. Finally, we describe the observed usage patterns of Social TV systems. We find that in naturalistic use, conversations are not as closely tied to the TV content as has previously been thought. On the other hand, television presence provides an important link between viewing behaviors and social interactions.

Because each topic draws widely on results from all our different studies as well as from the literature, the chapter is not broken up by individual study. Instead, to provide the necessary background for the reader to assess the findings we present, and explain where we are coming from, we first describe the prototype system used in our research, followed by a summary of the research we have conducted, before we start talking about what we have learned.

STV: A SOCIAL TELEVISION SYSTEM

At Motorola, we have explored several different kinds of social experiences around the TV. One of the experiences that has received most attention is to allow a small group of friends or relatives to share a feeling of contact or togetherness while watching TV; a "virtual couch." As part of this research, we have developed a series of prototypes, collectively known as STV, for use in lab and field trials (Table 1). The first iteration, STV1, consisted of a simple, single-session audio link between households, which allowed users to communicate via open room-microphones and hear their conversation partners through their television speakers, mixed with the TV audio (Harboe, Massey, Metcalf, Wheatley, & Romano, 2008a). There was no visual user interface, and the only control given to users was the ability to adjust the relative volumes of the TV audio and the voice audio using a remote control.

Later prototypes have been more elaborate, providing fully integrated Social TV systems that could be deployed in the field for extended periods of time. Since their features largely overlap (the biggest difference being an evolution in communication capabilities), we will describe them together in more detail. The main features of these prototypes are television presence (provided in the form of a buddy list and an ambient display), program suggestions, communication (including at various times graphical emoticons, pre-defined text messages, text chat and voice communication) and historical information such as viewing habits.

Table 1. Versions of the STV social television prototype.

Version	Presence	Suggestions	Communication
STV1	No	No	Voice
STV2a	Yes	Live, Future	Emoticons
STV2b	Yes	Live, Future	Emoticons, pre-defined text-messages
STV3	Yes	Live	Emoticons, text chat, voice

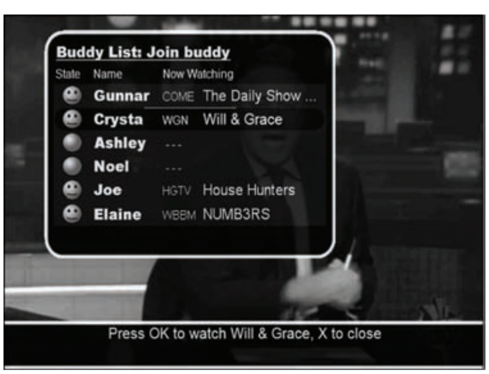
Presence

Presence information provides users with awareness of other users' current state, particularly their availability or whether they are currently active on the system. It can also include other information about their context. Television presence information, for example, lets users know about their buddies' current TV viewing. In STV, the two most important presence features are the buddy list and the ambient display.

Buddy List

The buddy list displays the user's contacts ("buddies") on the STV network, and shows their current status (Figure 1). Buddies who are not currently watching TV, or who have logged off in order to watch in private, show up in the list as unavailable. The STV buddy list is similar to buddy lists in instant messaging (IM) applications such as Windows Live Messenger[1] or AIM[2],but provides additional television-specific context, showing the station and program each buddy is watching. The user can tune directly to those stations by highlighting the buddy and pressing Select on the remote, joining whatever channel the buddy is watching.

Figure 1. Screenshot of the STV buddy list.



Ambient Display

The ambient display provides a way for users to be aware of their buddies' presence status even when the TV is turned off. An Ambient Orb[3] (Figure 2) displays aggregate presence information by glowing in different colors depending on how many buddies are currently active watching TV on the system, with separate states for no buddies, one buddy, and multiple buddies active. The ambient display is described in more detail in Harboe et al. (2008b).

Program Suggestions

In addition to the ability to join what a buddy is watching through the buddy list, it is also possible to actively ask buddies to watch something. Program suggestions help users let each other know about specific shows, and arrange to watch them together. Upon receiving such a program suggestion, a user can accept and automatically tune to the program, or close the suggestion without accepting (Figure 3).

STV2a and STV2b also let users send suggestions for upcoming shows. If the recipient accepted the suggestion, the show was scheduled so that a notification would remind them when it was about to start. STV has no DVR capability, so there was no option to record the show. Perhaps because of this limitation, suggestions for upcoming shows were rarely used, and the feature was removed in STV3 to simplify the user interface.

Communication

Different iterations of STV have included different forms of communication. Although STV1 supported voice, this function was not included in the STV2 prototypes, which instead tested more limited, closed-form communication options: emoticons and pre-defined text messages. When these features proved unsatisfactory, STV3 restored voice support, and also added text chat, providing a choice of freeform communication options.

Closed-Form Communication

Two forms of simple, closed-form communication have been tested in STV, both of them restricted to users watching the same program. Graphical emoticons, present in all versions since STV2a, are meant as a quick way to comment on the program or exchange greetings without necessarily getting engaged in further conversation. Currently, this takes the form of "thumbs up" and "thumbs down" smileys (Figure 4, Figure 4b), which can be sent using dedicated remote control buttons. A third smiley, called "shoutout" and representing a generic greeting or exclamation, was included in STV2a, but proved redundant and was removed from later versions.

In STV2b, the shoutout was replaced with a set of around 20 fixed, pre-written text messages and responses, with phrases such as "How is this show?", "This sucks!", and "Call me" (Figure 4a). The content of the messages was picked based on input from study participants so as to express the most important things users might want to say to each other. After poor participant response in the field trial of this version, the pre-written messages were scrapped, and replaced in STV3 by full freeform communication in the form of voice and text chat.

Figure 2. Ambient "orb" display sitting next to the television.

Text Chat

The text chat feature of STV3 is similar to IM, in that users select a buddy from their list (the buddy must be active, but can be watching a different channel), type them a message, and that message then immediately appears on the buddy's screen, initiating a conversation. The chat window can easily be hidden so as not to obscure the TV program while waiting for a response. Users can be in multiple text chats at the same time, switching between them (Figure 5), but in our current system

Figure 3. Screenshot of incoming program suggestion.

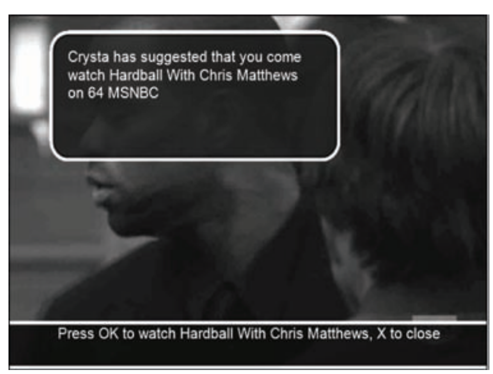
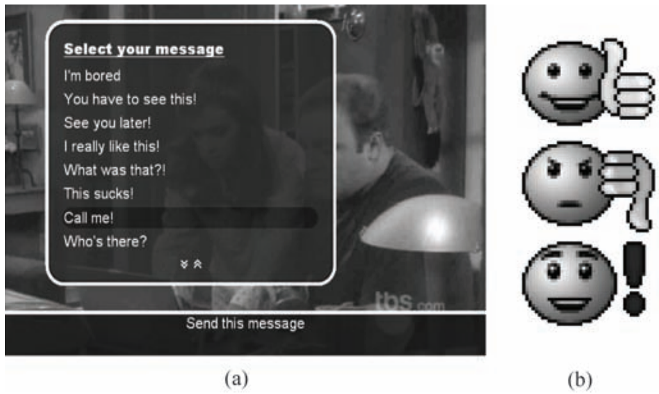


Figure 4. Closed-form communication in STV. (a) Pre-defined text messages. (b) Emoticons.



each conversation is one-to-one; we do not support group chat for text. Text entry is through a wireless Bluetooth keyboard, for ease of typing.

Voice Chat

In STV3, as in STV1, voice communication is made possible by establishing an audio link with one or more buddies. This is done in STV3 by selecting them from the buddy list and calling them. If any of the buddies accepts the incoming call, the audio link is set up and the call starts directly. Group calls are possible; a call can be set up with multiple people from the start, or more can be invited to an ongoing call (Figure 6). There is no particular ownership of a call; any participant can invite more people to join, and the call lasts for as long as any two participants remain. It is only possible to join a call by invitation, and each user can only be in one call at a time. While in a voice conversation, or when invited to a voice call, users can see a list of all the current participants in the call.

For voice communication, users have an echo-cancelling room microphone placed somewhere central in the room, for example on the coffee table. The voices of the remote participants are transmitted through the television speakers, mixed in with the audio from the TV program. The microphone sensitivity and the volumes of the voices and the television program audio can

Figure 5. Tabbed text chat window with two ongoing conversations.

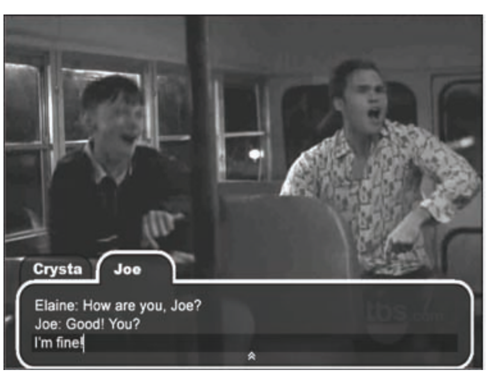
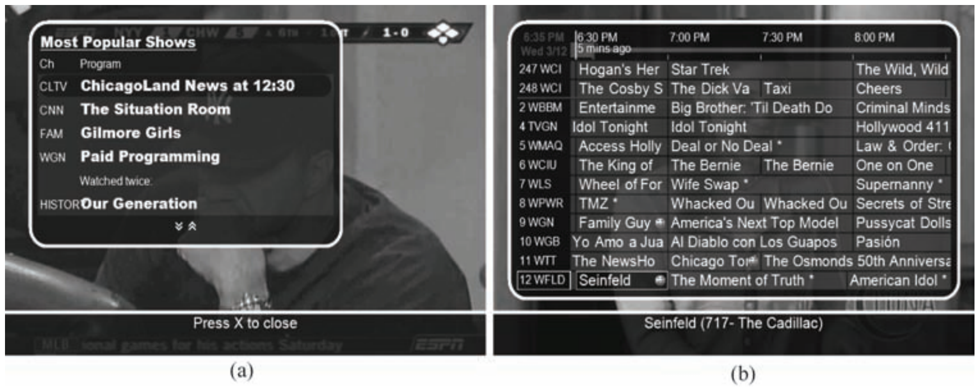


Figure 6. Screenshot of the calling process. Conversation presence in the top right lists participants in the call.

Figure 7. Historical information in STV. (a) Most popular shows. (b) Program guide with popular shows marked with a smiley face.



be muted and adjusted independently.

Users can start and maintain voice conversations with their buddies whether or not they are watching the same TV station or program. It is also possible to take part in both a voice and text conversations simultaneously, either with the same participants (e.g. using text as a backchannel in a voice conversation), or in different conversations with different people.

Historical Information

In order to make the TV content more socially meaningful, STV provides users with some awareness of their buddies' viewing habits. There is a viewing history which lists the programs each buddy has watched. Users can also see a list of favorite (most frequently watched) shows for each user, and for their buddy list as a whole (Figure 7a). These shows are also marked in the Program Guide grid with a little buddy icon (Figure 7b). Finally, another option allows users to view a list of shows they have in common with another buddy, meaning shows they have both watched.

A program only counts as having been watched if the user watched at least ten minutes in total of a single broadcast of that program. Programs that a user watches while logged off are not counted, and users can remove programs from their own viewing history.

OUR RESEARCH

The social television research in Motorola originated in several studies that we conducted on family communication and use of media. These found that "people who want to build/maintain relationships but live far apart can use mediated communication technologies to develop 'close' relationships through a virtual experience of being 'physically' close," and that sharing the experience of commercially created content is an important way to maintain a personal connection (Bentley, Metcalf, & Harboe, 2006). In one study in particular, we noticed people calling each other during a TV show they were both watching, so that they could watch it "together." This led us to explore the concept of social television.

Our research to date has included paper prototyping tests, lab tests, usability studies, participatory design sessions and technical studies. However, the results presented here are drawn from four main studies (Table 2). Initial concepts were evaluated in a focus group study. The different STV prototypes were then tested in a series of in-home field trials. We will describe the methods used in each study in detail, followed by a summary of our data analysis methods, before going into our actual findings.

Table 2. Overview of Motorola Social TV studies. Publications referenced: (1) Harboe., Massey, Metcalf, Wheatley, and Romano, 2007; (2) Harboe et al., 2008a; (3) Harboe et al., 2008b; (4) Metcalf et al., 2009; (5) Tullio, Harboe, and Massey, 2008; (6) Huang et al., 2009.

Study	System	Method	Participants	Publication
Concept Study	[N/A]	2-hour focus groups	7 groups, 53 participants	(1), (2)
STV1 trial	STV1	1-hour field trials	4 groups, 8 (+1) households	(1), (2)
STV2 trial	STV2a STV2b	2-week field trials	2 groups, 10 households	(3), (4)
STV3 trial	STV3	1,3-week field trials	2 groups, 9 households	(5), (6)

Focus Group Concept Study

We ran a concept study to test the appeal of communication and interaction through the TV, as well as four other, more advanced, concepts (which will not be addressed in this chapter). The primary purpose was to guide the future course of the project. The study consisted of seven focus groups (and a pilot group) followed by a data analysis workshop. In the focus groups, which lasted for two hours, participants were shown a number of storyboards depicting possible Social TV scenarios and were asked to discuss them with respect to their own needs and lifestyles. They also individually filled in worksheets with quantitative ratings (using Likert scales) and other information.

In all, 53 people participated in the focus groups. We had 6 groups of 8 participants, representing teens (17 to 19); young adults (25 to 35); and baby boomers (42 to 61), split into separate male and female groups. Finally, a group of 5 male Xbox Live gamers (18 to 25) was included. The groups were selected to include people with and without children, and for other demographic characteristics considered relevant. The concept study was run by an independent consultancy, with researchers from Motorola involved at each step of the design and execution.

STV1 Prototype Field Trials

For these field trials, we used the STV1 voice-only prototype (described above). The prototype was set up in the participants' own homes for a live TV show of their own choosing. We ran four trials with STV1. Each trial lasted for one hour, and the participants watched live programming that had been agreed upon in advance. Participants were recruited from our social networks using the friend-of-a-friend method. In all, there were 11 males and 8 females participating in 9 different households, and all were non-engineers (Table 3). The programs consisted of a basketball game, an American football game, an animated comedy followed by a sitcom, and a home decorating show. The participating households were connected to friends and their friends' families, except in the second trial which brought together a family by connecting a woman with her son, daughter-in-law and grandchildren. In the first trial, one of the 3 participating households was that of a Motorola employee familiar with the project, and data from this household was not used in the analysis. The participants were video-taped during the trial (the researchers were not present), and interviewed immediately afterwards. We also recorded the programs they watched.

Table 3. STV1 field trial sessions

Trial	Households	Participants	Programming
1	2 (+1)	5-10 (varying)	Basketball
2	2	5	American football
3	2	2	*Family Guy, Full House*
4	2	2	*Trading Spaces*

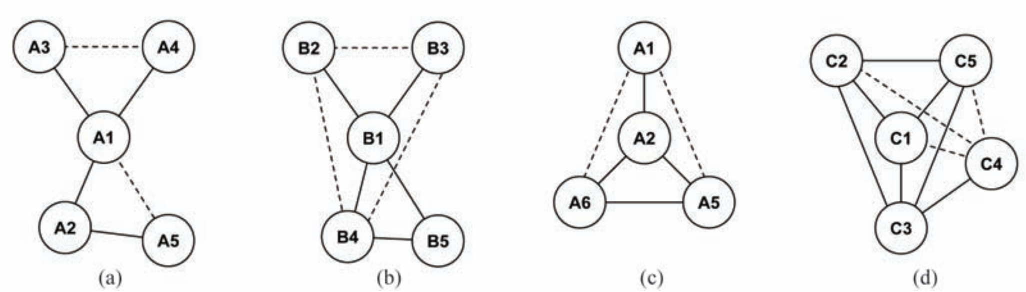
STV2 Prototype Field Trials

We ran two separate in-home trials of STV2, using slightly different versions of the prototype (STV2a and STV2b). The focus in this iteration was on the presence awareness, with limited capabilities for communication through suggestions, emoticons, and (in the second half of the study) pre-defined text messages. Five households were recruited for each trial, and each trial was conducted over a two-week span. Participants were recruited using an independent recruiting agency. Its instructions were to find social groups in which the various household members were mutual friends, and all had strong ties with one another. A number of different kinds of relationships were represented in the two social groups, but neither group was completely tight-knit (Figure 8a, b). All the recruited participants were women. However, other family members such as husbands, fiancés, and children also used the system, and were secondary participants of the study.

We used multiple methods for data collection, including semi-structured interviews, automated usage logs, and voice mail diaries. Each household was interviewed three times. The initial interview lasted about half an hour and was used to collect background information about viewing habits, communication routines, and social relations between the participants. In a phone interview after the first week, lasting between 15 and 30 minutes, we gathered data about the participants' use of and reactions to the prototype in the first week. The final interview, lasting from an hour to an hour and half, was structured to collect more detailed information on their use of and reactions to the prototype.

We logged all interactions with the system, including when the TV turned on and off, and all button presses during system use. Voice mail diaries were used to collect information on behaviors surrounding the ambient presence features and other communication with other people in the study, since these did not appear in our logs.

Figure 8. Social network graphs of relationships between households in our field trials. The solid lines represent friendships and close kinships (siblings), and the dashed lines represent more casual acquaintances.



STV3 Prototype Field Trials

This study, which used the STV3 prototype, was run in two stages: first a preliminary one-week trial with four households participating, then a more elaborate three-week trial with five households.

For the preliminary trial, we contacted three participants from the first group of the STV2 study (A1, A2, and A5) who formed a tight-knit group. A fourth participant, A6 (the sister of A2 and A5) was also added (Figure 8c). The participants were between the ages of 25 and 35. The system was deployed in their households for a period of one week. As in the STV2 study, an initial interview was used to gather background data, a phone interview was conducted mid-week to investigate participants' experiences with the system during the first half of the week, and a final interview was conducted at the end of the week to examine their experiences in-depth. We also logged all interactions and all text chats, and recorded all voice conversations held through the system.

For the longer trial, a recruiting agency recruited five participants, all of whom were males between 30 and 36. All were sports fans, and most were old friends (Figure 8d). The study was run during "March Madness," the American college basketball playoff series. For one week, the participants used the system without being able to connect to use the social features, in order for us to gather baseline data and to populate their viewing histories. After that, the social features were turned on, and they could use the system to communicate for two weeks, until the end of the study. The data gathering was as in the preliminary trial.

Analysis

In each study, we used a form of grounded theory analysis to interpret the data, applied as an affinity diagram technique (Bernard, 1998; Beyer & Holtzblatt, 1998). We reviewed the interview data, and (when available) the observed or recorded data from the usage sessions. We pulled out direct quotes and observations from the sessions and interviews that addressed the research questions. These items were grouped using the affinity method. Insights were drawn from the patterns that emerged, and the resulting organization of the data surveyed to answer the research questions.

For the focus groups and the STV2 and STV3 trials, we also performed statistical analyses of the data (ratings and usage logs, respectively). This quantitative data is mainly descriptive, especially for the field trials, since the small scale, non-experimental setup and numerous confounding variables don't permit us to draw statistically sound conclusions about any effects.

The results produced by our analysis, based on data from all the separate studies, form the material for the following section.

WHAT DO WE KNOW ABOUT SOCIAL TELEVISION?

In addition to the primary research just described, we have been able to draw on a growing social television literature. Research around social television has mainly clustered around a few big questions. We can sum these up as: validating the effectiveness and appeal of social features around video; exploring and comparing specific features and communication modalities to produce more optimal designs; and studying the behaviors around use of social television systems. Through the studies detailed above, we have made important contributions to answering each of these questions, which we will deal with in order.

Effectiveness and Appeal

As a concept that has never been widely deployed, social television requires some validation to test whether it is actually something people want or would enjoy, and whether it is useful or has other positive effects. The flipside of this question is the need to identify the concerns it causes and any potential negative effects it could have. This section will describe attempts to quantify the social and psychological effects of social television use, as well as people's response to it. We will then look at qualitative studies that describe people's first reactions to the idea without having used it, and compare these to studies of people's actual experiences with different Social TV systems. Finally, we examine the issue of privacy, which is crucial to the acceptability of social television.

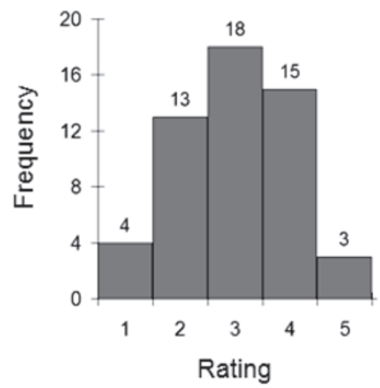
Quantitative Measures: Ambivalence

A fundamental question to ask about social television is whether it really does provide a social experience. A number of researchers have studied the problem using quantitative methods.

Baillie, Fröhlich, and Schatz (2007) compared the "joint TV experience" and "social presence" of watching TV in the same room to watching together through the AmigoTV system. They found that using audio chat did not differ significantly on these measures from actually being in the same room, but communicating only through graphical symbols was significantly lower on both. Similarly, de Ruyter, Huijnen, Markopoulos, and IJsselstein (2003) found that group attraction was significantly higher for participants watching TV when they had a live video view of their friends watching the same thing than when they only had a sketch visualization or no view at all. Along the same lines, Weisz et al. (2007) found that the ability to text chat while watching video on the computer significantly increased feelings of closeness with and liking of other participants. Finally, participants in a 9-week trial of ConnecTV felt significantly more connected when using the ConnecTV system than when watching regular TV in a control condition (Boertjes, Klok, & Schultz, 2007). Plainly, there are social television features that increase television sociability, at least when compared to solitary viewing.

As reassuring as it is that social television clears this fairly low bar, the last study, the ConnecTV trial, deserves a second look. In addition to measuring connectedness, the researchers collected four other ratings from participants, on the scales pleasant–unpleasant, activated–calm, satisfied–irritated, and inspired–bored. On all scales, ConnecTV scored worse than just watching television. Participants were less pleased, less calm, more irritated and more bored. After the trial, only slightly over half of respondents (17, N = 31) regarded the system as an interesting addition to watching TV (Boertjes et al., 2007). Frustration over technical difficulties may have depressed ratings in this particular study, but the question remains: is Social TV something people even want?

Figure 9. Focus group participant ratings of their interest in a generic social television concept. Likert scale from 1 (least interested) to 5 (most interested).



In our own concept study, focus group participants rated their response to the ideas presented in storyboard scenarios on a 5-point Likert scale. The ratings showed a response that can best be described as lukewarm, falling mostly near the middle of the scale (M = 3.0, SD = 1.04, N = 53) (Figure 9). Weisz et al. (2007) report a similar result for watching films while chatting on the computer; enjoyment was moderate (M = 4.3, SD = 1.6, N = 15, on a 7-point scale).

In contrast, Regan and Todd (2004a; 2004b) report that 93% of participants in their study (N

= 32) answered that they would like to IM with others while watching TV, and Baillie et al. (2007) also found that 93% (N = 30) of their participants would like to use a Social TV application. Harrison and Amento (2007) got a somewhat weaker, but still positive, response to their CollaboraTV system, with 69% of participants saying they would use the system, and most agreeing that it made watching TV more enjoyable (M = 3.56, N = 32, on a 5-point scale). Results from a later CollaboraTV study by Nathan et al. (2008) were similar (M = 3.57, SD = 0.65, N = 16).

A lot of this variation can be attributed to differences between systems and study conditions, especially the recruiting. Both Regan and Todd and Baillie et al. specifically recruited participants believed to be receptive to buying this kind of product, while Harrison and Amento recruited employees of, and Nathan et al. former interns at, a corporate research lab. The participants in the other studies, on the other hand, were recruited from the general public, or from particular communities without a predictable bias. This may indicate that social television appeals primarily to certain demographics, and does not currently inspire widespread interest.

First Impressions: Wariness

In addition to responses measured quantitatively on Likert scales, there is a wealth of qualitative data on people's reactions. This information helps to paint a richer picture of the aspects of social television that excite people, and the things that concern them about the idea. Three similar studies all point towards the same concerns.

In our focus groups, the mixed reactions to the concept were expressed in words such as "intriguing," "interesting" and even "wonderful," on the one hand, but, "weird," "unnecessary" and "pointless" on the other. Matching descriptions were elicited by Ali-Hasan (2008) in a participatory design exercise and by Hess (2008) in a user forum. In each case, the concerns of skeptical participants soon turned to privacy. The focus group participants worried about others being able to see what they were watching at any given time. Most argued that this social transparency overstepped the boundaries of acceptability, and several invoked "Big Brother," perhaps recognizing in STV the telescreen from *Nineteen Eighty-Four* (Orwell, 1949/1990). As in the studies by Regan and Todd (2004b) and Ali-Hasan (2008), participants articulated their discomfort in variations of, "I don't watch porn, but if I was…"; except for a few male participants who were more worried about getting caught watching programs targeted at women. The more general point expressed in these examples is that people worry about being embarrassed about their TV viewing. After all, many popular TV shows, as well as television viewing in general, are held in low regard critically and culturally. These "guilty pleasures" may therefore not reflect well on the viewer: "If someone was watching stupid shows all the time, I would think, 'God, what a moron are *they*!' to be watching these dumb shows."

Some of our focus group participants could see no value in linking personal communication to broadcast content. They felt that a television program would be an irrelevant distraction from their interaction with other people, for which existing communication technologies (telephone, email, IM, etc.) or face-to-face meetings were sufficient. The lack of perceived utility was captured in the words "toy" or "novelty," terms also heard in other studies (Metcalf et al., 2009; Ali-Hasan, 2008).

Experiences: Interest and Appetite

While user panels and focus groups are cautious in their response to social television, field studies where people get a chance to use it reveal a different and far more positive reception. The enthusiasm is apparent in the testimonials about Zync, the video sharing IM plugin, collected by Shamma et al. (2008) "Let me start by saying, I absolutely love Zync, currently myself and my wife are about 2000 miles apart but we love to watch movies together and it allows us to talk and watch together and its the closest thing we have to actually being together."

The participants in the STV1 trials were similarly very positive, on the whole, towards the concept and their experience with the prototype. We consistently found evidence that social television added value over and above watching alone, in a number of different ways. It helped to relieve boredom, allowed the participants to share their interests, gave them someone to ask questions of and show off their knowledge to, relieved loneliness, and heightened the intensity of exciting moments (cf. Weisz et al., 2007). In some cases it came close to the experience of actually being together: "I kind of forgot I was talking through the television at some point. I just was talking and could hear Mom." "It felt like she was in the room."

Participants in the trial of the STV2 presence-oriented prototype expressed frustration about the lack of communication options (a reaction shared by participants in the Boertjes et al. (2007) pilot study of the similarly restricted ConnecTV system), and their overall reaction was more negative. When some of them had a chance to try STV3, which incorporated voice and text communication, they all agreed that it was a significant improvement, describing it as "a lot more fun." Other participants in the STV3 study said the same thing: "I certainly liked it. It was a nice means to communicate and interact with my friends who share some of the same interests." "It opens and creates new avenues and communication experiences that I didn't have with a normal TV."

Other questions find less clear-cut answers. Some focus group members were concerned being in communication with others would interrupt and disrupt their viewing, causing them to miss parts of the show they were watching. They argued that television was their "down time," the only chance they had to relax and unwind. In the tests of STV1, however, voice conversations generally did not prove to be greatly disruptive. This agrees with the findings by PARC researchers (Oehlberg et al., 2006; Ducheneaut et al., 2008) in a similar experimental setup. In our later prototypes, some participants expressed impatience with the amount of on-screen notifications and messages, calling it "a chore" to deal with, while others enjoyed the fact that they could use their downtime to stay in touch with friends. Weisz et al. (2007) found that text chat during video viewing is distracting, and their participants reported this as their main dislike, and Weisz and Kiesler (2008) again demonstrated a distraction effect. On the other hand, when Regan and Todd (2004b) asked participants to rate how much incoming IMs interfered with the enjoyment of the TV content, average ratings were uniformly low.

Just like the response of participants in our field trials was generally more positive than that of members of the focus groups, several of those people were more enthusiastic after having had hands-on experience with it than they were beforehand: "Before going into this I thought 'What would I ever use this for?' But it was a totally different experience actually doing it. Because I totally changed my mind: […] I would totally use it!" Supporting this observation, Abreu and Almeida (2008) found that the proportion of subjects expressing high interest in a Social TV application rose from 27% before use to 67% after having tried it. (Baillie et al. (2007), on the other hand, found that participant reactions after having used the system were consistent with advance expectations. However, in that study, initial attitudes were already overwhelmingly positive.) To us, this underlines the value of practical testing in the study of new experiences. It is hard for people to predict their reactions to a hypothetical scenario. That is not to say that prototype tests are without their own biases; in all our field trials, as well as in the ConnecTV pilot study, technical problems (including degradation of TV image quality) were among the top complaints, and appear to have affected participants' overall reactions negatively.

People seem to respond more positively to social television when they try it than when it is only explained to them, and those who like it are a lot more enthusiastic. Some of the concerns people have when the concept is presented are not as serious as they imagine.

Effects on Privacy

As in the various user panels, aspects of privacy were also an important issue in our field studies. Although some participants expressed worry about government surveillance ("Can you imagine, like, back in the fifties, if they were Big Brother watching what we were watching? I would hope the government now doesn't want to come and… I mean, we don't have anything on our TV that's so…"), spammers, hackers, the possibility of strangers stalking them through the system, and the safety implications for their children, the gravest privacy concerns were in relation to their friends and family, both those on the system and those with whom they shared the home.

In practice the concerns were somewhat different from those anticipated by the focus group participants. The live television presence, which participants without direct experience worried about, did not prove to be a problem, perhaps because participants were able to log off if they wished to watch something in private. However, many felt that the viewing history feature, which logs all the TV programs watched publicly by a buddy, was too intrusive: "It's not really personal information, but it's not information required for anyone else to know. […] I don't think people would feel comfortable knowing what other people have watched." When the information was presented in summarized and aggregated form in STV3, participants had fewer objections.

STV3 also exposed another problem: the confidentiality of—and the confidence participants could have in—communications via the system. In the trials, there were numerous instances of participants being impersonated by other members of their households when using text chat. In some cases they were quickly found out ("it was the way [her husband] said 'Hey dude,' and my sister doesn't talk to me that way"), while in other instances the other person never realized the deception. Once people recognized this potential, reactions were strong: "Oh wow, that's scary... Heavens no! I'd be, like, angry if I knew that that happened. […] That's just, like, a violation of just, like, normal goodness!" "If she just pries a little bit, […] [my girlfriend] might find out something she doesn't necessarily need to know."

Everyone did not share this reaction. One participant was generally unconcerned about divulging information to the wrong person, because he felt that the conversations generally centered on topics that were not particularly sensitive: "What I was saying, even if it wasn't the person I [thought I] was talking to, I didn't feel like it was going to hurt anything. It wasn't anything that was sensitive information… so I wasn't too concerned about that." "I wasn't giving out my social security number."

Nevertheless, the overall trend is clear. When it comes to Social TV the primary threat to privacy is not Big Brother. It is people's actual big and little brothers, as well as their sisters, significant others, and other close kin.

Effectiveness and Appeal: Discussion

Evaluations of social television concepts and systems turn again and again to questions of sociability. The ability of the technology to provide a social experience is well established. When users talk about the benefits of having social television, nearly everything they say is about how it makes them feel closer to the other users: "It kept us more in touch with each other." Observations of their usage show that they take advantage of the social nature of the experience to engage in a rich set of behaviors.

Despite this alignment of potential capabilities with desired outcomes, and enthusiastic reception in certain studies, reactions to Social TV have not been uniformly positive. While some participant reservations could be caused by unfamiliarity with the concept (in focus groups, participatory design sessions and user panels) or technical problems (in prototype tests), two misgivings are not so easily dismissed: People worry about their privacy, although precisely what worries them is refined after experience with the system; and they are unhappy about disruptions that distract them from the TV viewing. These are problems that need to be addressed in the design of Social TV systems.

A final cause of dissatisfaction with some social television systems is that they are not social *enough*. Prototypes such as STV2 and ConnecTV, which do not allow freeform communication between users, cause much frustration. This frustration is satisfied in systems like STV3, which offers full text and voice chat support. It is therefore necessary to look at which features do satisfy people's social needs around television, and how they compare to each other.

Communication Modality Alternatives

The social television systems in the literature differ in the capabilities they offer for sharing a viewing experience. As pointed out above, merely offering presence awareness, or limited communication in the form of emoticons or pre-defined text messages to choose from, is not a satisfactory solution for users (Metcalf et al., 2009; Tullio et al., 2008; Boertjes et al., 2008; Baillie et al., 2007; However, see Schatz, Baillie, Fröhlich, & Egger, 2008). There is a need for more expressive communication. In existing systems, solutions to this have mainly taken the form of text chat (e.g. CollaboraTV) (Harrison & Amento, 2007), audio links (e.g. AmigoTV) (Coppens, Trappeniers, & Godon, 2004; Coppens, Vanparijs, & Handekyen, 2005), and occasionally video links (e.g. Reflexion) (Agamanolis, 2008), generally according to the designers' beliefs as to what will provide the most satisfying experience for users. A number of studies have sought to compare these different modalities.

Text vs. Voice

Geerts (2006) looked at voice chat and text chat in two separate systems, AmigoTV and Windows Media Center with Window Messenger. After using both systems in the lab, nine out of seventeen participants preferred the voice chat of AmigoTV, five preferred the text chat of Windows Messenger, and three had no preference. While voice was the more popular choice and was considered more natural, younger users and those with experience with IM text chatting tended to prefer text.

In a 144-person between-subjects lab experiment, Weisz and Kiesler (2008) compared communicating using text chat, voice chat, and both while watching streaming videos. Their results show that all options were enjoyable, and do not point to any of them as clearly preferable. Participants tended to prefer the option they personally experienced to other alternatives presented. Overall, text chat did slightly better both on enjoyment ratings and preference rankings, but on the other hand, users who had both voice and text available used voice almost three times as much. On the whole, the authors interpret the findings as support for adding voice.

In our focus group, participants were uniform in their opinion that communication should be by voice, and that talking should be made as natural as possible. They rejected out of hand the idea of texting for communication. Participants in the field tests of the voice-only STV1 system agreed, while those in trials of STV2, which had no freeform communication, were split on which they would prefer. Some talked about the benefits of voice: "A microphone or something to turn on would be cool. I wouldn't take the time to be typing in stuff back and forth; I'd pick up the phone and call them." Others strongly preferred text: "There's no way I want somebody talking to me during a TV show. Let the damn letters pop up. If I want to ignore them I'll close the window. I would never want someone talking to me during a TV show."

Text and Voice in Practice

In an attempt to resolve these conflicting views and inconclusive studies, we included both voice and text communication in the STV3 field trials. The results were unambiguous, based both on people's subjective opinions and on their actual use of the system. In the first, one-week trial, we counted 6 separate conversations, made up of combinations of 4 voice calls and 12 text chats. Of the 6 conversations, 3 involved voice, and all involved text. In the second trial, where participants had two weeks to use the communication tools, we counted 43 conversations, 6 of which involved voice, and all of them involving text.

Text was clearly the more frequent communication choice, and all the participants except one stated that they preferred it to voice. Their reasons for this choice varied. Some simply gravitated to what they were most familiar and comfortable with: "I guess that's a technology I'm used to, because I text-message a lot, and that's all I do at work." Other explanations were exactly the opposite: "[At work] I'm constantly on the phone, and you get burned out and it's just easier to text."

A number of participants felt it was easier to use and interfered less with watching TV: "Texting is what I think I'm more comfortable with, and you can pay attention more with the program, doing that. And when the voice worked, it was still fine, 'cause I could hear the program and hear the person. But it seemed like it took a little bit more of your attention or focus to make sure that you're hearing them and responding."

There was also a widespread feeling that contacting people over text was less intrusive and disruptive than trying to contact them over voice. "I don't want to inconvenience somebody by calling them or vice versa." Text was also seen as less intrusive to the rest of the household. "There's no sound or anything, so it's not disruptive," especially at night after children's bed time. The reluctance to use voice was closely tied to a sense of a social obligation being imposed. "I think the calling feature can be kind of tough to determine whether or not they're up for chatting. […] Let's say you want to [text] first instead of just popping into a call, and so they don't have to turn you down and kind of feel bad about it or whatever." Considering this problem of initiating the conversation, it is interesting to note that all but one of the voice conversations started out with a text chat first. As one participant put it: "Texting sets up the conversation, 'Hey, I'll give you a call' or whatever… then I'll know to call."

Text may have been seen as less intrusive than voice because of the semi-asynchronous flow of a text conversation. While the back-and-forth in voice sessions was essentially instantaneous, text chats often included long pauses—many minutes, sometimes even hours—between a statement and the response. Participants felt that this offered more control over the rhythm of the conversation. "You don't feel like you have to be waiting on the other person's response." "I think you're more in a control in a conversation where you can text, where[as] when you talk, you're all in, you're in that conversation, and you can't just at the end of a sentence… you can't just walk away and then get back to them ten minutes later, like in a text." "So the same reason why you would send a friend a text, because they can answer it when they get to it, is the same reason you would text somebody on the TV. When you're on a voice call with them, you can't do anything else, you can't talk to anyone else, you don't feel like you can just get up and leave."

Video Communication

While there is now a substantial amount of data on text vs. voice, social television with video link communication has been less thoroughly studied. Agamanolis (2008) found that watching TV programs or movies together was "one of the most satisfying ways" to use the "magic mirror"-style video conferencing system Reflexion. And as already mentioned, de Ruyter et al. (2003) found that group attraction was significantly higher while watching TV with a video visualization of a remote group of users than when watching with a sketch visualization or without any visualization.

In our focus groups, many participants said that they would like for social television to include a video link, so they could see each other while talking. However, the field trials indicated that adding video to the voice connection would be problematic. When our participants were relaxing in their living rooms, they were very unselfconscious, which didn't always mean visually presentable. In the STV1 tests, all of our participants were barefoot, and most put their legs on a table or on the couch. In a more extreme example, a child walked naked into the living room during one of the sessions. "Good thing it's not live video! [My kid] has got no bottoms on." They joke about it—"That's just sick! (Laughter)"—but it is clear that it would be a genuine concern to them. One participant told us that "the best part is [that] it's not picture in picture, where you're talking to someone and they see you." "[People] don't want anybody seeing you." Mostly, having video just seemed unnecessary. "Visually you don't see them but it did feel like there was this big sense of camaraderie. But outside of the optical sensation of [not] seeing them it did seem like they were here. It was strange."

Communication Modality Alternatives: Discussion

In none of our studies did participants actually have a chance to try a video-mediated Social TV experience, so our findings on this issue cannot be conclusive. The difference between the opinions solicited in focus groups, the results of lab experiments, and the observations made in field trials demonstrate that we should be cautious in drawing firm conclusions from limited data. In addition, our findings on voice and text chat are themselves based only on two small groups of users, and may not be widely generalizable. However, if the results hold up, it would seem that text is the preferred mode of freeform communication for social television, followed by voice, followed by video (which surely faces all the same problems as voice, and others in addition).

Even this conclusion is not the full answer, however. Each communication modality can be provided in a number of different ways. For example, text chat can be enabled with a QWERTY keyboard or using other text entry methods and input devices, and voice communication can be open-microphone/open-speaker, or using personal headsets. The effects of such design variations remain mostly unexplored. Schatz et al. (2008) have found that they have substantial impact on the user experience of Social TV, observing that the method of text entry often determined participants' feelings about the text messaging features. The same authors also compared four ways to control voice conversations, and found significant differences in the experience of watching TV together and in the overall preference (Baillie et al., 2007). Additionally, they report that 50% of their participants preferred an open table microphone, 30% the headsets, and 20% had no preference.

The Uses of Social Television

Some of the most fascinating insights about social television have come from the detailed observation and description of the behaviors of people using it. Two main approaches have been used: observations in a laboratory, and observations in system field trials. Lab studies can be run on a large scale and allow close monitoring of participants, but sessions are typically short in duration, and the lab setting and experimental conditions can affect people's behaviors. Field trials can be much longer in duration and observe participants in their natural environment, performing natural tasks, but the ecological validity comes at a price: because they are time-consuming and difficult to set up they are typically smaller-scale, and rely more on interview data and records of actions than on high-fidelity monitoring. There are also studies with aspects of both approaches. We will first present an overview of the findings of a number of lab studies, then discuss two main themes identified in field trials: the content and style of conversations and the pattern of behaviors leading up to conversations. Finally, we touch on some of the ways social television can be harmful to social relationships.

Like Being There (In the Lab)

Lab studies are the most common method used to observe groups using social television. The key exemplar of this line of research is PARC's Social TV study (Oehlberg et al., 2006; Ducheneaut et al., 2008). In that study, the researchers compared the speech acts of a group of people watching TV in the same room to those of groups watching in two different rooms, connected via an audio link. Analysis showed that the nature and structure of the conversations were surprisingly similar in the two conditions. Participant interactions were tightly interwoven with the structure of the show, with conversations taking on a rhythm to minimize disruption of the programming.

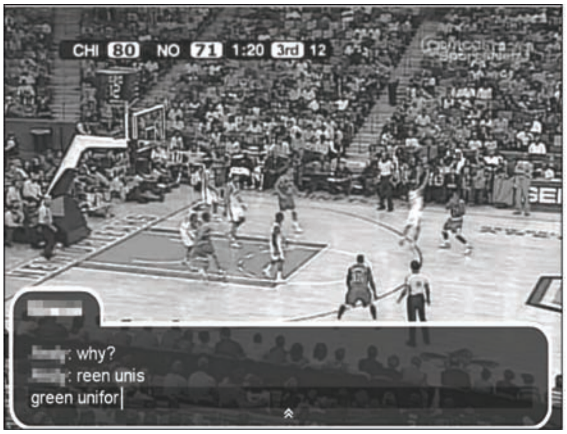
In our field trials of STV1, we observed many of the same things. The flow of the conversations was remarkably natural, much more like a face-to-face conversation than a phone call. People would leave and come back, chime in from another room, fall silent when they were paying attention to the show, and chat with each other when nothing interesting was happening. In the bigger groups we often saw several conversations going on in parallel, and collocated groups frequently had side-conversations among themselves while still taking part in the larger, connected group.

Adding support to these results, Baillie et al. (2007) found that conversations over AmigoTV audio chat had characteristics similar to face-to-face conversations, and Geerts (2006) concluded that Social TV voice chat is more natural than text chat. Weisz et al. (2007) coded the content of text chats during video watching in the lab, using categories similar to ones identified by Oehlberg et al. (2006). In their data set, 55.3% of all statements were related to the content in some way, with 22.8% consisting of personal conversation. In a later lab study, Weisz and Kiesler (2008) found that 48.1% of the conversation concerned the video and 9.9% was personal. In a field study by Nathan et al. (2008), the numbers were 42.3% and 18.9%, respectively. When seen alongside the observational studies, these results point to social television experiences that are natural, unforced, but adapted to the rhythm of the concurrent content, which also provides the primary topic of conversation.

Just Talk

Although the above studies point in the same direction, it is important to recognize that none of them observed behaviors under natural conditions. In each, researchers arranged the viewing sessions, set up the communication link ahead of time, and, in several cases, selected the content. (With one slight exception: In the Nathan et al. study the researchers selected the content and gave participants viewing assignments, but did not otherwise interfere.) Because the initiative to watch and interact did not come from the participants, the way they do these things may be

Figure 10. C1 in a text chat with C3, commenting in passing on the team's green St. Patrick's Day uniforms.



different from how they would act if the decision to engage was spontaneous.

In fact, when we examined these behaviors under less artificial conditions in the STV3 field trials, the results were very different. We found that personal conversation was far more common than conversation about television content. In the second group, for example, only eleven of the 43 text chats and three of the six voice chats contained any references to the current TV content. As one participant put it, "A lot of the text chats I had were more just general, 'Hey. How's your day? I haven't talked to you in a while. What are you up to?' It wasn't necessarily focused actually on the program. Which I thought was interesting, myself, 'cause I was thinking at the start that that's what we're gonna be focused on, we'll be talking about the programs." The following excerpt from the beginning of a voice conversation serves as an example:C3: [C3].C1: Hello. What's up?C3: [C1], what's up buddy?C1: How are you? You sound funny.C3: Ha-ha, I'm just exhausted dude, Monday just eats me up.C1: It does, huh? It's the first day of the week. You should be at your strongest. C3: Na, I think it's just from really enjoying the weekend and come Sunday at night you're finally feeling decompressed. You know? And then it's like you go back to the grind.

In cases where conversations did touch on the concurrent programming, the comments were in passing. The conversation structure did not seem to be tightly interwoven with the structure of the programs. "We touched on watching it, but [our conversations] were separate from what we were watching." (Figure 10)

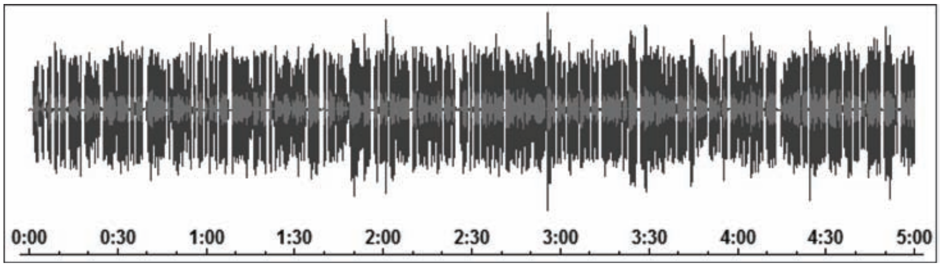
In fact, conversations were on a wide variety of topics. Participants reported that the topics and tone of their conversations bore resemblance to their face-to-face conversations. Participants often engaged in small talk and banter, as in this text chat:C5: does [C1] always text about food?C3: he must..i heard he sleeps with a bag of doritos under his pillowC3: if [C1] were president, free zingers 4 everyoneC5: for sureC5: time to take the dogto dumpoutC3: yeah, you have a good night broC3: sweet dreamsC3: sweet dreams on chocolate creams

However, participants also used the system to engage in more serious conversation. In one text chat, one participant inquires about how the other is doing after a recent move:C2: How are you enjoying the burbs?C5: we love itC5: nice and quietC2: It is a change from the city. Like the quiet too.C2: Only thing is a good night out is going to Bennigans.haha

In another example from a text chat, participants used STV3 to provide live context updates about themselves and their families, and to set up face-to-face meetings:A2: i'm backA2: whats [your son] doing?A1: being a pain in my butt. I am going oA1: to put him to sleep soonA2: but hes so cuteA2: sounds goodA1: yea he isA2: i miss himA2: we should get together really soonA1: he gets his looks from his dad...

Just like the content of the STV3 conversations was largely independent of the TV programming, participants did not fit the rhythm of their speech in the audio conversations to the TV content. Unlike the long silences between statements that

Figure 11. The waveform of the first five minutes of a typical audio session. Participants are talking continuously, and pauses are short (<3 s).



we observed in the STV1 trials whenever participants were paying attention to the program, here conversation was constant, with the longest pauses between utterances less than 5 seconds in length (except at times when users had technical difficulties with the system), and most no longer than a second or two (Figure 11). As a result, each audio session generally corresponded to a single, unbroken conversation. The data shows no indication of participants ever pausing to listen to the TV, and they generally kept the program volume low (but not off) during their conversations.

Overall, despite the coupling of communication with television and the fact that participants could only communicate with others who were also watching television, television content was generally not the main focus of conversation. Participants in the STV3 trials did enjoy the opportunity to communicate through the television. However, the voice and text chat features were not primarily used to create a social television experience of "watching together," but rather as another communication medium that had little to do with the television content.

Usage Patterns

As touched on above, one explanation for the different patterns of use found with STV3 compared to previous studies is that the social dynamics of communication are to a large extent determined by when and how conversations are initiated, as well as how they are terminated. If social television designers wish to encourage different types of social experiences, they need to understand the steps that lead up to the actual conversations. We investigated this issue in our studies of STV2 and STV3.

STV2 and STV3 both incorporated an ambient display, intended to help participants establish contact with each other. We saw evidence that the ambient information did help to engage them in the social television experience. Many of our participants told us of occasions when they turned on the TV because the orb indicated that others were watching. For example, one participant told us "as soon as I come into the house or I wake up or come into the room, that's the first thing. It draws my attention, and the first thing I do is turn on the TV." Another said that the orb "has made me a little bit more aware, makes me want to, when it does change colors, to see which of my buddies are on."

Once their TV was on and participants could see not only who was watching but what was being watched, their curiosity was stimulated further: they would often take a peek at the shows their buddies were watching. Said one participant, "If they're watching it, then maybe it's a good episode or something." Some participants used what their friends were watching as a sort of menu of program options to choose from. No one needed to suggest a show; they would simply be curious and join them. One participant described that

Figure 12. Different stages of interaction with the system, along with some notable characteristics.

Interaction	Presence specificity	Context detail	What others experience	Degree of participation
Noticing ambient display	Aggregate buddy list (+inferences)	TV is on/off	No presence info	Peripheral awareness
Viewing buddy list	Aggregate household (+inferences)	The program(s) being watched	TV is on/watching program	↓
Co-viewing program		Shared viewing context (common ground)	Sharing the viewing experience	
Message probes		Reactions to show, responses to messages	In contact, communicating	
Full two-way communication	Individual	User-provided context (+ background audio)	Rich conversation	Full involvement

she would turn on the TV "just to see who's on, and then most of the time we would all end up watching the same thing."

In the STV2 trials, participants often used lightweight messages like thumbs-up as greetings and to acknowledge others watching the same thing. For example, one said she sent messages to express "'Hey! You're watching the same show. Good show!' Kind of… acknowledging." In other instances, suggestions were used in a similar way, as a way to greet someone who just came on. Lightweight messages were also taken as a signal of availability to communicate. Sometimes this would culminate in a phone call:

"I noticed the orb was blue, so I knew somebody had their television on, and sure enough, it was [B2's household]. And I knew that her husband's at work and her kids were at school, so I deduced it was [B2]. And so without even saying 'Who's there?' I immediately went to her channel, which was Oprah, and I sent her a thumbs-up. And then she thumbs-upped me, and then two seconds later I said [to myself], 'This is dumb!' And then [I called her, and] we had a whole conversation." (B1)

When freeform communication was integrated in the system with STV3, we saw a similar pattern. The orb would alert participants that a buddy was available, and they would then test the buddy's interest in communicating:

"I sit down, and then I see the light go blue or whatever color, that means someone else is on there; and I go look and see, and then if I'm in the mood… I think if people are in the mood they'll type a line or two, and if they're not interested and just want to have a quiet night without having the keyboard in front of them in the family room, [they'll] just ignore it." (C5)

As an indication of how important this gauging of interest is, we can observe that with only one exception, all voice conversations were preceded by a text chat.

To generalize the steps reported: the participants become aware of their friends' availability through the ambient display, turn on their TV (thereby themselves showing up as available to the other participants), look at their buddy list, and often either join what one of their friends were watching or suggest that their friend join them. Once they were viewing together, they would usually send messages or emoticons. From this idealized flow, we can define different stages of interaction (Figure 12).

Moving through the stages, the user becomes progressively more engaged with the experience, going from peripheral presence awareness to immersive participation through a number of intermediate levels. Part of the reason for this is that at each stage, the user has access to more detailed social information. However, the most interesting thing to note may be the two-way dynamic at work. As users become more deeply engaged, they also become increasingly present to and connected to their buddies, which tends to nudge their buddies to become more deeply engaged. In this way, the system encourages more social interaction and communication at every level.

Anti-Social Television

Although the purpose of STV is to connect people and strengthen social bonds, we have always been on the lookout for possible negative effects social television could have on sociability. In our focus groups, some participants were concerned about the risk that easy communication through Social TV could be a substitute for face-to-face socializing. Similarly, there have been concerns that it might increase TV viewing, making people less active and less social.

In our field trials, we saw little evidence of either of these effects. Although STV3 participants reported that the system substituted for some phone calls or text messages, they did not get together any less frequently in person. In fact, our results suggest that STV3 may have encouraged increased face-to-face interaction. Participants reported extending and receiving opportunistic invitations or suggestions to meet in person through STV3 that would otherwise not have occurred:

"There was one time that we started texting on the system and he's like, 'Hey, we're going out for dinner. Do you guys wanna join us?' First of all, we probably wouldn't have talked to him that night [without STV3] but since we did it was pretty neat. It was something that opens communication between everybody." (C1)

In the STV2 trials, several participants felt that the system made them watch more TV, while with STV3 all agreed that they did not watch more television. Our usage logs do not indicate an increase in viewing.

Another concern about a system like STV is that the awareness it provides will not lead to feelings of closeness, but instead emphasize differences and cause alienation. The ability to observe friends' viewing habits may lead to the realization that you have less in common with them than you thought. In fact, while many participants told us in the initial interviews that they thought they had similar tastes to the others in their group, they in fact learned that their interests differed significantly. As one participant expressed it, "I have noticed that for the most part we don't watch a lot of the same shows." Several people commented that one particular household watched what they variously called "weird shows" or "crazy movies." That participant in turn observed, "they watch something totally different from what I watch."

Similarly, a presence indicator can also be an absence indicator. There were many occasions on which only one participant was watching TV, so that there was no one to talk to over the system: "The oddest thing, it's a nice night to be in… and not one person is on Social TV tonight!" Some participants would repeatedly check their buddy list, and sometimes try to contact people who were offline before giving up.

Even when other buddies showed up as being on the system, attempts to contact them were not always answered. "We were sending suggestions and nobody was answering us back, and it was like, 'Are these people just leaving their TV's on?'" Some participants felt like they were being ignored: "I thought, 'OK, maybe she just doesn't feel like responding.'" One participant speculated that her friends "just wanted to watch their show, and they were ignoring you."

Participants never explicitly stated that they felt rejected or were hurt by such non-responses, or that being the only person on the system made them feel lonely. However, turning the question around, they *were* concerned about how others would take it if *they* didn't answer. Accordingly, there was a social pressure to respond. For example, one participant felt "obliged to send something back" when she received a message, because "it just felt like they're doing something, so should I do something back…"

Another potentially disturbing problem which we saw scattered evidence of in the field trials was a displacement of sociability. In the STV1 sessions, one of our participants confided that because he was interacting with his friends, he was paying less attention to his son than he would have done otherwise. By bringing outsiders into the family room, social television can intrude on important "quality time," and weaken the closest ties even as it builds relationships with more distant people.

As stated by a participant in the STV3 trials, evenings are traditionally "our time with our significant others that we live with." By effectively bringing other people into the living room, social television challenges the home sphere. In some cases, this can literally drive away the ones who are closest: "My wife would probably just look at it, see something ridiculous [my friend] would write and say, 'Oh, you guys are stupid,' and she'd go out and leave the room." Taken to its ultimate consequence, this could lead to a situation like that reported by Quico (2003): "I left my wife because I am in love with the TV set."

The Uses of Social Television: Discussion

Earlier studies have tended to portray the conversation experience of social television as very much an aspect of the viewing experience, with both the structure and the content of the communications tightly linked to the program content. In contrast, the STV3 field trial reveals a communication system that goes beyond simply being a tool for communicating about television.

That is not to say that integrating voice and text communication with the TV is irrelevant. Through the presence mechanism, TV viewing influences the set-up of conversations in a number of ways, most of them positive. Although there is always a risk of causing harm to existing social relationships, so far the overall effect has been to strengthen social ties and even cause new ones to form.

WHAT DON'T WE KNOW ABOUT SOCIAL TELEVISION?

Many of the important unanswered questions about social television arise from what we have learned so far. Research into the appeal of social television has uncovered challenges around privacy and disruption that need to be resolved. Evaluations of different types of communication modalities have indicated high-level preferences, but left details unanswered. And finally, studies of social television behaviors have found that the process of initiating contact, and the way remote communication interacts with collocated relationships, require further investigation. Here, we will look at these questions from a slightly different angle, organizing them under three big questions: how the challenges raised by the fact that TV is often a shared device and a shared activity can be resolved; which missing technical pieces are necessary to realize social television; and which direction social television should go in to provide a distinct and particularized social experience.

How Do We Support Multiple Users within the Home?

In households with more than one person, the main television is usually a shared device, what we might call "public within the home." It is used by multiple different people, both separately at different times and in groups at the same time. This fact has a major impact on social television.

Of all the privacy concerns surrounding social television, the ones most manifest in the field are those over how to protect communication from other people in the household. Let us call this the "Little Brother" problem. At different times and in different situations, Little Brother could be a sibling, a girlfriend, boyfriend or spouse, a parent, a child, or a roommate. Little Brother complicates social television in a number of ways:

- Little Brother is nosy, and particularly interested in the private matters and personal relationships of his family. He listens in on family members' conversations unannounced. He impersonates them on text chat with their friends. He sometimes conspires with the real person to fool others, sometimes with that person's buddies, and sometimes he acts by himself.
- Little Brother is (at least sometimes) a child, and it is important to his parents that he is protected from inappropriate messages like swearing and adult conversations, kept safe from strangers, and that they can restrict and control how he uses the system.
- However, Little Brother does not want to be monitored.

In addition to these privacy issues, Little Brother faces another two problems of television sociability:

- Little Brother has his own friends. Most of the time he wants to talk only to them and see only what they are doing, and doesn't care about his other household members' friends.
- Little Brother is (usually) a family member, and watching TV is traditionally his quality time with the others in the household. Social television makes it easier for outsiders to intrude on these family moments.

In order to address these problems, a way to manage the multiple identities within the household is needed. This may include separate accounts for each user, with a logon process to verify identity. Since multiple users may be watching at the same time, the presence states needs to be flexible enough to represent this, and the interface needs to bridge or merge separate buddy lists and allow interaction from different user accounts. To date, Media Center Buddies is the only documented social television system with explicit support for multiple users (Regan & Todd, 2004b). For the most part, the design requirements for such capabilities remain unexplored, although ideas from the general interactive TV field may come into play (e.g. Farré, 2006).

Several approaches could be taken to limit the increase of intrusion and reduction of intimacy caused by social television. One avenue could be social television applications that support collocated sociability, socializing within the home, as suggested by comments by Chorianopolous (2007). In another direction, the shared nature of the TV makes it a potentially more inclusive social device. We have seen several instances where STV helped make other family members part of a relationship, such as when the girlfriend of one participant for the first time had a real conversation with one of his friends, or as the husband of another participant said about his wife's relationship with her sisters: "Usually I wouldn't know what they talk about. Here I get more involved, probably more than I wanted to." It remains to be seen if this involvement can be maintained once each household member can contact *their own* friends.

If, then, multiple users want to use social television individually at the same time, there are some scarce resources that need to be managed. Two of the most important ones are screen real-estate and system control. TV's have traditionally only had one remote control, which limits direct input to a single user at any one time. Similarly, only a limited amount of information can be displayed on the television screen, and will always interfere with the TV programming. Potential solutions to these problems include appropriating other devices, such as cell phones, for use as control and input mechanisms (Lin & Chen, 2005; Cesar, Bulterman, & Jansen, 2006), and employing secondary screens to display supplementary and personalized information (Fink, Covell, & Baluja, 2006; Cesar et al., 2008). This brings us to the issue of equipment.

What Equipment Do We Need?

Even if social television proves itself viable in field trials and pilot deployments, significant barriers to mainstream adoption remain. One of the main bottlenecks for deployment is the requirement of specific hardware. For this pragmatic reason, determining the necessary hardware components of a social television system is important. From the point of view of social television, current hardware is limited in terms of processing power, middleware support and networking ability, in the availability of input devices for communication (including text, voice, video and other forms), and in the use of peripheral and secondary displays.

We found an ambient display to be a popular addition to the STV system, and an important part of the experience. Because such displays are rare in the home, the question becomes whether the functionality can be provided through other equipment. One candidate are the secondary screens mentioned above. As already pointed out, the more important function of secondary screens is to move the display of (and often interactions with) advanced and personalized features off the TV. The effects of such a separation between TV content and social application on how social television is perceived and used are not well understood.

The most important hardware requirement, however, is very likely the choice of input device, or input devices. This choice is primarily driven by the communication modality. For text chat, a text input device is needed; for voice chat, a microphone; and for video communication, a video camera. A pointing device is desirable for on-screen drawing; closed-form communication (like emoticons and multiple-choice messages) can make do with a regular remote; while a game controller is ideal for rich avatar interactions.

Current findings point to text as the preferred communication modality over voice, and seem to show that video communication is not suited for social television. Nevertheless, efforts are likely to continue with all of these means of communication, and others. In any case, the demonstrated inadequacy of closed-form communication indicates that regular remote controls are insufficient for input.

We can predict, then, that a flood of different input devices is heading for the living room, if people are willing to let them in. However, the details remain open. For voice, what are the merits and drawbacks of a room microphone compared to headsets? For text, are any entry methods other than a full QWERTY keyboard acceptable? We know that these choices affect the experience, but the exact effects are unknown.

The numerous complicating factors with deploying social television for the TV, and the restricted capabilities of most current set-top boxes, raise the possibility that social experiences can more easily make a breakthrough as part of the burgeoning TV and video offerings on the Internet and on mobile platforms (Schatz, Wagner, Egger, & Jordan, 2007). The chance that widespread deployment may happen through systems and devices already primarily used for communication only makes the question more acute: in what way can Social TV differentiate itself, so that it offers a communication experience that is not interchangeable with existing offerings?

Where Should Social Television Be Going?

From the original definitions of social television (whether narrow or broad), both research results and system developments have tended to blur the line between Social TV and other social network and communication technologies. As online video becomes increasingly integrated with chat (e.g. Zync) (Shamma, Bastea-Forte, Joubert, & Liu, 2008), the distance between text chat over social television and over IM becomes smaller. Findings that show that most communication over social television is not content related make such systems seem less distinct. And with the prospect of using a cell phone or computer for the interaction, it becomes hard to separate social television interaction from any other form of communication.

For social television to become merely an extension of existing communication systems would be mildly disappointing, given some of stated ambitions of the field. We believe that the potential for social television to contribute unique and powerful user experiences exists. In order to achieve it, two goals should be pursued: close integration with the activity of television viewing, and close integration with the television content.

Our studies have shown that television presence information influences communication initiation. Presence awareness as part of a frequent and extended laid-back, recreational activity provides a spur to striking up conversation. At the same time, the degree of contact and transparency imposes social pressure, not just to communicate, but also around the patterns of TV viewing. Social television systems should seek to harness these forces positively (cf. Consolvo, Everitt, Smith, & Landay, 2006), for example by improving the mechanism of word-of-mouth recommendations of high-quality programming, and be designed to minimize the risk of alienation (Sokoler & Svensson, 2008). Future research should continue to explore the social effects of exposing TV viewing to public scrutiny.

Alongside these efforts, communication modes that are more directly focused on the content deserve more attention. These include shared program tags, exchanging clips, and social bookmarks that point to moments of interest within a program. Previous studies have shown that commercial content such as music is appropriated by people for their personal and social uses (Bentley et al., 2006), and one could take the perspective that social television is about using television content as a resource for personal and social interaction. Even more promising is the creation of social television experiences tailored to specific programs, such as multiplayer competition within quiz shows (Luyten, Thys, Huypens, & Coninx, 2006), fact checking or commentary during political debates, or a gossip channel as part of entertainment news. Enabling third-party creation of these custom experiences requires standardized protocols and a social television API. The ability to define interaction formats could allow a wide variety of structured social experiences for the television (van den Bergh et al., 2007).

Social TV systems can certainly provide generic text and voice communication experiences over the television. Much of the research and development to date has been explicitly of implicitly aimed at reaching and validating this capability, and most of the major questions have now been answered. Moving on from this early achievement, social television should set its sights on making a difference and creating an independent identity for itself.

CONCLUSION

Several years ago we embarked on a project with a simple idea: to create a "virtual couch" that would let people watch TV together even when apart. We quickly found ourselves on a lengthy exploration of a much bigger topic; an exploration that has involved extensive prototyping, reading, and primary research. We have made some surprising discoveries, and on at least one occasion had to change our course.

In that time, the uncharted waters of the topic have been mapped, at least to some extent, by ourselves and others. On three big questions about social television we have at least partial, tentative answers. The exploration is not yet complete, and there may be major discoveries yet to be made in the further reaches of the subject area. However, according to our bearings, some of the emphasis is moving from research to more practical concerns of design, implementation and deployment. Future advancements in social television are likely to come from new products as much as from dedicated research.

ACKNOWLEDGMENT

We would like to thank all the other people who have worked on or been involved with the Social TV project, including Vernell Chapman, Ambiga Dhiraj, Frank Bentley, Dave Wheatley, Josh Hurwitz, Larry Marturano, Seonyoung Park, Timothy Sohn, and many others. Thank you.

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ENDNOTES

1 http://get.live.com/messenger
2 http://www.aim.com/
3 http://www.ambientdevices.com/cat/orb/

This work was previously published in Social Interactive Television: Immersive Shared Experiences and Perspectives, edited by P. Cesar; D. Geerts; K. Chorianopoulos, pp. 158-186, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Section IV
Utilization and Application

This section introduces and discusses the utilization and application of social computing technologies. These particular selections highlight, among other topics, the many applications of social networking technology, social software, and social marketing strategies. Contributions included in this section provide coverage of the ways in which technology increasingly becomes part of our daily lives as it enables the creation of new forms of interaction among individuals and across organizations.

Chapter 4.1
Social Networking, Adult Learning Success and Moodle

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ABSTRACT

We know that technology is rapidly changing the world and it is hard to keep up. Social networking is the latest online trend we need to learn about. This chapter will consider the enormous changes that impact learners of all ages and offer some insights and resources for those professionals who want to provide more than just another lonely online learning experience. Social networking activities – including sites, blogs, chats, forums and wikis - are emerging to facilitate collaboration and knowledge sharing among adult online learners. The loneliness of the Web 1.0 is passé and the read-only, passive mode of adult learning is fading away. The term Web 2.0 has been used to describe all the new applications useful for a new collaborative or social approach to sharing and repurposing Web content to learn. Just as communities were important in prehistoric times, today online communities are an inherent and critical part of the Web learning experience. Implicit in most Web 2.0+ applications are social activities which help users network, share, create content, seek or research information, or contribute and interact with others. Youthful online learners are a driving force in this new social change, a change that adults can learn from and embrace. Our young Web users find technology is second nature and are unconsciously changing the paradigm of online learning as they communicate and socialize in a variety of new ways on the Web. Many adults are already following this trend. However, these ways of learning can only become mainstream only when many more adults who are responsible for adult learners learn to use the host of networking tools available. Moodle is an example of a popular open source application used successfully by many around the world. Understanding how to support collaborative online learning activities successfully can offer a huge leap towards greater online learning confidence, contribution and achievement. More is yet to come to change the paradigm of online learning and social networking in the future.

DOI: 10.4018/978-1-60566-828-4.ch007

SOCIAL NETWORKING, ADULT LEARNING SUCCESS AND MOODLE

Social networking is not really a new trend. The idea of learning through communication and collaboration is an old one. From the very beginning, humans have always gathered in groups to learn, communicate and socialize in communities with common goals, needs and interests. It is no surprise then that we humans, as the technology evolves, are similarly developing the Web with the same driving, evolutionary forces. Today, this process is enhanced by new online learning technologies supporting what is the next step in the evolution of the Web, commonly known as Web 2.0 or higher. The previous Web 1.0 phase, which was about finding and reading information, has passed—we have evolved. Users everywhere who have Web access are now collaborating passionately on a variety of social networking sites. Web 2.0 users are searching, creating and interacting with others with common interests to fulfill intrinsic needs to self-improve, learn new information and collaborate with others who are enjoying common likes and experiences. An important difference is that today's collaborative, online activities encourage others to engage and participate actively, continually and happily in the creation and use of new knowledge, artifacts and performance. This trend is in contrast to passive acceptance of what others know and pass on without collaboration or retention.

WHAT HAPPENING ON THE WEB? SOCIAL NETWORKING, SOCIAL MEDIA AND WEB 2.0+

There is a huge curiosity about the social networking phenomena. This is a groundswell of using technology to revolutionize learning and communication, especially among young people. More and more users really want to know how all this stuff works, who's doing it and how. Adults are equally becoming more enticed by the new opportunities to collaborate and be part of groups with common goals and interests. Social networking activities – including sites, blogs, chats, forums and wikis - are emerging to support online collaboration and sharing between users/learners more than ever before. Children are eagerly leading the way for adults in this latest fascinating and evolutionary technology trend. The loneliness of the Web 1.0 is over. Web 2.0 is about using new applications offering a social approach to work in collaboration to generate, share and reuse content. These new kinds of social activities and networks spark passions and help users find information, interact, self-improve and contribute. A description appears in the Wikipedia. Retrieved July 15, 2009, from http://en.wikipedia.org/wiki/Web_2.0.

Social networking activities can offer many advantages towards greater more successful online learning. Educators need to understand the opportunities supported by the new Web 2.0 tools and resources, which help harness the power to interact, create and contribute. Social networking websites are used by millions of people to connect with others with common, passionate interests and goals.

Researchers are also curious about social networking. It comes as no surprise that social networking offers other various benefits or influences. For examples, researchers at Harvard Medical School and the University at California, San Diego found that positive social networking relationships can make us happier. Such moods (e.g., happiness) can spread among those connected socially. "Everyday interactions we have with other people are definitely contagious, in terms of happiness," says Nicholas Christakis, a professor at Harvard Medical School and an author of the study (2008).Retrieved July 15, 2009, from http://www.npr.org/templates/story/story.php?storyId=97831171 and http://christakis.med.harvard.edu/

In North America, young adults are especially fascinated with collaborative sites, such as MySpace.com and Facebook.com. Adults are joining online communities too. For example, adults who may want to join charitable social networks that focus on giving back can join the Care2 non-profit foundation at http://www.care2.com/. Other examples are social networks that support families, health, longevity, hobbies, business or educational interests. Classmates.com and LinkedIn.com are examples of two social networking sites that have quickly grown in the last few years to accommodate those with passionate, related interests who want to network to accomplish common goals.

Federal governments and the military are equally involved in social networking to exchange information and interests behind heavily secured networks. In other examples, it is likely that social networking will have an even bigger impact in upcoming years in direct democracy, especially in how citizens involve themselves, voice opinions about how they are governed--nationally and globally. Already in the 2008 election, we experienced the powerful influence that social networking has on politics.

In the past few years, we have seen significant growth in seeing how companies and organizations are deploying consumer Web 2.0+ social networking tools to reach their customer base, e.g., online learning about products. This is a trend that will gain momentum as today's young people join the workforce and get involved in global concerns. Most corporate strategies will be adding social networking features on their site letting their users create profiles and offering opportunities to connect with people with common interests. They will want to support their workforce who are used to online collaboration. Many believe that social networking will have enormous potential for changing organizations, e.g., talent management effectiveness.

According to Awareness Networks, a social media solution provider, the "number of organizations that allow social networking for business purposes has increased, it says, to 69 percent in 2008-up from 37 percent in last year's survey." Retrieved July 15, 2009, from http://www.wipplaw.com/business-social-networking.html

You can find a list of international social networking sites on the Wikipedia web site. Retrieved July 15, 2009, from http://en.wikipedia.org/wiki/List_of_social_networking_websites

Individual Differences Impact Successful Online Learning

An especially important aspect of social networking and the successful acceptance and use of Web 2.0+-style tools is how individuals may need to learn, communicate and socialize differently. In other words, each of us a learning orientation, depending on a different set of genetics and body of experiences that influence how each of us will use our brain differently in different circumstances. Each of us have differences that will impact how we learn and use the Web differently—different abilities, goals, interests, needs and expectations will impact the success of each social networking and learning experience.

Recent advances in the neurosciences in the last ten years have revealed the extraordinary and fundamental impact of emotions on the brain. Emotions impact how we learn, communicate, socialize and set goals to live our lives. Theories about how emotions impact cognition, learning, memory and intention integrate biology with the more traditional psychological and educational aspects. Such neuroscientific theories propose new research foundations and explanations for individual differences and the important impact of emotions, values, intentions, and social factors on measuring and improving learning skills. These new theories will also help us understand how social networking technologies are changing our brain, especially our abilities to communicate, learn and innovate more successfully.

You can find examples of this research in Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning (Zull, 2002). Another example is Synaptic Self:

How Our Brains Become Who We Are (Ledoux, 2002). Newer books that echo this same research are: Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School by John Medina and The Brain That Changes Itself: Stories of Personal Triumph from the Frontiers of Brain Science (James H. Silberman Books) by Norman Doidge.

Based on these recent advances in the neurosciences, Martinez' learning orientation research (2001a, 2001b) provides information about individual learner differences. This research describes how learners think, socialize and approach life differently (learning, goal-setting, risk-taking, setting expectations, etc.) and uses three attributes to suggest reasons why, including independence or autonomy, self-motivation and strategic effort. Retrieved July 15, 2009, from http://www.trainingplace.com/source/research/. The neurosciences help to describe a comprehensive set of neurotransmitters in the nervous system that influence or alter these states to influence choices, learning, communication and social networking. Martinez' research demonstrates how some individuals may find it difficult and stressful to even use a computer for online learning much less sign on to a social networking site without an effective guidance and support system. Others may be good at using one type of collaborative tool but may find it overwhelming or frustrating to have to learn to use a wide variety of resources. Others might get angry if they have to do too much work in a site that does not interest them. The neurosciences and the learning orientation research can help educators understand individual differences and the reasons why some interventions and instructional strategies work better than others in social networking or online learning situations.

Unfortunately, too few educational studies explore how people interact with the Web and use online collaborative tools differently. However in areas such as Neuromarketing (a way to study the brain's responses to marketing stimuli), you will find much more research about individual Web use. Neuromarketing strategies explore how individual users create content, join communities and choose transactions, products and activities. Neuromarketing is a hot topic. An example is how Carnegie Mellon used brain scan research to study how consumers buy products. Retrieved July 15, 2009, from http://www.cmu.edu/news/archive/2007/January/jan3_brainscans.shtml.

Similarly in education and social networking, we need to explore the triggers that influence how learners anticipate, learn, commit and persist. We need to identify and better understand emotions, learning dynamics, relationships, and instructional strategies that provide more personalized, supportive solutions in a more social online learning experience. Tapping into emotions will help individuals make the connections that translate into improvement, progress and achievement. There is a growing body of neuroscientific research and evidence that suggests that each of us are differently influenced by various factors, such as maturity, gender, brain agility, learning, memory and communication ability, exposure to technology, life experiences, facilitation. Such factors are also influenced by an individual's ability to set goals, embrace change and take risks. Working against each of us are negative states, such stress, anxiety and frustration, which are detrimental to the learning and social networking experience. The neuromodulation research demonstrates how these negative emotions act as barriers to learning and communication and can impede progress to communicate, network and strive for self-improvement. Fortunately, these same negative states can shift into more positive states, such as anticipation, exhilaration and satisfaction, with sufficient guidance and support (e.g., using social networking tools and facilitation).

Not all educators embrace social networking tools. Many think such tools are a distraction and not supportive of academic goals. However, the growth of social networking technology demonstrates that many young people are very adept at embracing the innovative social changes introduced by technology. While education might have traditionally underestimated or ignored emotional and social aspects of learning, many young people today seem to be enthusiastic about getting it right. Put an interested kid on the Web with a MySpace account and you will probably not have to worry if he/she will learn how to use the computer or the social networking site. With the combination of enthusiasm, reward and social networking, his/her positive states are aimed at learning very quickly. Educators who can expertly tap into happy, engaged emotions in a supportive social networking environment have a powerful advantage, especially in addressing the individual needs of the learner and helping them with lifelong successful learning experiences.

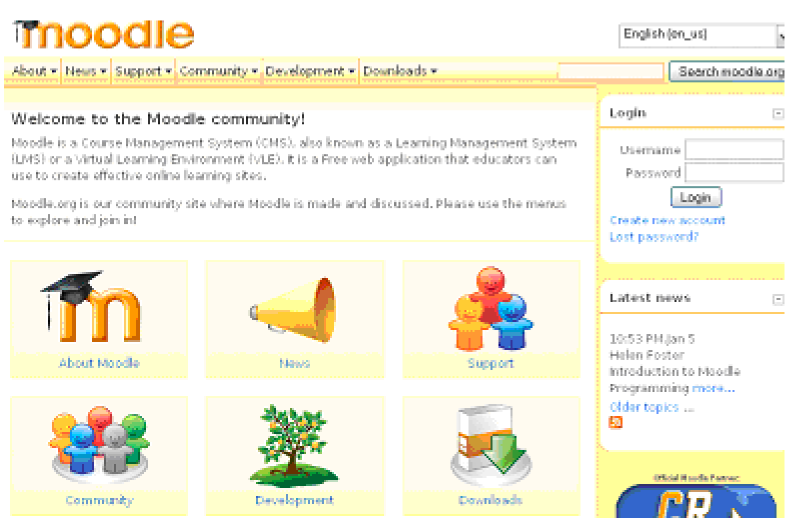
Fortunately in education, Moodle is just one of the social networking applications that has already changed online learning as we know it today. Moodle helps educators create, deliver and manage online courses. Moodle (Modular Object-Oriented Dynamic Learning Environment) offers many social networking tools, resources and activities to support opportunities for rich interaction and especially how people want and intend to learn differently.

Learning and Social Networking with Moodle

Moodle creator Martin Dougiamas, a WebCT administrator at Curtin University, Australia, began working on Moodle to support his dissertation about using "open source software to support a social constructionist epistemology of teaching and learning within Web-based communities of reflective inquiry" (Dougiamas, n.d.). While the dissertation remains unfinished, this research has strongly influenced the development of Moodle. Of particular importance, Moodle supports pedagogical aspects and constructivist and social constructionist activities. These types of considerations are often missing from similar learning and course management applications. The Moodle approach emphasizes that learners and teachers alike can contribute and experience learning using a variety of social networking resources and activities.

Moodle is an open source (free) course management system supported by a global community of developers, professionals and educators who are very passionate to improve the interactive online learning experience based on sound pedagogical

Figure 1. Moodle site at http://www.moodle.org



principles. Also often called a Learning Management System or Virtual Learning Environment, Moodle's open source license means that anyone can develop additional functionality and offer the new solutions back to the international Moodle community.

Increasingly, many schools, organizations and businesses around the world are meeting their online learning and social networking needs with Moodle. The Moodle community is global, rapidly-growing and eager to help with development, implementation, use and course creation. Introduced in 1999, Moodle has deeply penetrated K-12 and higher education and is now supporting the needs of corporations, especially small businesses. In 2006, the Moodle community reported over 22,000 registered web sites offering close to 900,000 courses to over 9 million users.

In less than 3 years, Moodle has multipled its user base with 35,437 registered sites with 24,396,163 users. Retrieved July 15, 2009, from http://moodle.org/stats/. It is easy to see that Moodle has enjoyed tremendous growth in the past few years. Moodle's international appeal is that it helps users create cost-effective online learning and social networking communities in different languages throughout the world; in rich and poor countries alike. Moodle's popularity also stems from the academic community's values of freedom, peer review, and knowledge sharing.

Typically in large organizations, institutions and corporations, Moodle use is restricted to departmental, divisional, or experimental use, particularly because of the lack of IT acceptance and Moodle's non-support of ERP, HR and other business processes. However, Moodle Partners (http://www.moodle.com) suggest that Web Services and W3C standards (e.g., SOAP and XML-RPC) strategies are successfully able to support the enterprise-wide needs of larger organizations. Many Moodle partners are available to offer a variety of corporate features to enhance Moodle capabilities. Whether you work in education, government, or the corporate sector, you cannot ignore Moodle's penetration into the LMS market. While Moodle isn't about to replace the more expensive proprietary enterprise-wide products like Saba's Enterprise or SumTotal's TotalLMS, the global community is using and enjoying Moodle a lot.

Worldwide institutions are deploying Moodle sites on a very large scale. A good example of a large Moodle implementation site is the Open Polytechnic in New Zealand. They have deployed Moodle across eleven polytechnics and three universities, along with several Government departments and a growing number of schools. In 2007, the Open Polytechnic of New Zealand won a prestigious $100,000 award from the United States-based Andrew W. Mellon Foundation. "The annual Mellon Awards for Technology Collaboration recognizes the work done by not-for-profit organisations globally in the field of open source software development and collaboration." Retrieved July 15, 2009, from http://www.icde.org/oslo/icde.nsf/id/DE27144682EDC2AEC1 2573A0003B8C71?OpenDocument. Their site appears at: http://campus.openpolytechnic.ac.nz/moodle/.

In the UK, according to government-funded 2006 OSS Watch Survey, Moodle was the LMS of choice for 56% of UK institutions. Retrieved July 15, 2009, from http://www.oss-watch.ac.uk/studies/survey2006/. Recently the Open University has announced a $7.39 million OpenLearn initiative that offers 900 hours of e-Learning available on their new Moodle platform for over 180,000 learners. Canada's Open University, Athabasca University has switched to Moodle for developing an effective learning management system that serves over 30,000 users for eleven undergraduate and graduate courses.

Similar developments have taken place in several countries ranging from New Zealand to Iceland, from China to Spain as a means of minimizing costs while maximizing reach. Developers, especially at large sites, are very adept at integrating Web 2.0 components into Moodle and expanding the platform to incorporate a larger variety of potential learning activities and learner engagement.

MOODLE'S 'SOCIAL CONSTRUCTIVIST PEDAGOGY' ENHANCES TEACHING AND LEARNING FOR ADULTS

Moodle's online learning innovations excite innovative educators. At its core, Moodle is educational software grounded in a philosophy of collaborative learning, often referred to as social constructionist pedagogy. In this approach, learning is viewed as much a creative, social process as it is an individual one, where people learn together by investigating, analyzing, collaborating, sharing, reflecting and drawing lessons. Perhaps this is a key reason why it has such a rapid uptake among the educational community.

Moodle developers put in core elements (e.g., tasks, activities, resources and tools) that encourage people to learn and develop understanding together by embodying pedagogical principles, including:

- Effective learning takes place when learners are actively engaged in constructing knowledge (i.e., creating or doing), rather than passively reading, memorizing or viewing
- An inquiry- and discovery-based approach is an effective way to learn
- Learners learn better when knowledge is chunked and structured according to a predefined segmentation, e.g. required and optional readings, key messages and in-depth content.
- Observing and interacting with our peers and the community is also crucial for learning and retention
- Collaborative environments encourage participants to be both teachers and learners at the same time
- Learning environments need to be flexible and adapt quickly to satisfy often rapidly changing learner needs
- Creativity and innovations are sparked (emotional appeal) when everyone has an opportunity to engage, contribute and exercise voice and participate

The organization and design of Moodle's interface is to support the learner and the online learning tasks and not technology and the tools. As an organizing framework, Moodle offers a choice of three different course formats to cater to a variety of eLearning experiences. For example, you can organize your course materials using the traditional Topic format, or a Weekly format, in which you organize content chronologically week-by-week, or even a Social format, which is less formal and more discussion-focused.

In terms of features, Moodle has all the standard features of LMSs that support a content-driven learning model (i.e., tools for course structuring, presenting text and multimedia, interactivity, quizzes, and assessments). Figure 2 shows a partial list of available collaborative activities. In addition, Moodle provides a suite of tools to promote interaction and social networking among people by sharing ideas, collaborating in small groups, discussing, and reflecting on experiences (and thereby meets the pedagogical principles summarized in the earlier paragraph). Discussions and dialogs are at the heart of effective online courses, and Moodle supports these through three standard channels of communication: Discussion forums (an asynchronous, public way of sharing thoughts), Chats (a more immediate and simultaneous conversation with groups) and Dialogues (a private channel between two or more people). Research indicates that learners remember only 10% of what they read, and about 50% of what they discuss, proving that these are more effective forms of learning.

In addition, Moodle offers teachers and course designers a toolbox full of powerful, interactive online teaching tools based on Web 2.0 collaborative technologies. A few of these tools that promote new channels of communication, and collaboration are described below.

- The use of online journals encourages participants to reflect on the course and content, to experiment in a safe haven, and to stimulate deep thinking and learning.
- Blogs are relatively new in Moodle and therefore is not as feature-rich when compared with other blogging platforms. However, since blogs for learning are growing in importance, you will definitely see major improvements to blogs in future versions of Moodle. Even in its current form, there is plenty of room for creative applications for blogging in Moodle. Some ways learners can use blogs include: to reflect on new learning, to express opinions, comments on topics, and to share and discuss course related resources, activities, projects. Teachers also find blogs useful to post course information, examples of student work, build a class newsletter, link to another class worldwide, and even to reflect on teaching experiences and offer insights.
- The simple, flexible nature of Moodle wikis makes them a powerful tool for collaborative work. Wiki, which means quick in Hawaiian, is a type of free, on-line writing space where content can be created, edited and viewed by a community of users. The best example of wikis is the Wikipedia (www.wikipedia.org) which is a free, multilingual web-based encyclopedia with over 12 million articles written collaboratively by volunteers. Moodle wikis offer a quick way for learners to collaborate and share ideas textually, while creating a content rich web site. Here the knowledge of the group is greater than an individual, and the end product is the result of the group's interactions. Learners can collaborate to summarize readings or lectures; brainstorm initial thoughts on new ideas, topics, or technology; investigate the authenticity of a topic, e.g., on Wikipedia; collaborate on group projects (where each person contributes a piece); create e-portfolios; and participate in group authoring of presentations, reports, papers and research papers. Computer-savvy users in the teaching community find wikis useful to collaborate on a syllabus or learning materials. Wikis offer huge potentials for building community collaboration and team solutions.
- Glossaries in Moodle help learners internalize the vocabulary of the field by creating definitions collaboratively and negotiating their meanings for common understanding and use. Beyond vocabulary, glossaries can also be used for other brief learning material, such as stories, tips, quotes, examples, and frequently asked questions. The key advantage of a Moodle glossary over a web page it is that its constant presence on the

Figure 2. A list of collaborative Moodle activities

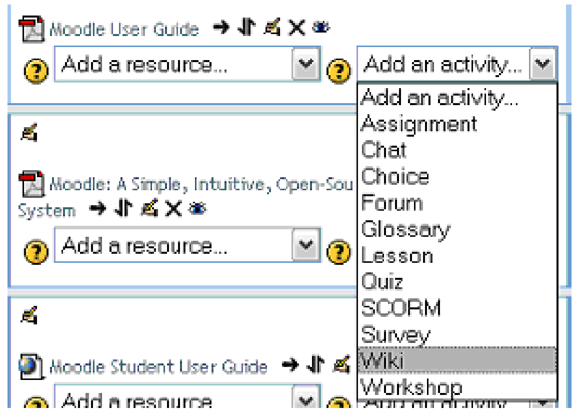
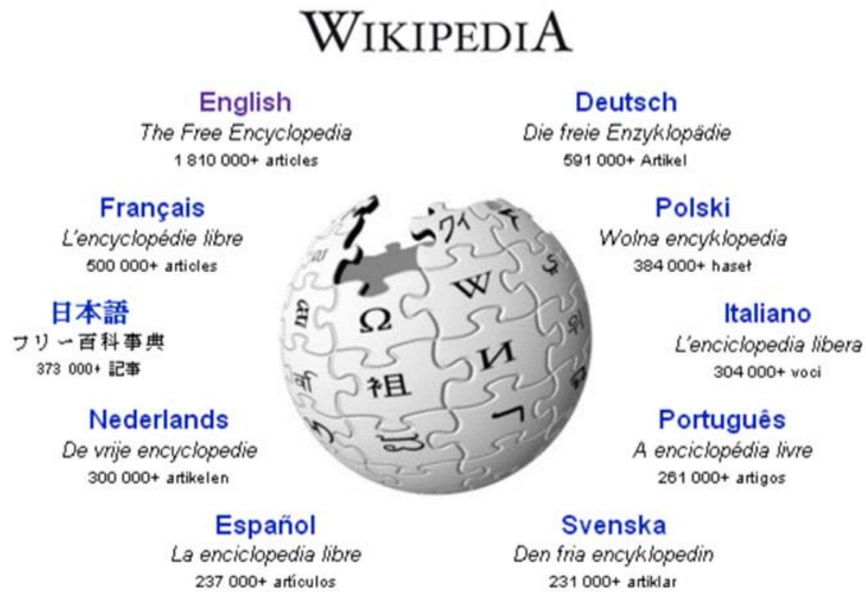


Figure 3. Largest WIKI – Collaborative encyclopedia edited by anyone in real-time



sidebar making it easily accessible from anywhere within the course.

By facilitating the use of various types of multimedia (such as audio, video clips, simulations) as well as a learner-centered approach, Moodle caters to adults with different learning preferences. Also, providing timely feedback and responses to adult learners is important to improve the effectiveness of learning. Moodle allows teachers and learners to provide both quantitative (via grades and reports) and qualitative (via scales that can be customized) feedback for nearly all activities and modules. Moodle features that support reflection address an important criticism of e-Learning compared to traditional face-to-face classrooms. For example, the Assignment module (in which learners can upload their work in any file format), allows the instructor to provide detailed comments in text as well as audio formats. This is true of Discussions, Journal and many other modules, in which feedback and reflection can be encouraged, restricted or made accessible to all participants.

In summary, via the tools and functionality described above, Moodle capably support adult learners. This fits Malcolm Knowles (http://en.wikipedia.org/wiki/Malcolm_Knowles) theory of andragogy, which suggests that adult learners are more autonomous and need the freedom and resources to direct themselves. They know their goals and abilities and they need to be able to connect to their own experience. Typically, adults must see a reason for learning something and then apply new knowledge that relates to their life, e.g., work life.

If you want to learn more about how to use social networking tools in Moodle, you can explore the following links resources for educators:

- Moodle Teaching Techniques, William H. Rice, Packt Publishing, 2007
- Using Moodle, Teaching with the Popular Open Source Course Management System,

Jason Cole, Helen Foster, O'Reilly Community Press, 2007.
- Useful Resources for Moodle Users. Retrieved July 15, 2009, from http://www.ibritt.com/resources/moodlethings.htm

Moodle, like most Web 2.0 tools, are not without some limitations. Some key concerns are described below:

- Vandalism and spam concerns could reduce credibility
- Culture of collaboration needs to be passionately promoted by champions offering incentives in support of common interests
- Inherent intention between control of content vs. freedom to collaborate and innovate
- Privacy issues
- Participants may potentially create legal complications by failing to respect intellectual property rights

Moodle and New Literacies for 21st Century Education

The increasing importance of collaboration for learning in the 21st century can be seen in the recent update to Bloom's taxonomy which factors in the new collaborative behaviors, literacies and new online learning opportunities that arise out of the advances to educational technologies (especially those associated with Web 2.0). As illustrated below, the updated Blooms taxonomy by Arthur Churches includes a digital component that maps out cognitive elements as well as the methods and tools that a teacher would use in the classroom. Such collaborative experiences that facilitate higher-order cognitive process are often facilitated by a variety of digital media increasingly available in Moodle and other CMSs/LMSs/LCMS.

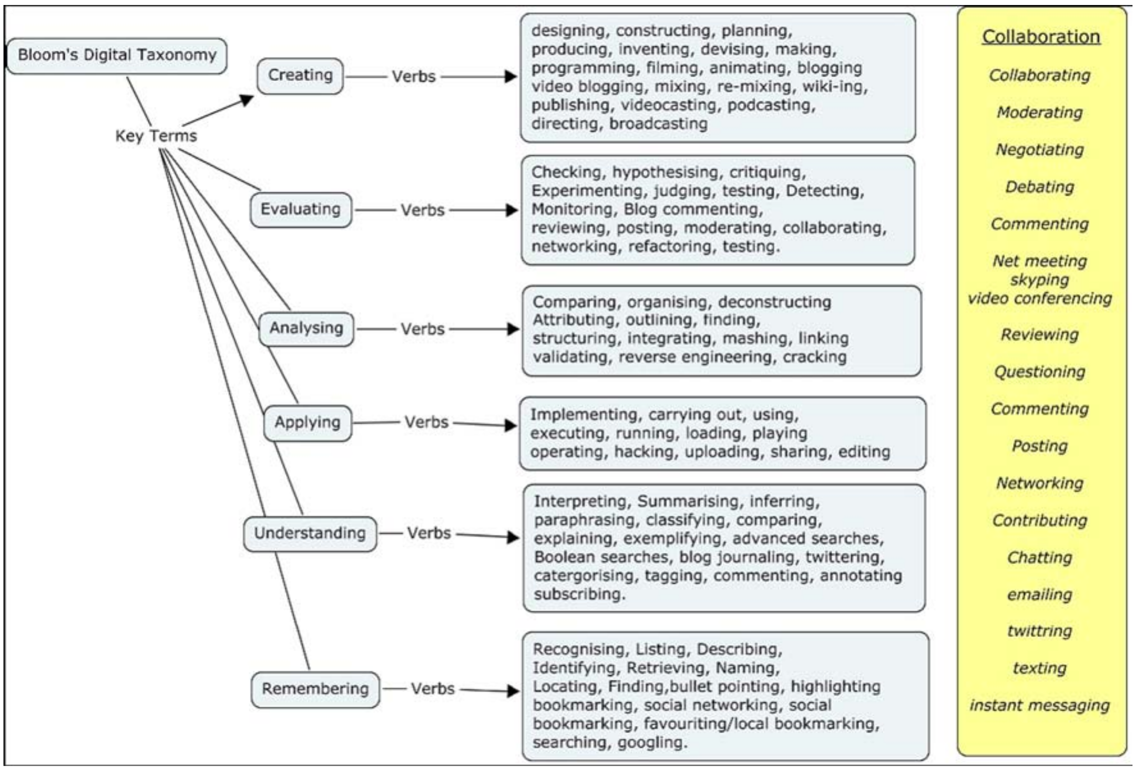
The impact of these Web 2.0 collaborative technologies on adult education is going to be huge, especially for the next generation. In addition to Moodle, just about every new software application that is available today has such tools built in –often free, open source and easy to use. As Will Richardson (2006) puts it "teachers will be using Web 2.0 tools like blogs and wikis and the like in ways that are transforming the curriculum and are allowing learning to continue long after the class ends. They are tapping into the potential of the Web that is a conversation and not a lecture, where knowledge is shaped and acquired through a social process, and where ideas are presented as a starting point for dialogue, not an ending point" (pp. 126). What we have now is a read/write/collaborate Web, which will continue to evolve and grow in the coming years (Richardson, 2006, pp. 126). As educators, we must use the new tools creatively to enhance teaching and learning for future success. To be effective, the role and abilities of adult learners too will need to change to include the new literacies. Learners must learn to be active consumers of information on the Web, be able to articulate and publish their ideas and thoughts online, be adept at working collaboratively with others in virtual environments and also be able to manage vast amounts of information. For adult learners this is a challenge.

FUTURE TRENDS FOR MOODLE

Work is now ongoing for Moodle version 2.0 (Expected late 2009). Follow Moodle's roadmap. Retrieved July 15, 2009, from http://docs.moodle.org/en/Roadmap and Moodle news at: http://moodle.org/mod/forum/view.php?id=82 to monitor upcoming changes. Some changes expected very early in 2009 are:

- File handling improvements
- Conditional activities - allows dependencies and forced paths through activities, e.g., "You can't do this thing until that thing is completed"

Figure 4. Blooms digital taxonomy - Drawing by a churches created using C-Map Tools (© 2008 Andrew Churches. Used with Permission)



- Learner plans and competencies - individuals can have learning plans which are updated when courses are completed
- Improved HTML editor 2.0
- Community hub interfaces – makes it easy for users to find and navigate other systems and external Moodle repositories, leveraging the Moodle Network in various ways. Unit tests (mock db), and remove the need for slashes in user space.
- Feedback module – cleaned up and included as a core module.
- Improved Wiki module (nwiki) - cleaned up and included as a core module. Nwiki is a wiki engine designed to be part of a LMS.

As a supportive adult learning and social networking environment, Moodle seems to be meeting the needs of a very diverse international group whose members depend on sophisticated activities and resources to change education to a more active, social networking and collaborative experience. They see using Moodle to focus on learners and how they learn. It will be fun to sit back and watch the future unfold. Will the number of Moodle sites again double by this time next year or will Moodle be just another passing trend? And, will Moodle keep pace with the trend for a more intelligent, learner or user-centered Semantic Web?

CONCLUSION

Kids are leading the way with the new social networking and technology changes. Our younger generation is having a huge impact as they indulge in the very natural human need to share, collaborate, learn and contribute together as a group with common needs, interests and experiences. Young people are not only familiar with virtual worlds but will expect to access their information and develop their relationships with Web 3D environments.

As a result, adult online learning is also rapidly changing as the technology and trends are changing. Discussions about social networking and Web 2.0 tools are already evolving into Web 3.0 or the Semantic Web discussions. Terms like business and student intelligence and new literacies are also commonly accepted terms. These new developments will "collectively comprise what might be called 'the intelligent Web'—such as those using semantic web, microformats, natural language search, data-mining, machine learning, recommendation agents, and intelligent tutoring using artificial intelligence technologies—which emphasize machine-facilitated understanding of information in order to provide a more productive, intuitive and more personalized or individualized user experience." Retrieved July 15, 2009, from http://computer.howstuffworks.com/web-302.htm.

And already, futurists are discussing Web 4.0. Web 4.0 is still a hazy vision about personal intelligent agents. Retrieved July 15, 2009, from http://blogs.zdnet.com/BTL/?p=4499. "The Semantic Web is an evolving extension of the World Wide Web in which the semantics of information and services on the web is defined, making it possible for the web to understand and satisfy the requests of people and machines to use the web content. It derives from World Wide Web Consortium director Sir Tim Berners-Lee's vision of the Web as a universal medium for data, information, and knowledge exchange. Retrieved July 15, 2009, from http://en.wikipedia.org/wiki/Semantic_Web. It is important to note that these more sophisticated Web technologies have another important impact. As the technologies evolve, complex security threats and privacy, legal and ethical issues will emerge and need to be addressed.

Predicting what the Web will be like in ten years is very difficult. What is clear is that the Web will continue to change the way we teach, learn, work and socialize. More importantly, there is a rapidly growing understanding that the many behaviors are being influenced by social networks and other evolving technology in ways that we have not fully researched or addressed. Social networking is an area where researchers in many disciplines need to ramp up quickly to keep pace with our younger generation. There is less than a ten-year window where universities and corporations will need to develop more intelligent Web 3D learning environments. Environments that are personalized and reactive to individual needs of users and groups of users will become an essential part of the technological learning infrastructure. Within the next five to ten years, a corporation without an intelligent technology, and virtual world presence will be losing market share rapidly.

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This work was previously published in Adult Learning in the Digital Age: Perspectives on Online Technologies and Outcomes, edited by T. T. Kidd; J. Keengwe, pp. 68-80, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 4.2
Use of Social Software in Education: A Multiple Intelligences Perspective

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ABSTRACT

In this chapter, numerous educational activities are presented for instructors in order to address each type of multiple intelligences. Most probably, these educational activities are those which are already being experienced by many instructors. The key point here is that although students are exposed to many educational activities, instructors generally don't have any idea or rather don't consider the learning outcomes in terms of multiple intelligences. In general, assessment activities are based only on the chunk of knowledge that the student gains after any particular activity. In fact, instructors should deal with the effects and improvements in students other than just the knowledge, after engagement in educational activities. Thus, instructors should base their instructional plans on a theoretical basis, especially when integrating technology into their courses. Hence, the development and changing activities and other tasks of social software according to the multiple intelligences that underline individual differences were discussed briefly in this chapter.

INTRODUCTION

Innovations in technology have lead to the transformation of face to face interaction to online environments in past two decades. Many virtual communities have been constituted, for realizing different purposes by means of various technologies. Starting with the oldest and inevitably used technology, which we call e-mail, communication patterns and thus technologies have changed into discussion lists, forums, chat rooms and more recently blogs and wikis. These technologies are primarily used in

DOI: 10.4018/978-1-60566-826-0.ch004

business, nevertheless they have swiftly entered into and extended education. Hence, the latest technologies are used widely in most educational institutions today. The three common approaches for using of technology are to support to traditional instruction, blended learning, and e-learning. Among these alternatives, blended learning is the most prevailing as it has much more advantages than traditional instruction and e-learning (Horton, 2000). Blended learning takes the advantages of the strengths of classroom techniques together with web based training. Thus, the teaching-learning process occurs both in the classroom setting and the virtual environment, and all stakeholders can communicate both face-to-face and online.

Together with integration of the popular approaches, the usage of educational social software has moved forward greatly in distance education and e-learning at first. Afterwards, traditional learning and e-learning have begun to be used together - under the title of blended learning - by possessing the different benefits of both traditional learning and e-learning. In that process research studies have begun to be conducted in order to find out how effective all existing technologies are? Since the emergence of communication tools, many research studies have been conducted to maintain the effectiveness of these tools. Moreover, the results of these research studies have brought about the existence of the field known as computer-mediated communication (CMC).

In order to determine the success of these platforms, studies about students' and instructors' preferences and opinions about social software, content analysis of written posts or logs from the systems, interaction patterns and levels, which point out the usage of these social tools were conducted. Although the effectiveness of communication tools has been investigated from multiple perspectives by using different research methods in various settings, these studies currently do not contain the necessary theoretical framework. Nevertheless a number of conceptual frameworks, such as individual differences, social learning, collaborative learning and constructivism, frequently seemed to be used by many studies for establishing the theoretical foundation. However, the effectiveness of learning is a major concern in these environments since online environments are social platforms. It is necessary to make different theories for clarifying available communication patterns or educational activities in order to reach a more generalized and reliable result.

Under the lights of discussions, educational activities and tasks in these platforms must be constructed according to the theoretical framework. Thus, this chapter aims to discuss the development and changing activities and other tasks of social software according to the multiple intelligences that underline individual differences.

MULTIPLE INTELLIGENCES THEORY

"Multiple Intelligences Theory", proposed by Gardner (1993), approaches learning and instruction from a different perspective. Some researchers have claimed that our intelligence or ability to understand the world around us is a changing process, where people show diversity in terms of understanding and learning. Abilities in performing different skills may differ from individual to individual. One person may be good at playing a musical instrument; one individual may be good at playing football and another maybe good at writing poems. These differences among people are addressed in the multiple intelligences theory. To give an example, if an individual has strong spatial or musical intelligences, instructors should encourage those students to develop these abilities. Gardner points out that the different intelligences represent not only different content domains but also learning modalities.

Howard Gardner viewed intelligence as the capacity to solve problems or to fashion products that are valued in one or more cultural setting (Gardner & Hatch, 1989). Although Gardner initially proposed a list of seven intelligences, he

Table 1. Multiple intelligences

Type of Intelligence	Description
Verbal-Linguistic intelligence (Word Smart)	Interested in spoken and written language, the ability to learn languages, and the ability to use language to accomplish certain goals like effectively use language to express ideas.
Logical-mathematical intelligence (Number Smart)	Addresses the capacity to analyze problems logically, solve mathematical operations, and investigate issues scientifically. Examples maybe detecting patterns, reasoning deductively and thinking logically.
Visual-Spatial intelligence (Picture Smart)	Involves the potential to visualize graphics such as three-dimensional objects, imagine the details of an object mentally and draw visually appealing graphics and arts.
Bodily-kinesthetic intelligence (Body Smart)	Includes the potential to use one's whole body or parts of the body mentally and physically in harmony. The coordination of bodily movements in a rhythm, balanced and flexible way is the core of this type of intelligence.
Musical-Rhythmic intelligence (Music Smart)	Involves skills in the performance, composition, and appreciation of musical patterns. The ability of recognition and composition of musical pitches, tones, and rhythms are also among the important tasks of this type of intelligence.
Interpersonal intelligence (People Smart)	Deals with the abilities to understand and interpret the intentions, motivations and desires of other people emphatically. Effective communication and collaboration is also covered in this type of intelligence.
Intrapersonal intelligence (Myself Smart)	Involves an individuals' ability to recognize herself / himself in terms of trust, problems, feelings, fears and motivations. Knowing one's own capacity and deciding on what to achieve is also among the properties of this type of intelligence.
Naturalist intelligence (Nature Smart)	Deals with sensing patterns in and making connections to features and elements in environment and nature. It also enables individuals to recognize, categorize and draw upon certain features of the earth.

later made additions to this list. For this chapter, eight intelligences are taken into consideration: Verbal-Linguistic (Word Smart), Logical-Mathematical (Number Smart), Visual-Spatial (Picture Smart), Bodily-Kinesthetic (Body Smart), Musical-Rhythmic (Music Smart), Interpersonal (People Smart), Intrapersonal (Myself Smart) and Naturalistic (Nature Smart) (Smith, 2002, 2008; Brualdi, 1996; Gardner, 1993, 2006; Gardner & Hatch, 1989; White, 1998).

In the light of these facts, educational social software can be investigated in terms of different intelligence types. Furthermore, the tasks given to students may be organized in a way that addresses multiple intelligences. In this way, not only will technology be integrated into teaching-learning processes in an effective manner, but students will also have the opportunity for improvement in the different multiple intelligences. As also suggested by McCoog (2007), one of the best ways to make students acquire 21st century skills such as global awareness and social responsibility, is to differentiate instruction through the use of Gardner's multiple intelligence and technology.

For this chapter, blogs, wikis, instant messaging, forums and e-mail technologies have been selected for investigation from a multiple intelligences perspective. Before going any further, it will be useful to understand these technologies in more detail.

BLOGS

Blogs are called as a method of effective communication in online environments, and innovative ways to use them in education are frequently appearing nowadays. Originally, a blog was an online diary posted on the web that included the publication of personal thoughts, feelings, hobbies, and experiences in a chronological order.

Blogs can also be defined as online writing tools that help their users to keep track of their own online records (Hsu & Lin, 2008). Anyone who doesn't have advanced computer and Internet usage skills can still create such web pages, and express their feelings to others with the help of blogs. Furthermore, blog users and non-blog users can post their comments on the written issues easily. Depending on the authors' preferences, these online writing tools can include features such as links to other blogs, the author's detailed profile, and most importantly feedback from readers (Ellison & Wu, 2008). Blogs can be used for many purposes, but when they are used for educational goals, they can enrich the classroom environment and facilitate social interaction among students. Instructors can integrate blogs in blended and online learning to facilitate specific strategies: posting student work, exchanging hyperlinks, fostering reflective approaches to educational genres, forming and maintaining knowledge communities (Oravec, 2003).

Moreover, usage of blogs can address some of the theoretical underpinnings that are summarized below (Glogoff, 2005):

- In instructional blogging, as a knowledge-centered instructional tool, the instructor designs research activities that engage students in discussions with practitioners, and lead them through developmental concepts of the discipline's knowledge domain.
- In learner-centered blogging (that acknowledges the important attributes of learners as individuals and as a group), the instructor gives positive feedback to students regarding their comments and by posting comments for discussion. In this way, learner-centered blogging offers particularly useful opportunities for learner-centered feedback and dialogue.
- For providing community-centered instruction, blogging supports the importance of social and peer interaction.
- As a receptive learning tool, blogging can encourage students to acquire information from resources and reflect on what they have gathered.
- In a directive learning environment, blogs provide students with equal access to information, to expand students' understanding of specific issues, and to direct students to explore additional material.
- As a guided discovery and knowledge construction, blogs can also be used to present information architecture and explore more from web sites for other content.

To briefly summarize their many purposes, blogs can easily be used in educational environments. Publication of any materials, course notes, reflections may lead others to review, comment or study. At the same time, blogging not only supports individual sharing, but also allows other visitors to interact with the archived content, blog readers and the owner.

WIKIS

A wiki is a collection of web pages linked to each other which reflect the collaborative effort of many students working together. "Although it is not known as content management systems, wiki systems are another approach to publishing on-line information and a different way to collaborate" (Pereira & Soares, 2007, p. 88). Unlike blogs, which are chronologically reverse-organized, wiki pages are loosely structured but are linked in different ways (Beldarrain, 2006). Namely, "a wiki is a web site in which users can create and collaboratively view, edit, track changes, and save information by means of web browser" (Butcher & Taylor, 2008, p. 34). In these wiki pages, the instructor can also assess, edit or delete the information posted by the students, while students in a team can revise-edit, comment, contribute, reference or study.

Table 2. General information on blogs (adapted from Hsu, 2007)

BLOGS	
Description	A technology that allows a sequence of entries to be posted and published online
Advantages	Reflection and critical thinking Authenticity through publication Social presence Development of a learning community Active learning Ability to receive and respond to feedback
Disadvantages	Controlled primarily by blog author Editing/modifications not open as in a wiki
Educational applications	Online learning journal Problem solving/manipulation space Online gallery space (writings, portfolio, other work) Peer review exercises
Course/ subject suitability	Writing courses Foreign language courses Research seminars
Theoretical foundations	Activity theory Guided discovery Cognitive scaffolding Receptive learning Social cognition Community practice Communities of inquiry

One of the most well known examples of a wiki is Wikipedia, an online encyclopedia with entries authored and edited by different people from around the world. Wikis are very useful tools for educational purposes, since they encourage student participation and also a sense of group community. "Indeed, an important element of this is the relaxed sense of control over the content, allowing students to have a greater role in managing its focus and direction" (Hsu, 2007, p. 80).

The attractive characteristics of wikis can be summarized as follows by Shih, Tseng and Yang (2008).

- **Rapidity:** The wiki pages can be rapidly constructed, accessed and modified, in hypertext form.
- **Easy:** A simple markup scheme (usually a simplified version of HTML) is used to format the wiki pages, instead of the complicated HTML.
- **Convenience:** Links to other pages, external sites, and images can be conveniently established by keywords. Moreover, the targets of the keywords, links, need not exist when the links are built. They can be appended later.
- **Open source:** Each member can create, modify and delete the wiki pages. Wiki content is not reviewed by anyone before publication, and is updated upon being saved.
- **Maintainability:** Wiki maintains a version database, which records its historical revision and content, thus enabling version management.

In summary, a tool for collaboration and a form of groupware, wikis can be used for courses and activities where there is a document, text, or other project to be worked on jointly by a class or group. The compilation of a class or group report

Table 3. General information on wikis (adapted from Hsu, 2007)

WIKIS	
Description	A technology that allows for material to be easily published online, and also allows open editing and inputs by a group
Advantages	Contributions and editing by a group Open access to all users Collaborative
Disadvantages	Lack of organization and structure may result in an unmanageable wiki Tracking of contributions and modifications can be difficult Quality control
Educational Applications	Collaborative writing/authoring Group project management Brainstorming activities Knowledge management
Course/ subject suitability	Knowledge management Writing Group work in courses
Theoretical foundations	Conversational technology Constructivist learning tool

or project, the creation of a knowledge base, or brainstorming sessions appear to be viable applications (Hsu, 2007).

INSTANT MESSAGING (CHAT)

Synchronous discussion, or chat or instant messaging, refers to online dialogue occurring in real time. In chat sessions, there is no time delay between the sender's transmission and the receiver's receipt of the message unlike asynchronous communication (Borowicz, 2004).

Instant messaging engages geographically-distanced students in synchronous dialogues and offers a flexible platform for knowledge construction. Moreover, chat can be used to enhance out-of class learning activities by supporting collaborative learning and improving communication (McCreary & Ehrich, 2001).

Chat can be used in educational settings for many purposes. For example, in distance education it can be used for meeting with students once a week or twice a week, thus facilitating regular meetings, since online discussion lies at the core of distance courses. Moreover, in a blended environment, other activities can be arranged in which all students from a variety of locations are given a problem to solve collaboratively, meaning virtual problem solving groups. Students can invite people such as expert in various fields, community leaders, and others to their chat sessions. Furthermore, it is possible to communicate other people to practice language skills with the help of chat programs (Ingram, Hathorn & Evans, 2000).

For effective usage of instant messaging in courses, and to affect the quality of educational discussions, Ingram, Hathorn, and Evans (2000) identify a number of critical issues for instructors:

- **Environment:** As the graphical environment of the chat rooms is important, it is advised to use a chat program supporting graphical-based programs instead of text-based ones.
- **Task:** A clear discussion topic or detailed description of the expected product at the end of the discussion should be offered to the students. A second important issue for

Table 4. General information on instant messaging (adapted from Hsu, 2007)

INSTANT MESSAGING	
Description	Synchronous communications that allow for informal communications to be conducted easily and quickly
Advantages	Availability and acceptance by students Social presence Synchronous communications Encouraging collaboration Reduces formality in communications
Disadvantages	Distracted attention Expectations of 24-7 instructor access Can be time consuming for instructors Benefits are uncertain in classroom settings
Educational applications	Virtual office hours Collaboration on group projects Synchronous class discussions Mentoring
Course/ subject suitability	Courses with group projects and assignments Distance learning support
Theoretical foundations	Active learning Dual (verbal and visual) processing

offering task is type of task, i.e. tasks that require research and review of other materials would not be appropriate for this type of synchronous online discussion tool.

- **Rules:** A clear set of rules is useful for controlling and directing discussions in the chat sessions. It is also important for students to know when to write and when to read.
- **Group-size:** Synchronous online discussion tools usually work best with small groups of three to five students. When group size is larger than this range, it is advisable to divide discussion groups into separate groups in different chat rooms.
- **Identity:** To prevent a student from hiding their own identity, it is advised for students use their own name and not to mislead the rest of the group and the teacher with nick names.
- **Moderation:** According to factors such as large group size, task type or level of students, the instructor may prefer to find a moderator to lead the discussion and keep it on track.

Instant messaging, which is a synchronous tool mostly used to communicate, can also be used to support distance and blended learning to enhance learning activities by supporting collaborative learning. Possible activities may be performed by using chat programs in educational settings in a way of short discussions individually or as a group. Some activities may consist of role playing, conversation in different languages, word games in different languages, grammar games in different languages, brainstorming, summary of a subject taught previously, problem solving activities, case studies and peer review/editing.

FORUMS

A forum is an asynchronous platform where students can communicate by posting messages and responding to them for collaboration or discussion. If it is used for academic discussions or

Table 5. General information on forums

FORUM	
Description	Asynchronous communications that allow for communication and discussion to be conducted easily
Advantages	Availability and acceptance by students Social presence Asynchronous communication Encouraging collaboration Reducing formality in communication
Disadvantages	Distracted attention
Educational applications	Collaboration on group projects Asynchronous class discussions Mentoring Peer review exercises
Course/ subject suitability	Courses with group projects and assignments Distance learning support
Theoretical foundations	Active learning Dual (verbal and visual) processing

out-of class activities, online forums can enhance learning processes (Chen & Chiu, 2008). The most useful educational advantage of online discussion forums is to provide the time available for reading a message and think about a response, which can help to improve reflection upon and development of a topic (Guiller & Durndell, 2007).

Discussion forums can be used for many different purposes in different educational environments. The forums may be used as a support to distance or blended learning for social interaction, for discussion of topics towards answering the frequently asked questions, and for individual homework or group projects as a collaborative tool. Differentiated according to the purpose of the forum, instructors may:

- "limit discussions to one or more instructor-initiated themes,
- lead more general discussions,
- assume the role of answering most of the questions from students,
- moderate the discussions but maintain a low profile in them, or even be entirely absent from the discussions" (Mazzolini & Maddison, 2003, p. 238),
- assign a student as a moderator, and
- support discussion and motive to join non-participants into debate.

The discussion in the forum can often be carried out easily within small groups, which made up of four to eight students for learning sets or medium sized group with 20 to 30 students for discussions. If the forum is supposed to set up for very large groups, there may be disappointment with the levels of participation and there may be disorder of posted messages, so that it becomes unmanageable. Conversely, in small groups it is easy to control and follow the messages and information and also the participation level of the students. The participation in the discussion is not only important in face to face environments, but also it is an important concern within any small group in an online environment (Hammond, 2000).

E-MAIL

E-mail (electronic mail), which is a service for sending messages electronically, allows communication among people regardless of the status of

Table 6. General information on e-mail

E-MAIL	
Description	Asynchronous communications that allow for communications and discussion to be conducted and send messages electronically
Advantages	Asynchronous communications Encouraging writing and communication skills Reducing formality in communications Sending messaging to more than one person
Disadvantages	Distracted attention Time consuming for answering complicated questions
Educational applications	Asynchronous class discussions Peer review exercises
Course/ subject suitability	Courses with group or individual projects and assignments Distance learning support
Theoretical foundations	Active learning Dual (verbal and visual) processing

people, i.e. whether they are online or not. Moreover, the exchange of electronic text messages and computer file attachments between computers requires people to have a mail account, which is a place where someone can contact another person. Furthermore, an e-mail address is a unique name that identifies an e-mail recipient for the transfer of information from one computer to another. It is possible to store, send, compose, forward and receive messages over electronic communication systems by means of the using e-mail.

E-mail can also be used for many purposes. These purposes may be mainly for communication and the transformation of information. Palmer (2000) illustrated internet usage in education, noting that the WWW (for the delivery of multimedia content) and e-mail (for basic electronic communication) are the two important Internet services for teaching and learning. If the students and instructors cannot easily arrange face-to-face meetings, it is important to use e-mail communication (Lightfoot, 2006; Le & Le, 2002).

Martin (1996) chose the e-mail method in his courses in a research study because "student assessment was through requiring students to summarize, comment or discuss the content of each lecture", and "most of the students were part time, visiting the campus only for the scheduled classes" (p. 823).

Being an easy method to send messages, information or other kind of materials by just a few mouse clicks, the instructor want to take into consideration some issues. Instructors can:

- choose a topic for which individualized communication can take place and create links outside of regular space, time,
- support detailed analysis and reflection,
- give participants insight into others' perspectives, and
- keep records of the dialogues and messages (Cook-Sather, 2007).

CREATIVE IDEAS TO USE SOCIAL SOFTWARE IN EDUCATIONAL SETTINGS FROM MI PERSPECTIVE

Considering the advantages, opportunities and educational applications, social software can be integrated into many courses in various ways. Differentiating among intelligence types, social software can be used to create, modify, share, publish, and store course content while also offering communication flexibility. A list of educational activities addressing multiple intelligence types are presented in table 7. The concept and subject can be varied according to the type of intelligence and activities can be enhanced in this way.

For example, if students are required to complete a brochure with a word processor, the tasks and requirements should include steps such as: download a brochure template from the web site, modify the style and formatting of the template, choose a place to introduce or create a place never seen, search for images and information for that place, place images and information into the brochure template, and save and share this product via appropriate educational software. Adding details not only makes educational activities more extensive, but also addresses more than one type of intelligence. In this example, it is thought that Verbal-Linguistic, Bodily-Kinesthetic, Visual-Spatial, Intrapersonal and Naturalist intelligence types are emphasized through the completion of this kind of brochure.

For the effective integration of educational social software into existing curricula and courses, instructors should take into consideration the following suggestions. These suggestions will lead instructors to being able to achieve two major goals. The first goal is the improvement of the ICT skills of students through proper use of recent technologies. Use of the latest technologies to communicate and share resources will provide students the chance of having or improving their ICT skills and become lifelong learners which is expected of them as 21st century students. The second goal addresses the improvement of multiple intelligences. Performing tasks addressing different multiple intelligences will not only yield the manifestation of the dominant intelligent types but also provide opportunities for improving the less dominant intelligence types. In order to enhance students' ICT skills by addressing various types of multiple intelligences, instructors should be aware of the capabilities and opportunities that the software provides.

As previously mentioned, blogs provide users with a platform where people can post messages and others may view and respond to these posts. Moreover, the blog users can upload files, images, sounds, video, etc. to create more amusing content for their viewers. All the content elements are kept in a certain section or category named by owner. Distinct from blogs, a wiki is a type of web site which enables the students to add, remove, and edit the available content and includes the collaboration of work from many different author that is wikis can be seen as a community for collaborative documentation. Discussion forums, applications allow users to post messages and replies, also the linking of images, videos, sounds or other types of files with the help of other web sites offering opportunities to upload files. Chat programs and e-mail provide the opportunity for sharing all types of file with attachments. Transmission of information is sent in real-time in chat programs, whereas there is a little time delay in the e-mail method according to the status of servers.

Moreover, after realizing the potential benefits of the software, an instructor should take into consideration which multiple intelligence domains is mostly covered by the selected software. Hence, as also suggested by Nelson (1998), instructors can design their lessons including new learning activities fitting the individual strengths of all their students by using internet and web tools. Thus, the list in table 8 is provided to serve as a guide for instructors while addressing multiple intelligence types.

In the light of these facts, some suggestions for instructors in order to support courses with the use of social software for improving multiple intelligences of students are listed as follows. For each type of intelligence, possible computer software, educational tasks and activities have been explained separately.

Table 7. Activity chart for multiple intelligences

	Verbal-Linguistic	Logical-Mathematical	Bodily-Kinesthetic	Visual-Spatial	Musical-Rhythmic	Interpersonal	Intrapersonal	Naturalist
Brochure about a place	●		●	●			●	●
Course document	●		●	●			●	
Concept map	●	●	●	●			●	
Story telling presentation	●		●	●	●		●	
A short play	●		●	●	●		●	
A scenario	●		●	●			●	
A poem	●		●				●	
An essay	●		●				●	
A newspaper	●		●	●			●	
An interview	●		●			●	●	
Scoring excel sheet		●	●	●			●	
Self-improvement Graph in excel		●	●	●			●	
A talk show	●		●			●	●	
A puzzle	●	●	●	●			●	
A drawing in graphical editor program			●	●			●	●
Curriculum vitae	●		●	●			●	
Documentary film about global warming	●		●	●	●		●	●
Strategy game		●	●	●	●	●	●	●
Drill and practice		●	●	●	●		●	
Word game	●		●	●	●		●	
Simulations		●	●	●	●		●	●
Sound edit			●		●		●	
Video edit			●	●	●		●	
Sound record			●		●		●	
Video Record			●				●	
Write a song	●		●		●		●	
Create animations			●	●	●		●	
Discussion in chat-forum-email	●	●	●			●	●	
Database creation	●	●	●				●	
Program coding		●	●				●	
E-portfolio	●		●	●			●	

Table 8. Software chart for multiple intelligences

	Verbal-Linguistic	Logical-Mathematical	Bodily-Kinesthetic	Visual-Spatial	Musical-Rhythmic	Interpersonal	Intrapersonal	Naturalist
Word Processor	•	•	•	•			•	•
Desktop Publishing	•	•	•	•			•	•
Animation Software	•		•	•	•		•	•
Audio Editing Software			•		•		•	
Video Editing Software			•	•	•		•	•
Graphics/Image Editor			•	•			•	•
Simulation Software		•	•	•	•	•	•	•
Educational Games		•	•	•	•	•	•	•
Tutorials			•	•	•		•	
Drill and Practice		•	•	•	•		•	
Multimedia Editing Software	•		•	•	•		•	
Web Development Tools	•		•				•	
Audio Conferencing			•		•	•	•	
Video Conferencing			•	•	•	•	•	
Mathematical Software		•	•				•	
Concept Mapping Software		•	•	•			•	•
Musical Software			•		•		•	
Web-based Educational Software	•		•				•	
Modeling (3d) Programs			•	•			•	
Database Management Software		•	•				•	
Search engines	•	•	•	•	•	•	•	•
Virtual Courseware	•		•			•	•	
Research Tools	•	•	•				•	
Collaborative Software	•		•			•	•	
Programming languages		•	•				•	
Architecture software		•	•	•			•	•

Suggestions for Verbal-Linguistic Intelligence (Word Smart)

Students may prepare a composition, a story, a poem, a report (on a film, a theatre play...), a summary report, a newspaper, a brochure or a scenario through word processors. Using audio editing tools, students create recordings of a sketch, a composition, a poem, storytelling, news program, interview, scripting, choral reading and retelling. Through audio-video conferencing, students make discussions on a previously given topic. Using presentation software, students may design a narrated presentation on a given topic.

Suggestions for Logical-Mathematical Intelligence (Number Smart)

Students may create scoring pages by using spreadsheets. With the help of puzzle maker programs, students may prepare puzzles. Through mathematical and scientific software, it is possible to solve equations and draw graphs and moreover, students may report causes and effects of solutions. With the help of programming languages and database management programs, students may write codes to create databases. Playing strategic, logic and mind games and simulations is another type of activity to be completed according to lesson objectives.

Suggestions for Visual-Spatial Intelligence (Picture Smart)

By using a graphics/image editor, students can design graphics, cartoons, posters, and can create concept maps with concept map software, worksheets and flowcharts with word processing. Moreover, through 3D modeling programs, students may 'architecturize' real-life objects. It is also possible to integrate actual taken photos into animation programs to present a slide show or create a video in video editing programs. Through architecture software, students can create samples of buildings according to the given scale.

Suggestions for Bodily-Kinesthetic Intelligence (Body Smart)

Students may have the chance to drag and drop cards, elements, objects etc. in the computer-aided environment by using drill and practice software. Playing any games, simulations, strategy and card games, or any programs reinforce this type of intelligence.

Suggestions for Musical-Rhythmic Intelligence (Music Smart)

Audio editing software makes it possible for students to create audio clips by mixing sounds and adding effects. It is also easy to add sounds and audio clips to animations designed in multimedia software or authoring languages. Moreover, PowerPoint slides including sounds or sound effects can be produced. Besides these kinds of activities, it is easy to play virtual instruments with the help of musical software.

Suggestions for Interpersonal Intelligence (People Smart)

By playing video games that involve hundreds of players simultaneously, for example massive multiplayer online games, students can interact and communicate with others. Communication, consensus, and collaboration are the other main concepts underlined by group projects completed in any software in project-based learning. Likewise, the completion of a WebQuest requiring role playing enables students to empathize with one another in different situations. Moreover, joining a video conference, a type of connection of groups via satellite or codec technology, also can be recorded and shared via educational social software. By moderating a chat session or a discussion in a forum, students are able to follow the flow of discussion, communicate and interact with others in a more responsible manner.

Suggestions for Intrapersonal Intelligence (Myself Smart)

Through the usage of word processing, students can design curriculum vitae including the individuals' life history, job history, achievements and skills. With the help of virtual courseware, tutorials and drill and practice, students may study and repeat their lessons at their own pace. Through search engines, students can make research on a topic individually and prepare a reflection paper via word processor. To publish personal feelings, photographs, interests and hobbies, a personal web page can be created using web page development tools.

Suggestions for Naturalist Intelligence (Nature Smart)

Video editing programs provide students to create a documentary film covering possible environmental problems and solutions: i.e. environmental pollution, weather pollution, sea pollution and global warming. Through graphic/image editing software, students can design a poster that announces the issue of waterlessness and smart usage suggestions for it. Again in the same software, it is possible to create a banner that gives a message to stop forest fires for use at the top of web page. In animation programs, students can create season timelines to depict the differences between seasons.

DISCUSSION AND CONCLUSION

Today, all these tasks require technological literacy to some extent. Since the traditional curriculum does not promote the acquisition of contemporary technology skills, many attempts at integrating technology into the curriculum have been made and are still continuing. Being aware of the potential contributions of technology during and after graduation, instructors should use technology for its anticipated effects on students. Instructors should be aware of how children learn through technology, and should facilitate students' pursuit of inquiries, and their development of critical thinking and problem solving skills through the use of collaboration, communication and technology.

These issues notwithstanding, the method of integration of educational social software should be based on one or more of these learning theories. The answers to questions, "how do students learn with technology" and "how can the content be delivered through technology", which are related to educational practices and activities, should follow a learning theory. Moreover, the integration of social software should also meet basic learning needs and goals for students. Some technologies like internet and web tools supporting individual and collaborative learning, classroom presentation, discovery/exploration, synchronous and asynchronous communication and distance learning, provide environments for teaching that focuses on students' individual strengths (Nelson, 1998). Hence, instructors should effectively integrate social software into their courses, and should prepare their students for their future careers as lifelong learners, by providing a variety of activities promoting the development of the multiple intelligences.

A review of educational social software and multiple intelligences theory has shown that no single educational software and no single educational activity based on computer software may not address the expectations of all students. Thus, educational social software and activities which are to be performed by students should be carefully selected in order to meet the diverse needs of all students, and make them achieve expected learning outcomes. Moreover, the selected social software should also support the type of content to be shared with students.

In this chapter, many educational activities are presented for instructor use in order to address each type of multiple intelligences. Probably, these educational activities are those which are already being utilized and experienced by many instructors. The key point here is that although students are exposed to many educational activities, instructors generally don't have any great idea about, or don't consider the learning outcomes in terms of multiple intelligences. Generally, assessment activities are based only on the chunk of knowledge that the student has gained after the particular activity. In fact, instructors should be dealing with the effects and improvements in students other than their knowledge after engagement in educational activities. A curriculum that combines technology and some learning theories such as multiple intelligence supplements students' strengths and expands their possibilities (McCoog, 2007). Thus, instructors should base their instructional plans around a theoretical basis, especially when integrating technology into their courses.

Technology, especially computers, are multimedia tools which provide students with many attractive features such as sounds, pictures, animations, films, visual appeals, virtual field trips and three dimensional visions. When instructors encourage students to use their different intelligences creatively, students may have the opportunity of extending and enhancing their own capabilities and multiple intelligences. Noting that "technologies set out to be mobilized for better instruction" (Gardner, 2000, p. 33), we need to realize how various technologies can help students to develop different capabilities and skills. It is not the presumption that all technologies can help all students equally, but that certain technologies can help certain students (Veenema & Gardner, 1996).

Each type of multiple intelligences supports certain instructional strategies. The ultimate goal of instructional strategies is to meet the overall needs of each learner in the class and therefore might require designing multiple lessons (McCoog, 2007). In order to support a student who possesses strong verbal-linguistic intelligence; activities should be mainly in the scope of the world of words. These educational activities may for example include researching the origins and meanings of the words from online dictionaries, online encyclopedias or e-books, learning how to speak in other languages, learning the grammatical structures of other languages, playing word games such as hangman, puzzles etc, preparing an online book or e-book on a given subject, writing a composition, a story, a poem, a report, a newspaper, a brochure or a scenario via word processor, etc. These activities mainly address the improvement of the quality of the students' writing and expressing his/her feelings.

From the logical-mathematical perspective of the students, by means of educational software students can conduct an experiment and see its results, prepare a crossword or any type of puzzle, write scripts using programming languages, draw graphs, play strategic, logic and mind games and simulations, etc. These activities mainly help to improve the analytic, critical thinking and also problem solving skills.

For empowering students who have visual-spatial intelligence; activities should cover the 'visuals'. It is easy to hold this kind of students' attention on a topic by allowing them to prepare movie clips, timelines, posters, graphics, and cartoons, integrate photos into animation programs to present a slide show or create a video in video editing programs, etc. Moreover, through 3d modeling programs, students may 'architecturize' real-life objects. Also, publishing or sharing his/her products to the visitors via web pages, blogs and other types of educational software will encourage the student to produce more.

All the educational activities completed with the use of a computer-based environment support the usage of the skills of students with bodily-kinesthetic intelligence. The fact that computer applications are required to be used with a keyboard, joystick, mouse or other kind of hardware, students have to use these with physical skills, which is the scope of this intelligence. Therefore, using drill and practice software, playing any games, simulations, strategy and card games, and students may have to drag and drop cards, elements, objects, etc. in the computer-aided environment.

To support students with musical-rhythmic intelligence, educational activities should include activities based on music or musical forms. For example, activities may include adding sounds to presentations, animations, creating audio clips by mixing sounds and adding effects. Moreover, allowing students to play virtual instruments may keep interests in lessons alive.

For the students who have strong interpersonal skills, educational social software serves as a communication tool. It is easy to interact with other students by completing a project, playing video games with other players, joining a video conference, etc. Moderating a chat session or a discussion in a forum allows students to follow the flow of discussion, communicate and interact with others in a more responsible manner.

Individualized learning for the students possessing strong intrapersonal intelligence type is also applicable with all type of computer-based software. For example, tutorials, drill and practice software, simulations, web-based courses, educational games allow students to progress at their own pace. Through the usage of word processing, students can design curriculum vitae including the individuals' life history, job history, achievements and skills. Through search engines, students can conduct research studies on a given topic individually and prepare a reflection paper via word processor. To publish personal feelings, photographs, interests and hobbies, personal web pages can be created using web page development tools. Also, a self-improvement report with graphs prepared via word processing make this kind of student aware of their capacity, meaning things which are in the range of his/her ability and things which are not.

In order to support students with naturalistic intelligence, computers and the internet help them to explore the world as a virtual world. For example, virtual museums about dinosaurs, nature, or history offer a journey to the ancient times. Image galleries about underwater life, e-books about the environment, and videos including different scenes of the world may hold the attention of this type of student in educational applications. Moreover, some self-prepared activities will cover this kind of intelligence, such as creating a documentary film including global warming, a poster describing waterlessness and a banner giving a message to stop forest fires, etc.

The creation of educational applications underlining multiple intelligences and usage of a medium for delivering these via educational social software may motivate students to hold their attention on various topics. Moreover, it is possible to make them like the topics they may have previously disliked. Through a variety of intelligences, educational activities can be enhanced and attract the students' attention. Therefore, instructors try to use these technologies or explore new technologies in order to get an answer to the question as to how students learn best through technology. Furthermore, instructors should facilitate their students' sense of inquiry for their development of critical thinking and problem solving skills. Finally, instructors can keep in mind that technology-based activities enhance their intelligence, interest, and improve their communication and collaboration with each others.

CALL FOR RESEARCH

Some possible research studies can be conducted in order to discover answers to the following questions:

- What are the preferences and perceptions of the students about artifacts they produce in terms of sharing them in educational social software?
- What is the contribution of completed educational activities to the development of different type of intelligences?
- Which educational activity may lead students who have dominant or innate intelligence types to learn more easily?
- What are the suggestions of the instructors about the integration of these activities into the curriculum as an integration model according to their experience?

- How can educational activities addressing multiple intelligence be best assessed? What are alternative assessment types?
- How can an e-portfolio be used from multiple intelligence perspective?
- How to design courses where the communication and collaboration is based on educational social software from a multiple intelligences perspective?
- How can technology-based educational activities be differentiated according to levels of primary, secondary and high school students?

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This work was previously published in Educational Social Software for Context-Aware Learning: Collaborative Methods and Human Interaction, edited by N. Lambropoulos; M. Romero, pp. 50-68, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 4.3
Using the Social Web for Collaborations in Software Engineering Education

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ABSTRACT

The discipline of software engineering has been gaining significance in computer science and engineering education. The technological environment in which software engineering education (SEE) resides and thrives has also been changing over the past few years. A technological revitalization of SEE requires a considerate examination from human and social perspectives. This chapter studies the impact of integrating Social Web technologies and applications based on these technologies in collaborative activities pertaining to SEE. In particular, teacher–student and student–student collaborations, both inside and outside the classroom, are highlighted. In doing so, the feasibility issues in selection and adoption of technologies/applications are emphasized and the use of pedagogically-inclined patterns is made. The potential prospects of such an integration and related concerns are illustrated by practical examples

DOI: 10.4018/978-1-60566-368-5.ch048

INTRODUCTION

In the last decade, software engineering has been playing an increasingly prominent role in computer science and engineering undergraduate and graduate curricula of Universities around the world (Rezaei, 2005; Surakka, 2007). As software engineering matures, the question of how its body of knowledge is shared, communicated, and consumed arises. In particular, the role of collaboration is likely to remain crucial to software engineering in the foreseeable future (Whitehead, 2007).

Like other disciplines, software engineering education (SEE) is prone to evolution. To do that, it needs to be sensitive to the variations and evolution of the social and technical environment around it. In particular, any changes in the information technology (IT) environment need to be reflected in SEE, if it leads to viable opportunities and demonstrated benefits (Kamthan, 2008b).

The Social Web, or as it is more commonly referred to by the pseudonym Web 2.0 (O'Reilly, 2005), is the perceived evolution of the Web in a direction that is driven by 'collective intelligence,' realized by information technology, and characterized by user participation, openness, and network effects. In particular, the Social Web has enabled new avenues for collaborations (Coleman & Levine, 2008).

The aim of this chapter is to assess the implications of the Social Web for teacher–student and student–student collaborations in SEE, and underscore the prospects and concerns in doing so. It assumes a basic background in software engineering (Ghezzi, Jazayeri, & Mandrioli, 2003) on part of the reader. The terms Social Web and Web 2.0 are used interchangeably. For the sake of this chapter, it is also acknowledged that the notions of *coordination* and *cooperation* differ from the term collaboration and are subsumed by it.

The rest of the chapter is organized as follows. First, the background necessary for later discussion is provided and related work is presented. This is followed by a proposal for a systematic introduction of the Social Web technologies/applications for collaborations in SEE, labeled SW4CSE2 henceforth. The prospects of SW4CSE2 are illustrated using practical examples. The limitations of the underlying Social Web technologies/applications are highlighted. Next, challenges and directions for future research are outlined. Finally, concluding remarks are given.

BACKGROUND

For the sake of this chapter, collaboration is defined as collective work to achieve common goals. In this section, motivation for collaboration in software engineering is provided and related work in the area is briefly highlighted.

Motivation for Collaboration in Software Engineering Education

The human and social aspect of software engineering has been known since for quite some time (Weinberg, 1998). There is a need to foster a collaborative environment in SEE at several different levels for a variety of different goals (Whitehead, 2007), which is discussed briefly in the rest of the section.

The development of large-scale software has reached a point that it is no longer possible for an individual to grasp its size and complexity. This has necessitated (1) the use of computer-aided software engineering (CASE) tools and (2) carrying out a software project in teams, both of which require dedicated collaboration. Indeed, currently deployed commercial CASE tools such as Microsoft Project, IBM/Eclipse, and IBM/Rational Method Composer, and non-commercial CASE tools such as Subversion need certain degree of collaboration among their users.

The need for collaboration is relevant to the situative/pragmatist–sociohistoric theory of learning (Bennedsen & Eriksen, 2006). Indeed, group assignments and team projects are two common approaches to induce collaboration among students.

It is often the case that a software engineering course is equipped with a team project intended to prepare students for a similar environment later in their careers, including industrial software development. In a team project, there is a need for collaboration *throughout* the duration of the project at two levels: (1) *internal*, that is, collaboration among participating students themselves and (2) *external*, that is, collaboration between students and the (individual(s) playing the role of a) client.

Collaborations in Software Process Environments

The software process environments with the client and user involvement have increasingly become collaborative (Williams, 2000). In particular, the movement in the past decade has been towards social flexibility of which agile methodologies and open source software (OSS) ecosystems are exemplars. Indeed, one of the agile principles is that "the most efficient and effective method of conveying information to and within a development team is face-to-face conversation."

The human aspect and indeed the social aspect of software process environments trickle down to process workflows. The following examples illustrate how collaboration permeates certain activities performed in process workflows.

To create an understanding of the problem domain of a software project, structural and behavioral models are constructed, both of which require collaboration among the project team members. For example, the terms and their definitions need to be agreed upon by the team as a whole. It has long been recognized that requirements elicitation is a social process (Macaulay, 1993) where the participants must work together for the most optimal outcome that may require making compromises in the process. The crucial design decisions, such as selection of views and viewpoints for software architecture and subsequent application of architectural styles or patterns, often depend upon close collaboration. Among the interaction design approaches, participatory design involves active collaboration between designers and end-users to ensure that the product is useful and usable. The Class-Responsibility-Collaborator (CRC) cards (Bellin & Simone, 1997) is an informal, high-level object-oriented design (OOD) approach that relies explicitly on the collaboration between the participants for identifying appropriate classes for the software system. The success of Pair Programming (Williams & Kessler, 2003), one of the core practices of Extreme Programming (XP) (Beck & Andres, 2005), strongly depends on the collaboration between the pair. Finally, usability evaluation methods such as card sorting, focus groups, and pluralistic walkthroughs involve moderated participation and collaboration of real users.

An Overview and Analysis of Related Work

The technologies/applications enabling the social component of software engineering and its education have taken time to get established. In the 1970s, the technologies/applications to support the social aspect of software engineering were not mature, and in the 1980s, they were largely limited to the use of electronic mail (e-mail). It was the 1990s, particularly the ascent of the Web, that opened new frontiers for people that were non-proximal to communicate in a variety of ways on a global scale.

Indeed, the use of Java applets in illustrating the *dynamics* of non-trivial algorithms in a classroom has been emphasized (Kamthan, 1999) and the benefits of hypertext for relating software artifacts and navigating through them have been shown (Bompani, Ciancarini, & Vitali, 2002). The use of instant messaging and the Web is made in a distributed software engineering course project that required collaboration at a global scale (Favela & Peña-Mora, 2001). The concerns related to the use of course management systems based on the Web have been pointed out (Wijekumar, 2001) and it has been concluded that the dynamics of group composition are critical for a successful collaborative learning. The benefits of collaborative learning in the construction and understanding of UML Class Diagrams have also been highlighted (Baghaei, Mitrovic, & Irwin, 2007). The use of Web to solicit feedback from stakeholders on requirements and bug information from users has become increasingly common (Whitehead, 2007).

Advantages and Limitations of Social Web Technologies/Applications

There are three primary factors that make the Social Web relevant to SEE:

1. The enablement of a many-to-many bidirectional communication paradigm in which the Web is (merely) the broker.
2. The maturation of the underlying technological infrastructure and the availability of its implementations as open source.
3. The awareness of the public followed by immense interest and large-scale participation.

These factors have made students 'first-class' active participants — rather than being mere passive observers — in the use of the Internet for education. By lowering the financial entry barrier, they have also helped level the playing field for students. It has been pointed out in surveys (Whitehead, 2007) that a heterogeneous combination of desktop- and Social Web-based technologies will be crucial for the future of collaborative software engineering.

However, there are evident side-effects of use of the Social Web for SEE. Unlike traditional commercial-off-the-shelf (COTS) desktop software, there are little or no a priori guarantees that a Social Web application will be available when accessed or provide the functionality as claimed. The open source Social Web applications inherit the issues pertaining to open source software (OSS) (Kamthan, 2007). For example, the legal realm in which these applications operate is currently unclear; technical support, if any, may not be assured; and technical documentation (such as a user manual or context-sensitive help), if any, may vary significantly.

Initiatives for Integrating Social Web Technologies/Applications in Education

There have been relatively few initiatives towards integrating Social Web technologies/applications in education. An overview of the potential of Social Web technologies/applications for education in general has been given (Anderson, 2007). However, the correspondence to any teaching strategy or learning theory is unclear, and the limitations in the deployment of Wikis have not been discussed. The uses of Wiki as a teaching tool in software engineering have been reported (Parker & Chao, 2007). In particular, it is pointed out (Parker & Chao, 2007) that Wikis can be used to publish and share course material and management of software process artifacts.

A learning process that is based on the socialization, externalization, combination, internalization (SECI) model of knowledge management and uses Social Web technologies/applications has been suggested (Chatti et al., 2007). However, the discussion is largely peripheral and one-sided: the precise advantages of the Social Web towards teaching and learning are not given and the corresponding limitations have not been pointed out.

In a recent work, the limitations of conventional computer-supported collaborative learning (CSCL) are pointed out and, via the introduction of an application, namely eLogbook, the usefulness of next generation of social software in engineering education has been demonstrated (Gillet et al., 2008). However, the treatment of Social Web technologies is largely one-sided, and eLogbook is not yet mature and its relationship to other social software and technologies is unclear. It has been reported that due to computer-mediated communications via Social Web, new social structures can emerge among students that in turn can help reduce the number of students leaving computer science programs prematurely (Jahnke, 2008).

In recent years, there has been an emergence of both commercial and non-commercial course management systems (CMS), such as Black-

Table 1. A feasibility-sensitive methodology for integrating Social Web technologies in software engineering education.

1. Deciding the Scope of Software Engineering Knowledge 2. Adopting a Learning Theory and a Teaching Strategy for Collaborative Software Engineering Education 3. Selecting and Applying Suitable Social Web Technologies/Applications to Collaborative Software Engineering Educational Activities	**Feasibility**

board/WebCT, Moodle, and Sakai that enable some degree of collaboration using the Web and provide assistance towards learning. In particular, Moodle (Cole & Foster, 2008) integrates some of the Social Web technologies like blogs and Wikis as part of its system. However, CMS are modeled primarily after the needs of the teacher, not necessarily that of the students. For example, CMS may enable teacher–student collaboration but are not designed for use in course projects or for student–student collaboration.

TOWARDS COLLABORATIONS IN SOFTWARE ENGINEERING EDUCATION VIA SOCIAL WEB TECHNOLOGIES/APPLICATIONS

To be effective, the integration of any technological environment in SEE (Kamthan, 2008b) should be both disciplined and systematic, and the Social Web is no exception. SW4SE2 is a specialization is a methodology for integrating Social Web technologies/applications in SEE. It consists of a nonlinear and non-mutually exclusive sequence of steps as shown in Table 1.

The steps 1–3 in Table 1 are stated at a high-level and could be granularized further if necessary. They must also be feasible in order to be practical.

In a software engineering context, collaboration can be one of the following three types (Goldberg, 2002):

1. **Conceptual.** This type of collaboration is related to sharing information, sharing work products, as well as, sharing responsibility.
2. **Practical.** This type of collaboration is related to decomposition of work and allocation of tasks followed by integration of results.
3. **Educational.** This type of collaboration is related to help each other learn.

This chapter is primarily concerned with conceptual and educational collaborations that occur within the scope of SW4SE2 where the activities and artifacts (produced during some of those activities) are assisted by patterns. Figure 1 illustrates the underlying collaboration model for SW4CSE2. Since these collaborations result primarily from asynchronous communication, they are non-ad hoc (Cherry & Robillard, 2008).

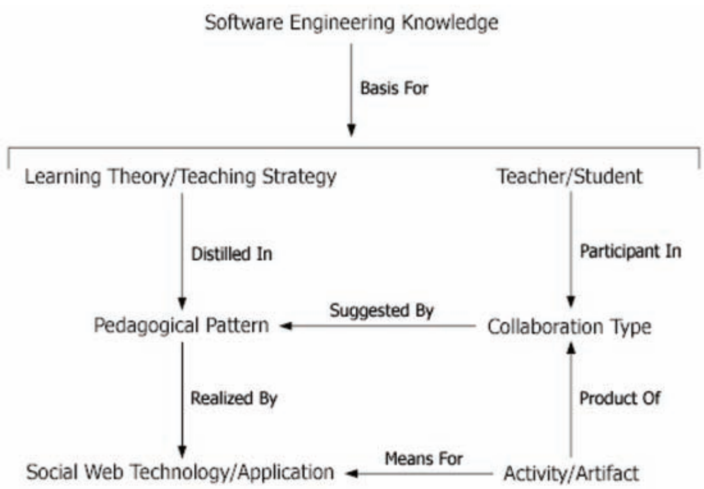
Step One: Deciding the Scope of Software Engineering Knowledge

The initial step in realizing SW4CSE2 is a characterization of software engineering knowledge. For that, the relevant software engineering topics could correspond to the knowledge areas of the Guide to the Software Engineering Body of Knowledge (SWEBOK) and the Software Engineering Education Knowledge (SEEK).

Step Two: Adopting a Learning Theory and a Teaching Strategy for Collaborative Software Engineering Education

The two theories of learning on which pedagogical strategies are being modeled today are *objectivism*

Figure 1. A model for collaborations enabled in software engineering education by the Social Web



and *constructivism* (Smith & Ragan, 1999). From an objectivist view, knowledge is external to an individual (and therefore objective), and therefore learning involves a 'transfer of knowledge' from the teacher to the student. From a constructivist view, knowledge is not external to an individual, and therefore learning involves constructing one's own knowledge from one's own experiences. In this case, it is a necessary that there are opportunities for social interaction among students. In recent years, constructivism has received attention in computer science education (Ben-Ari, 2001) in general, and SEE and OOD in particular (Hadjerrouit, 1999; Hadjerrouit, 2005). There has been much debate over the years in the educational community on the virtues and drawbacks of objectivism and constructivism. There are, however, signs of reconciliation (Cronjé, 2006).

Indeed, a classroom use of collaborative Social Web technologies/applications in SEE could be more objectivist than constructivist where the teacher plays the role of an 'instructor.' This could, for example, entail preparing Social Web technologies/applications-based lesson plans and lectures, and encouraging questions from students on a timely basis without severely interrupting the flow of the lectures. The teacher may also have to exercise some degree of discipline in the role of a 'manager' outside the classroom. For example, there may be need for a teacher to moderate a course mailing list, feedback to blog postings, a course Wiki, and so on, to maintain a level of decorum.

A project use of collaborative Social Web technologies/applications in SEE could be more socially constructivist than objectivist where the educator plays the role of a 'guide.' This could, for example, entail providing a balance between discipline and flexibility to the students in carrying out a software project with minimal guidance and timely feedback by the educator as and when needed: the crucial aspect being that the students play the primary role and the educator plays the secondary role.

From Theory to Practice

The reliance on the knowledge garnered from past experience and expertise is crucial for any endeavor. A pattern (Buschmann, Henney, & Schmidt, 2007b) is one such type of empirically proven and conceptually reusable knowledge.

Both objectivist and constructivist approach to collaborative SEE can be put into practice using pedagogical patterns. In particular, there are patterns for forming study groups (Sharp, Manns, & Eckstein, 2006), carrying out course projects (Hayes et al., 2006), and soliciting feedback from students (Bergin, 2006). These general high-level patterns can subsequently be supported by specialized low-level patterns for collaborative learning (DiGiano et al., 2002; Garzotto & Poggi, 2005; Hernandez-Leo, Asensio-Perez, & Dimitriadis, 2004) and patterns originally intended for computer-mediated communication (Schümmer & Lukosch, 2007). For example, APPLICATION SHARING, COLLABORATIVE SESSION, SHARED ANNOTATION, SHARED EDITING, and SHARED FILE REPOSITORY are patterns applicable to the Social Web context. As shown in the next step, solutions of these patterns manifest themselves in Social Web applications like blogging, social bookmarking, collaborative modeling, and so on.

Step Three: Selecting and Applying Suitable Social Web Technologies/Applications to Collaborative Software Engineering Educational Activities

Table 2 highlights the types of possible interaction between teachers and students in the context of SEE.

Table 2. A mapping between the types of possible interaction and educational contexts

Type of Interaction	Educational Context
Teacher–Student	Inside Classroom: Lecture Outside Classroom: Assessment Mode (Assignment, Project), Support
Student–Student	Outside Classroom: Assessment Mode (Assignment, Project)

Table 3. A mapping of student–student collaborations and corresponding Social Web technologies/applications

Collaborative Educational Activity	Social Web Technology/Application
Researching	Collaborative Annotation (Google Notebook, Microsoft OneNote)
Scheduling Events	Web Calendar (Google Calendar)
Brainstorming	Mind Map (bubbl.us)
Developing Software Process Artifacts	Collaborative Read/Write Application (Wiki, Google Docs)
Managing Software Source Files	Collaborative Source File Sharing (SourceForge)

Table 4. A mapping of teacher–student collaborations and corresponding Social Web technologies/applications

Collaborative Educational Activity	Social Web Technology/Application
Classroom Demonstrations, Audio/Video Interviews	Mashup, Podcast, Shared Presentation (YouTube, Google Video)
Dissemination of Lecture Material	Collaborative Note Taking (NoteMesh), Folksnomy, Wiki
Supplementary Course Material	Social Bookmarking (del.icio.us, Google Bookmarks, Yahoo! Bookmarks)
Notification and Syndication, Asynchronous Communication, Discussion	News Feed (RSS, Atom), Blog, Mailing List, News Group (Yahoo! Groups, Google Groups)

Tables 3 and 4 provide a relationship between common types of collaboration in SEE and Social Web technologies/applications.

For a given collaboration context, there may be multiple Social Web technologies/applications that are applicable. However, they may not necessarily be equally suitable.

The following criteria may be used for selection of a suitable technology or its application in SW4CSE2: nature of information (such as sensory modality) being communicated, alignment with teaching and learning goals, considerations for openness (commercial versus non-commercial), maturity, and feasibility. An objective third-party review of a candidate technology can also help in making the decision for adoption.

Examples of Collaborations in a Software Engineering Educational Context using Social Web Technologies/Applications

As evident from Tables 3 and 4, the Social Web lends various opportunities for collaboration and sharing. A sampling of these is considered next.

Collaborative Learning

The discipline of CSCL has a long history with origins in situated learning (Lave & Wenger, 1991). For the sake of this chapter, collaborative learning is a social interaction involving a community of teachers and students that acquire and/or share experience or knowledge.

In an objectivist approach to SEE, lectures and tutorials are still the norm where a teacher (or a teaching assistant) often makes use of black/white board or overhead projector for delivery. It is (theoretically) expected that each student will attend all of these lectures and tutorials from beginning to end, and be attentive all the time during the session. However, in practice, this need not be the case. The author has come across dedicated students who for one reason or another had to come in late, had to leave early, or for reasons of fatigue or otherwise, missed the essence of the session. A partial solution is to make the slides available for download. However, at times, there is implicit knowledge being communicated by the teacher that is not always made explicit. In such cases, students could benefit from their peers. NoteMesh is a Social Web application that allows students in the same courses to share notes with each other as well as edit each others notes. Its motto is 'collaborate to graduate.'

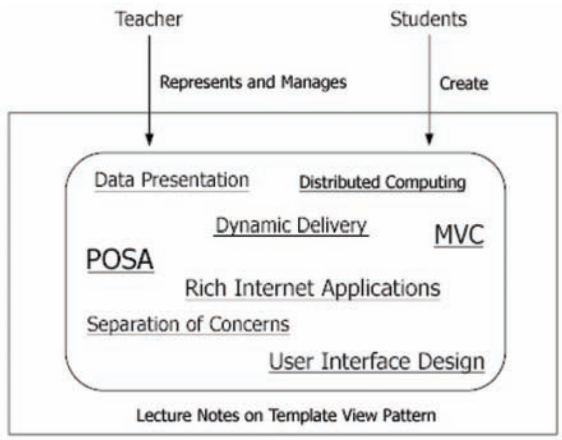
For the reason of time constraints or otherwise, the introduction of a topic during a lecture or tutorial is often relatively 'local' and from a single viewpoint. However, during assignments or tests, the students are expected to see the 'big picture.' Using the notion of folksonomy or social tagging (Smith, 2008), the students could associate other relationships with the lecture as they see fit. For example, phrases from past lecture(s) or the textbook could be candidates for tags.

A collection of tags can lead to the formation of a tag cloud. A tag cloud is set of related tags with associated weights that represent frequency of use of each tag. The frequency of use of each tag within a tag cloud is illustrated by visual cues, such as distinct font color and size.

The reliance on the knowledge garnered from past experience and expertise is important for any development, and a pattern is one such type of conceptually reusable knowledge. Figure 2 shows a tag cloud for the TEMPLATE VIEW pattern (Buschmann, Henney, & Schmidt, 2007a) used in the design of distributed software systems.

It should be noted that folksonomy (as opposed to taxonomy) is an uncontrolled vocabulary, and the lack of terminological control can have linguistic implications due to synonymy, homonymy, and polysemy. It is also not automatic that all tags that are created by the students may be relevant to the context. For example, a tag labeled 'template' or 'view' may not be related to the TEMPLATE VIEW pattern as depicted in Figure 1.

Figure 2. A tag cloud embedded in the lecture notes on the TEMPLATE VIEW pattern



In general, the success of collaborative learning may also depend on the students' background and past experience with technologies (Liaw, Chen, & Huang, 2008). For example, younger students may be more accustomed to technologies pertaining to the Web and are likely to have different attitudes than their older peers.

Collaborative Researching

The Social Web can be an indispensable source for students researching for information for assignments, or during the realization of a software project. There are Social Web applications that can assist in collaborative researching.

Social bookmarking goes beyond traditional bookmarking and enables management (for example, storage, organization, search, and sharing) of bookmarks residing remotely at third-party services. There are several social bookmarking services in use today including del.icio.us and Google Bookmarks. By unifying their knowledge base, social bookmarking can help both teachers and students to collaborate and share their links to resources.

The notion of social bookmarking can be extended to annotating the actual resources at the end of the hyperlinks. For example, applications such as Evernote, GoBinder, Google Notebook, Microsoft OneNote, and NoteScribe allow one to 'attach' notes to and clip text, graphics, and links during researching. Furthermore, the notebooks in Google Notebook can be exported to certain formats including Google Docs. The annotations associated with the resources found during researching can take various useful forms including comments on the relevance of the resource to the specifics of the software project, individual perceptions of the quality of the resource, reminders for comparing them with other resources, and so on. These notebooks can be saved, and can subsequently be used for collaboration and sharing with others. Furthermore, these notebooks persist once they have been created, and therefore can also be useful for future references.

Social Scheduling

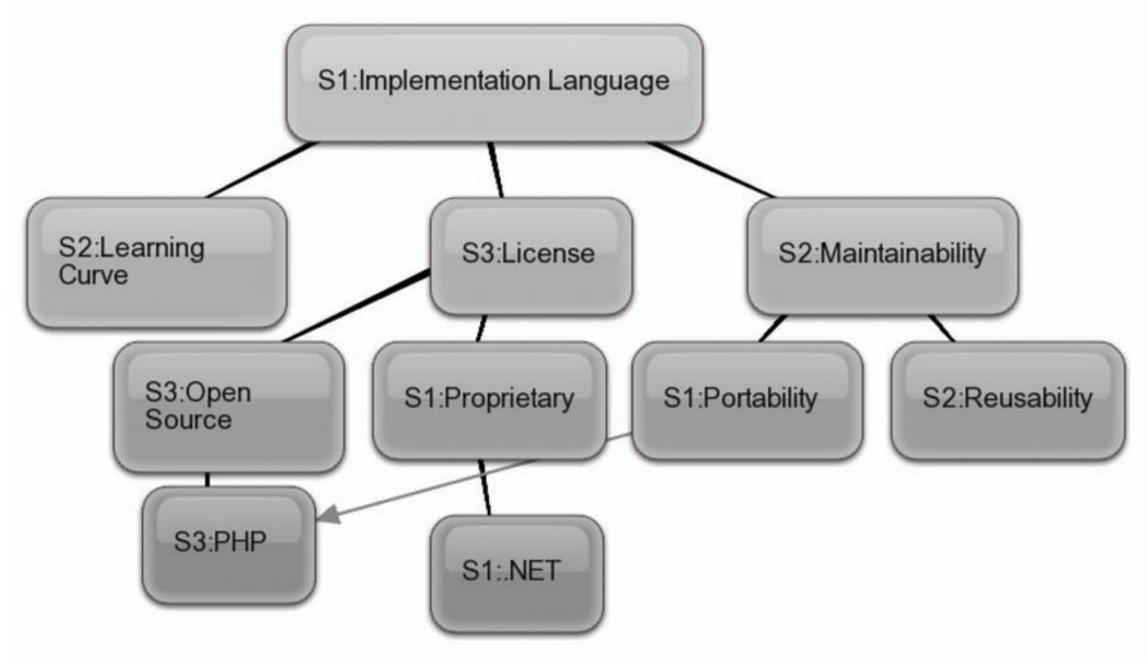
There is a need for meetings in a software project. For example, a team working on a software project has to schedule face-to-face meetings involving the members. An interview of representative members of the team with the client for the purpose of user requirements elicitation also requires meetings.

A schedule that is agreeable to all and is flexible (for example, due to frequent changes) can become difficult to manage, particularly as the number of persons involved increases. The use of Social Web applications that facilitate calendar sharing (such as the Google Calendar) can reduce some of the tedium involved in scheduling a meeting agenda.

Brainstorming

In a collaborative approach towards completing an assignment or formulating the details of a software project, students often need to engage in brainstorming. For example, for a given project, students may need to select a quality model, prioritize requirements, decide the best algorithm/data

Figure 3. An example of a partial mind map reflecting a brainstorming session on the viability of an implementation language



structure, or choose an implementation language, all of which necessitate brainstorming.

One way to brainstorm is through visualization, and mind mapping is a graphically-oriented approach to realize it. The authors can share these mind maps over the Web and, depending on the permissions, read and/or edit others' maps.

Figure 3 illustrates a snapshot in time (work in progress) of a mind map using bubbl.us. In it, three students, namely S1, S2, and S3 are in a brainstorming session on the feasibility of a proposed implementation language. The 'bubbles' in the figure reflect respective inputs by students.

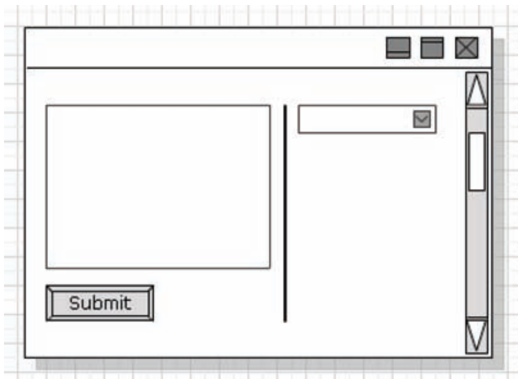
There are evidently other instances in which brainstorming is imperative. For example, the Goal/Question/Metric (GQM) (Van Solingen & Berghout, 1999) approach to software measurement necessitates formulation of recursively granular questions and assignment of corresponding metrics, both of which require brainstorming by the participants involved.

Collaborative Modeling and Prototyping

The activities of conceptual modeling and prototyping are critical to the success of software projects. They are becoming increasingly common in SEE (Cowling, 2005), particularly in model-driven approaches to software development (Völter et al., 2006) and interaction design (Beaudouin-Lafon & Mackay, 2008), respectively. They also should be carried out collaboratively. For example, the task of creating a large and complex model can be decomposed, and parts of it could be created by different students. Then, a conceptual model such as a domain model or a use case model being created by one student could benefit from informal inspections and feedback by another.

Figure 4 illustrates a snapshot of Gliffy, a Social Web application that allows collaborative modeling and sharing of diagrams. However, it should also be noted that Gliffy has limited capabilities compared to its desktop counterparts like

Figure 4. The construction in progress of a low fidelity prototype with six user interface elements



Microsoft Visio or IBM Rational Rose XDE. For example, support for the Unified Modeling Language (UML), a standard language for modeling object-oriented software systems, is partial. It is also currently not possible for users to extend a given template.

Collaborative Authoring

The Social Web presents a suitable environment for collaborative authoring of software process artifacts using various means including Google Docs and Wiki.

Google Docs is a Social Web application that provides capability to create word processing documents, spreadsheets, and presentations, as well as their import and export in various commonly-used formats. It also allows real-time collaboration and sharing of these resources using the Web. However, Google Docs has yet to completely replace a conventional office suite. The support is limited to certain user agents and there are currently physical limits on files sizes and designated storage space that may be constraining.

The concept of Wiki was invented in the mid-1990s as a group communication utility. It allowed open editing of information as well as the organization of the contributions and, with various enhancements, continues to serve well in that vein (Spinellis & Louridas, 2008). Wikis can be used, for example, for distributed collaborative authoring and multi-versioning of software process documents, recording design alternatives decision rationales, and feedback threads. The construction of knowledge takes places by the mutual influence of the social processes facilitated by a Wiki and the cognitive processes of the students (Cress & Kimmerle, 2008).

There are several, opens source flavors of Wiki available today addressing different target groups and organizational needs. Most flavors of Wiki, including MediaWiki and TinyWiki, can be easily acquired, installed, and administered under commonly-deployed computing platforms (Ebersbach, Glaser, & Heigl, 2006).

The Wiki environment can be used in a software project in various ways. For example, as shown in Figure 5, students could use Wiki to produce software process documents. These documents can be developed collaboratively and maintained independently, and can be hyperlinked for traceability and other purposes.

In software process documents, the key terms that are directly related to the domain of the project should be defined in a self-contained glossary. As shown in Figure 6, the terms that are not directly related to the domain of the project could point to resources from the projects of the Wikipedia Foundation (such as Wikibooks, Wikipedia, Wiktionary, and so on) for definitions and/or further details.

There are a few challenges in adopting a Wiki for SEE. It appears that the acceptance and use of Wikis varies significantly across education systems and countries (Gotel et al., 2007), and so their adoption may not be automatic. Since only some of the students may be extrovert in nature and may be prolific writers, others may not be, and therefore the participation of students is not guaranteed. Indeed, the personality traits of participants of Wiki may not be all that different from those involved in blogging (Guadagno,

Figure 5. A collection of software process documents using the Wiki environment

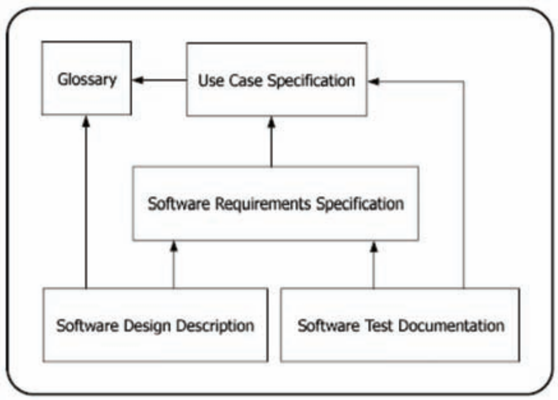
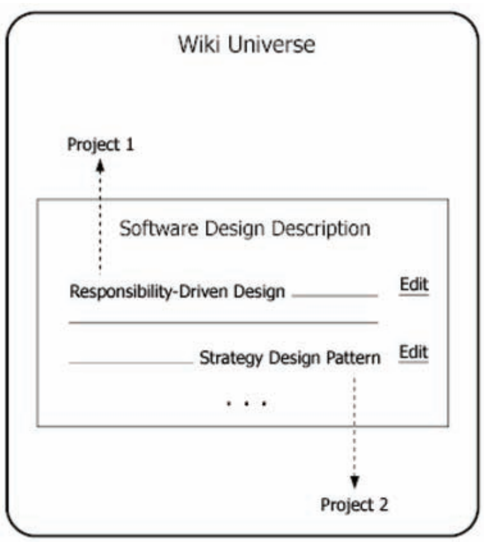


Figure 6. A software design document using external resources in the Wiki environment



Okdie, & Eno, 2008). Wikis are also known for 'noise' (impertinent information), 'casual writing' (presence of phonetic and 1337 style of writing), and 'editing wars' (discussions that have morphed into endless debates). These, however, can be attributed to human usage rather than to inherent limitations of the underlying technology. Also, the incidence of errors introduced by end-users involved in the development but not sufficiently familiar with the computing environment can be high (Costabile et al., 2008). Therefore, some form of monitoring and control, perhaps initiated by the institution or the teacher, is essential.

Guidelines for Adoption of Social Web Technologies/Applications for Collaborations in Software Engineering Education

Even when it is clear that the benefits outweigh the associated costs, any novel undertaking comes with its own challenges, and the same is true for adoption of the Social Web as a platform for SEE. The following set of guidelines is presented to help prospective teachers in making an informed decision towards enhancing their collaborative activities in software engineering-related courses via the Social Web.

- **Administration.** It is needless to say that the teachers must be aware of the current policies of the institution pertaining to legal and privacy issues regarding students, and security issues regarding information and computing infrastructure. It can also be useful to keep the administration (such as the department Chair or the Dean) abreast of any new endeavors, and periodically inform them of successes and failures.
- **Students.** The students should be informed of any 'social experiments' being pursued as part of the course, made aware of their rights and responsibilities that comes with flexibility of Social Web technologies/applications, including any acceptable use policy (AUP) put forth by the institution, and introduced to the ethical issues in software engineering (Kamthan, 2008a) before they embark on a software project. The relation of collaborative work to assessment should also be made explicit in advance, say, at the beginning of the course.
- **Infrastructure.** The selection and adoption of Social Web technologies/applications

does not have to be a matter of 'all or nothing' and could be introduced progressively. Indeed, it may be useful initially to introduce technologies/applications in activities that can benefit most, select technologies/applications that are relatively stable, hopefully sustainable, and in which the teacher does not have to relinquish control completely, and the presence of technologies/applications is not apparent to students (that is, technologies/applications are transparent to and do not interfere with the learning goals). Then, based on a retrospective, the use of technologies/applications can be scaled appropriately.

FUTURE TRENDS

The work presented in this chapter can be extended in a few different directions. In the rest of the section, the significance of these directions is discussed briefly.

Management

The introduction of any new technology/application in education is susceptible to indirections. For example, a sustained integration of Social Web technologies/applications in SEE needs to address associated quality-related concerns that can outweigh the benefits of collaborating electronically. In particular, an assessment of the impact on the credibility of information emanating from relaxation of control and governance (from teacher's viewpoint) and emergence of privacy and reliability issues (from student's viewpoint) is of research interest.

The hardware and software demands of Social Web technologies/applications on both server-side and client-side can not be ignored. For example, the file sizes of podcasts that are not streamed but are available only as download could be prohibitive to those on low bandwidth. It is also not automatic that educational institutions will simply abandon the resources to which they may have invested in past years and embrace the Social Web. Therefore, an investigation into a cost estimation model for integrating Social Web technologies/applications in SEE would be of interest.

Evolution

The focus of this chapter is on software projects being carried out by students registered at the same institution. It would be interesting to examine the challenges of a global software engineering project that is carried out in a distributed environment by students from multiple institutions and the role of Social Web technologies/applications in overcoming those challenges.

This chapter does not discuss teacher–teacher collaboration, an issue that has received little attention. The courses in a software engineering program (such as at the author's institution) are usually not isolated from each other. It may even be necessary and/or mutually beneficial for teachers for courses software requirements, software design, and software testing to collaborate with each other during the semester. For example, the software requirements produced iteratively and incrementally in one course could serve as input to software design in another course. Indeed, many of the aforementioned Social Web technologies/applications can assist teacher–teacher collaboration as well.

This chapter does not discuss the suitability of computing environments for collaboration. While certain technologies and their applications may be targeted for stationary devices, others may be generic. Further investigations into this mapping could help identify and channel appropriate services to requesting clients.

Maturation

It is still early to predict the outcome of the Social Web phenomenon in general and its impact on SEE in particular. Although certain benefits of integration are evident, studies of the impact on the changes to the learning model and further evaluation based on actual teaching experience followed by surveys are indispensable. It would be useful to distill this experience and subsequently present it in the form of 'best practices.'

Finally, it is evident that the level of adoption of (Social Web) technologies in software engineering programs will vary across educational institutions. It may be useful to devise a *Technology Maturity Model (TMM)* that an institution could use to assess and improve its technological awareness, capability, and support. It is anticipated that TMM would include a finite number of levels, definition of those levels, and a rationale for the assignment of a technology to a level. TMM could be 'instantiated' for different areas, including collaboration. The requirements for an institution to qualify at higher levels will be more stringent than at lower levels. For example, a software engineering program that allows the use of mailing lists only would be at a lower level compared to another program that provides explicit support for real-time streaming media that can be annotated and shared, and has policies in place for its practical realization.

CONCLUSION

This chapter highlights the collaborative disposition of software engineering in general and SEE in particular, and the role of the Social Web in enabling it. It is evident that the perception, realization, and manifestation of collaboration outlined here are likely to change with the evolution of software engineering as a discipline and with the societal views of education. For example, the needs for global software engineering projects, say, conducted and shared by multiple educational institutions may require modifications to the Wiki model (Hohman, & Saiedian, 2008).

The challenges facing the practice of software engineering today are as much technical as they are organizational and social in nature. The social and organic aspects of software engineering not only need to be acknowledged by teachers but also made explicit to the students in a feasible manner. In doing so, there is a need to communicate the significance of and help develop the necessity of a *collaborative culture* (Tabaka, 2006) in which the students, individually or as a team, can thrive.

The technological infrastructure underlying the Social Web provides an avenue for teachers and students to collaborate and share information both inside and outside the classroom. This departure from the current status quo can open vistas for teachers to convey to students in an educational setting some of the dynamism and excitement of IT the students they may be exposed to in their daily lives. It can also help form a 'bridge' between academia and the real-world, and thereby demonstrate, particularly to undergraduate students, that software engineering is indeed 'alive' and constantly evolving discipline. At the same time, the promise of the Social Web must be kept in perspective with the associated costs.

ACKNOWLEDGMENT

The author would like to thank his students for their commitment and dedicated participation in course projects over the years, many of which involved implicit and explicit use of the Social Web technologies/applications.

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KEY TERMS AND DEFINITIONS

Constructivism: A theory of learning that views learning as a process in which the learner actively constructs or builds new ideas or concepts based upon current and past knowledge. It is based on the premise that learning involves constructing one's own knowledge from one's own experiences.

Information Technology: Technology for activities related to information, such as acquisition, creation, communication, dissemination, processing, archival, retrieval, transformation, and so on, within the context of the Internet and the Web.

Mind Map: A diagram that represents goals, tasks, or other concepts linked to and arranged radially around a central theme or an idea. It is used to generate, visualize, and organize ideas, and as an aid to understanding, problem solving, and decision making.

Objectivism: A theory of learning that views knowledge as some entity existing independent of the mind of individuals. The goal of instruction is to communicate or transfer knowledge to learners in the most effective manner possible.

Open Source Software: A single encompassing term for software that satisfies the following conditions: (1) non-time delimited, complete software whose source is publicly available for (re) distribution without cost to the user, (2) imposes minimal, non-restrictive licensing conditions, and (3) is itself either based on non-proprietary technologies or on proprietary technologies that conform to (1) and (2).

Software Engineering: A discipline that advocates a systematic approach of developing high-quality software on a large-scale while taking into account the factors of sustainability and longevity, as well as, organizational constraints of resources.

Software Process: A set of activities, methods, and transformations that are used to develop and maintain software and its associated products.

Web 2.0: A set of economic, social, and technological trends that collectively form the basis for the future Web as a medium characterized by user participation, openness, and network effects.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 542-560, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 4.4
Exploring the Role of Social Software in Higher Education

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ABSTRACT

This chapter considers the potential of social software to support learning in higher education. It outlines a current project funded by the then Australian Carrick Institute for Learning and Teaching in Higher Education, now the Australian Learning and Teaching COuncil (ALTC) (http://www.altc.edu.au/carrick/go) to explore the role of social software in supporting peer engagement and group learning. The project has established a series of pilot projects that examine ways in which social software can provide students with opportunities to engage with their peers in a discourse that explores, interrogates and provides a supplementary social ground for their in-class learning. Finding creative ways of using technology to expand and enrich the social base of learning in higher education will become increasingly important to lecturers and instructional designers alike. This project represents one small step in testing the applicability of social software to these contexts. While many of our students are already using various technologies to maintain and develop their personal networks, it remains to be seen if these offer viable uses in more scholarly settings.

DOI: 10.4018/978-1-60566-208-4.ch012

INTRODUCTION

The evolution of the Web in the 1990s saw a parallel development of commercial Learning Management Systems (LMS) and, by 2001, the widespread adoption of the latter in Australian universities, in response to growing demands for flexibility or convenience for students. Yet much of the research indicates that in the main, LMS have been used more for administrative purposes (Dalsgaard, 2006; Hedberg, 2006; OECD, 2005; Reeves, Herrington & Oliver, 2004) and educators themselves most frequently use LMS as a content management system rather than exploiting the interactive potential of digital media (Boezerooy, 2003; Fiedler et al., 2007). With the official emergence of Web 2.0 in 2004 (O'Reilly, 2005), and the explosion of activity in social networking applications afforded by the technology, it is timely to consider whether the LMS, and the static learning environments they have typically modelled, should at least be complemented by (and perhaps even give way to) more interactive applications.

The original intention of Berners-Lee 'was all about connecting people' (Anderson, 2007). However, the Web was quickly colonised by vendors intent on using it for education purposes as a tradeable global commodity (Cunningham et al., 1998). LMS vendors promised a universal 'Economics 101' subject developed by the best professors in the world, and accessible - at a price - to all (Cunningham et al., 1998). Educators and the instructional designers who developed online materials were paradoxically complicit in this static model, recreating in their online materials the transmission model of pedagogy they inherited as 'the university teaching model' (Laurillard, 2002). Berners-Lee was not alone in his vision for a different technological future. In his book *Mindstorms*, Seymour Papert (1980) developed a compelling case for the potential of technology to mediate thinking in ways that reveal, enrich and expand learning. The prominent educator Paulo Freire (1985) argued that transformative education can only be achieved through a pedagogy that values learning as a process of *asking* questions not just *receiving* answers. The dominance of the administrative functions of e-learning has already been noted, with its preference for *content* over *process* most frequently achieved through one-way (vs. two-way) models of interaction. In these applications the *answer* seems much more important than the *question*. Papert (2000) argued that transformative shifts in the way we use technology will only be possible when educators have time to rethink both the *why* and *how* of its use. Given the widening gap between formal education and Internet culture, and the rise of the millennial learner, it is clear that we can no longer afford not to take time to reconceptualise technology-mediated learning. This will involve the design of a pedagogy that connects and engages learners in activities that value the question as much as the answer. Finding creative ways of using technology to expand and enrich the social base of learning in higher education will become increasingly important to academics and instructional designers alike. However, it is not clear that even the experts in higher education and e-learning can envisage such a pedagogy, with Guess (2007) assessing discussion at the Seattle Educause conference as producing 'more questions than answers' about capitalising on the contemporary enthusiasm for social networking in educational settings.

The project reported in this chapter represents one small step towards testing the applicability of different technologies to higher education contexts. While many of our students are already using various technologies to maintain and develop their social networks, it remains to be seen if these offer viable uses in more scholarly settings.

BACKGROUND

There are a multitude of Web 2.0 services that are readily available to students and educators such as blogs (e.g. Edublogs), wikis (e.g. Wikispaces), collaborative word processors (e.g. Google Docs), syndication and aggregation using RSS (e.g. Bloglines, PageFlakes and iGoogle), social bookmaking (e.g. del.icio.us), shared calendars (e.g. Google Calendar and 30 Boxes) and creative content exchange (e.g. Flickr for images, ccMixter for audio, and YouTube for video). The project reported here arose as a result of intense interest in the use of Web 2.0 technologies in higher education by a group of teacher-scholars. Although some of the group were using several applications successfully in their own teaching, predominantly in the area of media studies, they had little in the way of comprehensive research studies to support their belief that Gen Y students would be more engaged in their learning if formal study programmes incorporated Web 2.0 modalities, with their potential for more interactive construction of knowledge, skills and values.

Since 2002, conventional media and IT consultancy firms have reported exponential uptake of social technologies such as Facebook, YouTube and MySpace, and the near universal use of converged technologies like mobile telephones, at least in the West. Social commentators such as Prensky (2001), and educational technologists and managers such as Diana Oblinger (2004) have argued strongly that 'digital natives', in Prensky's term, demand a new pedagogical approach given their routine use of social technologies in their daily lives. Arguably, this is supported by the growing influence of constructivism as an underpinning tertiary learning theory (Biggs, 1999; Marton & Saljo, 1976), and social constructivism (Renner, 2006), since these theories propose that students mentally 'construct' their own learning, based on a variety of resources, including teachers and peers. Increasingly however, these resources are web-enabled.

Over the past five years in Australian universities, traditional face-to-face delivery has declined as the major mode of university teaching, for several reasons. The first is economic, as funding for teaching activities has decreased (Go8, 2007), and programme hours have been cut in consequence. The second is also economically related: as students' personal costs for tuition have increased, their paid-work commitments have risen to an average of over fifteen hours per week (Universities Australia (UA), 2007). The result has been declining attendances at scheduled lectures (UA, 2007), and demands for more 'flexible' access to learning materials.

As will be discussed further below, the literature presented the research team with contradictory findings. Krause (2006) for example, in her analysis of the decade long studies of the 'First Year Experience' in Australian Universities, argues from her data that students are less comfortable and familiar with new media in their learning environment than has been supposed. Ramsay's early data analysis (2007), supports that view. Berg, Berquam & Christoph (2007) also report some students at the University of Wisconsin-Madison warning off administrators considering muscling in on 'their spaces': 'Don't bother with IM or Facebook – that's **our** way to network. Leave us alone. This is my way to procrastinate. I don't want to feel guilty about it.' Yet Kvavik & Caruso (2005) argued that in their US survey, students were overwhelmingly positive about the attraction of IT in education: it was about 'convenience', easy off-campus access.

The issues underpinning the present project cross the usual boundaries of disciplinary study, making analysis and a standard literature review problematic. Indeed, Cobcroft et al. (2006, p.11) in their 138 page literature review on e-learning, assert that a literature review in this area 'cannot be exhaustive'. This chapter has sought to canvass the more recent and 'typical' of the research, and locate it within industry approaches. A thorough review would take into account not only the more 'academic' studies of technology usage that have methodological rigour, but the 'grey literature' of self-promotional industry reports, mass media reports, and the thousands of opinions available through the affordance of Web 2.0 technology itself, in the form of blogs, wikis etc. It would also situate this literature in the broader context of social and higher education systemic change, such that 'the university experience' no longer encompasses the 'withdrawal' from the world of work of an elite group of the young, to focus on preparation for life and work via study. Clearly such a thorough review is problematic.

Any summary of the literature is also complicated by the nature of inquiry into the phenomenon of social networking: some approaches focus on the technical aspects of social software, others on the sociological implications (the 'generational' or 'digital native/immigrant' line), others still on the philosophical implications of pervasive social technologies, while only a few consider the pedagogical and cognitive dimensions of social networks. Yet another approach is to speculate on the nature of institutional 'disruption' as a result of social and technological networking. This is an immense range of fields to canvass.

There is no doubting the uptake of social applications of technology. The explosion of subscribers to social networking sites is truly astonishing. YouTube, invented only in 2005, reports 70 million viewings per day. It was *Time*'s 'Invention of the Year' in 2006, according to *Time* writer, Lev Grossman, because it promotes 'authenticity'. Australia MySpace claimed on 27 June 2007 that over 48,000 videos had been uploaded in the past three days. It is the most popular social networking site in the country, according to HitWise, an Internet research company based in the UK. 27% of all Internet users regularly use MySpace, and it claims over 160 million subscribers. On that same day in June, Flickr claimed nearly 3000 photos had been uploaded in the last minute ─ at 9.20 am. HitWise reported that Bebo 'surpassed MySpace in weekly market share of UK Internet visits to become the most visited social networking site in the UK for the week ending 5th August 2006', and is the 11th most popular site on the Internet with 22 million users. SecondLife, opened in 2003, claims 7.4 million accounts have been opened, although many are never really 'peopled'. It seems to have over one million active users. The Australian-based Prospect Research (2006) claims that in 2006, 34% of Gen Ys had their own blog, and 13% their own website. Facebook claims 200,000 people sign up each day, and boasted 42 million members in October 2007.

The literature around Gen Y students and social technologies presents a conundrum with much of it falling into five categories:

- **Category 1.** A plethora of 'pop pieces' or 'op ed' pieces in conventional media, typically by amazed later age adults 'discovering' the worlds of Second Life and Facebook, and issuing alarmist warnings about identity theft and potential career damage.
- **Category 2.** The large number of industry reports, typically by IT consultants, and based on limited surveys of Gen Y usage.
- **Category 3.** More considered investigations of the youth demographic and their propensities in regard to technologies and learning approaches.
- **Category 4**. A number of studies, which investigate the pioneering use of new applications in selected universities, although many do not evaluate the efficacy of these applications in learning.
- **Category 5.** A small category canvasses new media usage as the object of academic interest in its own right.

Typical of the Category 1 literature is a piece in the *Weekend Australian Magazine* March 2007, which reflects the amazement of the 'newbie' to the world of social sites. Nussbaum, the writer, reprises the intimate details of one of her featured MySpace users, Kitty, including her sexual experiences and her reaction to the death of her parents at 22. Nussbaum characterises the reaction of the older generation to Gen Y's tendencies to 'self-exposure' in these terms: 'They have no sense of shame. They have no sense of privacy. They are show-offs, fame whores, pornographic little loons who post their diaries, their phone numbers, their stupid poetry ─ for God's sake their dirty photos! ─ online. They have virtual friends instead of real ones. They talk in illiterate instant messages. They are interested only in attention ─ yet they have zero attention span…' (Nussbaum, 2007, p.24).

Alarmist stories about the potential for identity fraud in social networks (www.abc.net.au/news/stories/2007/10/24/2068766.htm?section=justin) deepen concern among many in the general population and older academics regarding Web 2.0.

A common attribute of Category 2 type studies into Web 2.0, which examine its educational implications, is the predominance of IT consultants rather than traditional disciplinary academics among authors. This might be explained by a general lack of knowledge of new technologies among traditional academics, given the aging profile of Australian academics (Hugo, 2005), and their status as 'digital immigrants'. It might also be related to self-interest in promoting new technologies on the part of IT consultants, who also predominated in commentary during the 1990s 'tech boom' in e-learning systems. As then, commentary is usually accompanied by brave predictions on media futures and mobile devices (Franklin & van Harmelen, 2007; Livingstone & Bober, 2005; The Horizon Report, 2007).

Typical of such Category 2 publications is the late 2007 Franklin and van Harmelen study, both authors being IT consultants scanning the practices of five European universities in relation to the impact of Web 2.0 on institutional policy and strategy, and changes in pedagogical practices. The significance of this study is its environmental scan of European institutional approaches and policies around Web 2.0. Like the boosters of the 1990s, Franklin & van Harmelen parlay the 'profound potential' of Web 2.0, including its 'pedagogical efficiency' as well as its promise of 'greater student independence and autonomy' (2007, p.3).

Nevertheless, the Franklin and van Harmelen (2007) study offers cautions:

Because Web 2.0 is a relatively young technology, there are many unresolved issues relating to its use in universities. These include intellectual property rights for material created and modified by university members and external contributors; appropriate pedagogies for use with Web 2.0 (and equally which pedagogic approaches are enhanced by the use of Web 2.0); how to assess material that may be collectively created and that is often open to ongoing change; the choice of types of systems for institutional use; how to roll out Web 2.0 services across a university; whether it is best to host the services within the university or make use of externally hosted services elsewhere; integration with institutional systems; accessibility, visibility and privacy; data ownership; control over content; longevity of data; data preservation; information literacy; and staff and student training. At this stage all that we have to go on are the results of experiments with Web 2.0, rather than a set of solutions that are ready for widespread adoption (p.1).

These are all important issues and need appropriate technical and legal investigation, although the present concern is with pedagogical implications. As one would expect, the report concludes with a recommendation that institutions not 'impose' unnecessary regulations 'in order to avoid constraining experimentation with Web 2.0 technologies and allied pedagogies' (Franklin & van Harmelen, 2007, p.4). As will be seen in our conclusions, we endorse this view.

Franklin & van Harmelen (2007) explore several areas that have bearing on the present study. The first is a finding relayed (Franklin & van Harmelen 2007, p.7) from Arthur (2006) that in Web 2.0, 1% of users create content, 10% comment on that content and therefore add to it, and 89% simply 'consume' it. This, if verified in an educational context, poses difficulties if the learning objective is to *create* content. It is less problematic if the objective is to *disseminate* knowledge.

Franklin & van Harmelen consider that 'much (of the use of Web 2.0 technologies) is still experimental work carried out by enthusiastic lecturers who are willing to devote the time to *make the technologies work for their teaching*' (2007, p. 14; our emphasis). The evidence of this project in terms of the challenges faced at institutional and technical levels would support this observation: enthusiasts 'make' the technologies 'work'; institutional systems are not geared for the systemic incorporation of Web 2.0 in routine teaching practices. Given the case studies presented in the Franklin and van Harmelen report, it would seem that in the European universities surveyed at least, the technologies' most pervasive use has been in social support and building a community ethos, rather than in 'direct' academic work.

This project team supports the notion of using a variety of web applications as providing the most appropriate philosophy and pedagogy for academic users of Web 2.0, consistent with our Manifesto (http://wiki.openacademic.org/index.php/CookBookManifesto), but recognises that this position will be in conflict with many IT systems professionals who try ever harder to manage the unmanageable (Wilson, 2007).

Notwithstanding the many examples of IT consultants as authors of institution-oriented reports, there are a growing number of Media Studies academics conducting small scale research on student use of and attitudes to new technologies in their teaching. Such studies generally focus on particular aspects of technological applications. For example, in the brief report on students' use of Google as a research tool, Head (2007) suggests that the supposed and much deplored reliance on search sites and sources like Google, Yahoo! or Wikipedia has a limited basis in fact, once students have realised the limitations of these tools in providing depth in content. Most students turned first to their subject references as provided by the academic; only 10% used these general sites first in a research assignment. (Head's publication in itself is an indication of the transformation of scholarly publication as a result of the Internet: *First Monday*, its place of publication, is a peer-reviewed online-only journal).

Category 3 studies include those by the highly respected Demos Group: one study reported by the group found that 'one-third of the children surveyed, including one in five 11 year olds, regularly use the Internet for blogging, yet two-thirds of parents do not know what a blog is, and only 1% thought that their child used them' (Demos, 2006, p. 73). Such studies provide valuable background information on the aspirations of Gen Y, and their attitudes to new technologies.

In Category 4 is Anderson's (2007) JISC report from the UK, 'What is Web 2.0? Ideas, Technologies and Implications for Education' - an excellent introduction to various applications and their possibilities and implications. It is particularly useful in that it situates the applications within the wider literature on social, cultural and pedagogical change. EdNA (2007) also lists a number of resources relevant to Web 2.0 in higher education.

Finally, Category 5 is an emerging area where media researchers are closely examining the role of social software in education. Examples include the Rochester Institute of Technology's laboratory for Social Computing (http://social.it.rit.edu), and Seton Hall's virtual worlds projects (http://tltc.shar.edu/virtualworlds).

MAIN FOCUS

The main focus of this chapter is a discussion of the Digital Learning Communities (DLC) project that was funded by the then Carrick Institute for Learning and Teaching in Higher Education. The primary aim of this project was to apply an evidenced-based approach to increasing undergraduate and postgraduate student engagement, especially peer-to-peer interaction and communal learning, through innovative applications of social software in university teaching (http://mashedlc.edu.au/). The context of the three universities involved (University of Canberra, Queensland University of Technology, and RMIT University) was an important consideration: none could be considered 'bleeding edge' in relation to systemic use of sophisticated technologies, although each has a small group of innovative researchers in new media. Two of the universities are large (30,000+ students), with strongly centralised management. The third is small (12,000 students), and its IT services were in flux during the project. An important element of the study for the team as new media researchers was to 'test' the responsiveness of institutional systems to innovative pedagogies.

The general intentions of the DLC project were to:

- enhance student community and peer engagement through socially mediated content creation, classification, aggregation and sharing.
- apply existing free services and applications to maximise accessibility.
- document and disseminate the results in a way that allows immediate and sustainable take-up of these techniques by Australian university teachers.

From the outset of the project it was clear that to gain a better insight into this rapidly changing area we would need to build a multi-faceted evidence and resource base that would help universities understand their student body and offer ways of using social software. To this end we:

- developed a project manifesto that outlined the project team's shared understanding of what constitutes good learning and teaching in higher education.
- conducted a survey to characterise university students' present and emerging use of technology for study, work, and play. In particular we wanted to examine the quantity and quality of the data channels used by students and provide some baseline measures of the uptake of these technologies.
- developed a series of pilot projects to help focus attention on the identification, development and evaluation of how social software can be used to engage learners with emerging social technologies.
- developed a wiki-based resource (called a cookbook) that would help lecturers explore how to use social software in their teaching.

For the purposes of this chapter we will only report some of our preliminary survey results and briefly detail the pilot projects that are currently still in progress.

Table 1. Age distribution

18-25	58%
26-35	18%
36-45	11%
46-55	9%
56-65	4%

Table 2. Respondents by discipline

Economics	6	1%
Business	78	9%
Law	34	4%
Commerce	23	3%
Information Technology	146	16%
Engineering	14	2%
Science	50	6%
Medicine	5	1%
Education	68	8%
Nursing	7	1%
Languages	13	1%
Communications/Media	124	14%
Creative Industries	112	13%
Design	45	5%
Arts	22	2%
Creative Writing	23	3%
Other	112	13%
International Studies	10	1%
	N=892	100%

Social Software Survey

In August 2007 we conducted an anonymous web-based survey of students and staff across three Australian universities. In total we had 853 respondents (41% male and 59% female), 63% undergraduates, 16% postgraduates and 21% university staff. Our preliminary analysis of the data seems to indicate that as a whole, this is a fairly 'connected' group and as such may represent the leading edge of users. Of this group 56% indicated they had their own website, while 39% said they maintained a blog. Further analysis and comparison by discipline grouping will explore this more fully in subsequent reports. Nearly 92% had broadband access with the most common point of access being home (63%), followed by university (22%) and workplace (14%) and 93% had two or more email addresses. The age distribution is shown below.

To get a sense of the ways respondents connected with their peers we asked them to identify the three main ways they choose to communicate (Table 3). Face-to-face meetings and email were most popular, followed by phone and text messaging. The importance of text messaging relative to phone calls perhaps points to potential of texting to deliver a cost effective, reliable messaging platform with minimal disruption for both sender and receiver. Instant messaging (IM), blogs and discussion lists did not figure much at all. One should not read too much into this result, as on many university campuses, blogs and IM are not well supported.

Examining the use of popular social networking applications we asked respondents to characterise their use as either an Internet 'Browser', 'Participator' or 'Contributor'. We suggested that each of these characterisations could be defined in the following way:

- **Browsers:** Tend to mainly read, surf or watch Internet content
- **Participators:** Browse but also make comments, suggestions and critiques of Internet content
- **Contributors:** Browse, participate but also create and upload Internet content

In the three universities we surveyed, most students used social software to browse information (58%). Interestingly for most students, wikis, often held up as the archetypal content creator

Table 3. Choose the three main ways you usually communicate with your colleagues or fellow students

Face to face meetings	30%
Phone calls	16%
Email	27%
Text messaging	15%
Instant messaging	6%
Listserv or group emails	2%
A group website or blog	4%

application, were mainly used as an information resource. Given the success of wiki projects such as Wikipedia (http://wikipedia.org/) it is our view that this result may be more a reflection of users' limited understanding of how wikis work rather than a specific flaw of the application. However, specifically designed social networking applications such as Facebook (http://www.facebook.com/) suggest more sophisticated patterns of use with the highest levels of contributors being reported (34%) followed by blogging (27%), photo sharing (21%) and social bookmarking (19%). The questions that arise here are what content is being created and has that content got any educational significance? It is fair to say that at this point we do not know enough about the nature of the content to respond with confidence. Having said that, it is our view that much of the content on, for example Facebook, appears to be directed towards more recreational than educational applications.

In another question, we asked respondents to rate the usefulness of various features of social software on a five-point scale (1- not useful through to 5 -extremely useful). Table 5 shows that the top four features of social software were their search capabilities, opportunities for self publishing, commenting and maintaining friend/buddy lists. All of which suggests students value a role as an author (i.e. able to publish and comment) who can be easily connected with people (i.e. friends) and information (i.e. search) – what

Table 4. Which of the following sites do you: Browse, participate or contribute to?

	Browse	**Participate**	**Contribute**
Social Networking (e.g. MySpace, Facebook)	36%	30%	34%
Social Bookmarking (e.g. Del.icio.us, Digg)	58%	23%	19%
Blog Sites (e.g. LiveJournal, Blogger)	48%	25%	27%
Wikis (e.g. Wikipedia, Citizendium)	77%	24%	9%
Photo Sharing (e.g. Flickr, Photobucket)	50%	29%	21%
Video Sharing (e.g. Youtube, Blip.tv)	70%	17%	13%
Music Networking (e.g. Last.fm, CCMixster)	67%	20%	13%
Average	**58%**	**23%**	**19%**

O'Reilly (2005) and others have referred to as the 'architecture of participation' in which software systems are designed to help users connect with other users.

Pilot Projects

The pilot projects we have established include the use of wikis, blogs and related social networking applications. The underlying pedagogical rationale for the pilot studies was a recognition by each lecturer that the current form of e-learning was too restrictive and that they wanted to explore a different model that might increase student interaction. In one pilot a lecturer explored the use of MyToons (http://www.mytoons.com/), to support the teaching of animation in a New Media course. In a first year Information Systems course, another lecturer is supplementing her WebCT site by using a corporate implementation of the wiki application, Confluence (http://www.atlassian.com/software/confluence/), to build an information systems jobs registry. In a first year Applied Ecology course, another lecturer has given her students a blog through a Drupal-based application (http://community.mashedlc.edu.au) to encourage students to record and share their field notes and laboratory reports. In two similar projects based in two different universities, lecturers are testing a whole-of-programme approach to the use of blogs in New Media courses. Recently, one of these lecturers began using a staff retreat as an opportunity to use a wiki to engage in a curriculum re-design process by getting his teaching staff to work face-to-face undertaking joint curriculum writing activities. The reports from these pilots are still being developed however we can provide some reflection on the Mytoons pilot project.

MyToons (http://www.mytoons.com/) is animation site "…where people who really love animation - from seasoned industry pros to rabid animation fans - can upload and share their creations and animated favorites with the entire world for free". It offers students a wide range of functionality including an online gallery for their work, a personal online portfolio, off-campus access, documentation of personal and group processes, an authentic community of practice, global networks through groups and friend-lists, experience with social protocols and online culture, peer benchmarking, peer critique and technical support.

From the outset of the pilot there were a number of technical problems that prevented students uploading their animations files to the site. While that problem was eventually solved, it did create an initial level of concern amongst the students that they were relying on prototype software to complete their university studies. However by the end of the course students rated themselves as competent users of MyToons and generally believed the site supported their work. While the

Table 5. Rate the following features of social software

Self publishing	3.3
Tagging	2.9
Ratings	2.7
Buddylist/Friends	3.2
Search	3.7
Recommendations	3.0
RSS feeds	2.8
Commenting	3.3

pilot group identified themselves as experienced users of social software, their participation in this online community helped further raise their awareness of the risks of internet fraud and spamming and presented the lecturer with an opportunity to talk about ways they could manage their identity through the use of online screen names.

A key recommendation arising from the pilot was that the syllabus should be reoriented from technical mastery of animation tools to also consider the skills students require to effectively engage in an online community. Another outcome of posting their work in such a public space was the heightened awareness of copyright issues. In the lecturer's explanation as their work was now under wider public scrutiny, plagiarism became increasingly socially risky (Barrass & Fitzgerald, 2008). The technical problems early in the unit served to highlight that innovation and experimentation can be risky and that adopting longer implementation time frames would help mitigate some of this risk.

EMERGING ISSUES AND FUTURE TRENDS

While this project continues into 2008 with a second social software survey being conducted in May, we are beginning to see a number of issues emerging that we will briefly detail here.

No One-Size-Fits-All

The rich variety of alternatives and complementary tools available online to support learning and teaching can make the selection of the best tools for a particular purpose difficult. In our experience there is no single application or tool that meets all these needs. What is becoming clear is the potential value of networked repositories and aggregation services that university teachers can subscribe to or track easily. Our project remains founded on the belief that there are a multitude of web services that are readily available to students and educators, and we continue to seek the underlying principles that make these services valuable in learning and teaching rather than building or significantly modifying large information systems. The ALCT is developing an online resource to facilitate sharing and exchange. Referred to as the ALCT Exchange (http://www.alctexchange.edu.au), this project seeks to create an online social networking hub for the exchange of ideas about teaching practice in the Australian and international higher education sector. While this work will be a significant development for higher education, the reality is that it will not be the only space for social networking. We will require a multiplicity of social networks that are designed in interconnecting ways that facilitate communication and exchange across different university networks. Interestingly, students themselves are not seeking ICT solutions as alternatives to traditional teaching. Some recent surveys (Berger, 2007; Ipsos MORI, 2007; Salaway & Caruso, 2007) note that students are wary of too much ICT in teaching and prefer a balance between online and face-to-face instruction. They are also concerned that instructors may not have sufficient expertise to use ICT effectively in teaching: some students feel that they have more expertise than their teachers (Ipsos MORI, 2007).

Institutional ICT Services are not Partners in Innovation

Centralised ICT services departments with their focus on management and standardisation have proved a barrier to the exploration of innovative emerging online technologies and services. There is a pervasive view that external services should not be used for teaching as they represent unacceptable risk. It is not just high profile applications such as Facebook that are frowned upon but often decisions are taken in the interests of simplification and standardisation that effectively limit the choices available to lecturers. In one of our universities, a request to have the Firefox web browser included on the standard computer image was denied by ICT Services because they argued Internet Explorer provided equivalent functionality. Despite concerted efforts both within and outside the university to document the pedagogical strengths of Firefox over Internet Explorer 6 (see http://talo.wikispaces.com/Browsers), only Internet Explorer was retained on student labs. Staff were given the opportunity to use Firefox but only if they were able to develop a business case for their application.

In another example, our need to alert students to our survey highlighted difficulties and gaps in the ways universities communicate electronically with students. Many students do not regularly use their university email accounts due to limited mailbox storage limits and the fact that many university portals cannot be easily configured by students to meet their particular communication needs. The result is that it can be difficult to contact students. There are arguments for standardisation and common approaches for institutional services, but as Franklin and van Harmelen (2007) argue, there is also a need to support innovative and creative activity that explores additional or alternative learning and teaching techniques and environments

Open Source Software and 'Free' Web Services are Vital

Much of what others and we have been able to achieve in the DLC project is the result of the availability of open source software like Drupal and 'free' online services like Google Groups, MediaWiki and MyToons. In institutions where ICT departments can be unresponsive or hostile to requests from academics to use this new software or an online service for research or teaching, access to the Internet's growing range of accessible services provides a more than viable alternative to in-house supplied services. ICT departments are actively discouraging such approaches where they can, for example by denying the easy availability of appropriate browsers on university computers or closing ports on routers used for video collaboration. While there are risks to privacy, questions of accountability, and no guarantees of reliable or continuing services associated with external services, equally there are questions of quality of service, responsiveness and availability of expertise when using institutional services.

Cross-Institutional Innovation is Problematic

Cross-institutional collaboration can be richly rewarding for students and staff. The benefits include raising awareness of best practices, reuse of resources, peer review and economies of scale generally, but there are barriers, not just of time and place. There is a not-invented-here attitude that may have some credibility: individual institutions have their own cultures and timetables that don't necessarily align with others but this should not be a reason to reject outright an approach or resources developed elsewhere. Part of the challenge of working across the sector is that while each institution continues to run its own ICT services, there will be barriers such as authentication issues to impede seamless cross-institutional collaboration. It is time to investigate opportunities to provide ICT systems (like student email, financial management, student management, human resources, student portfolios, alumni services, even a common learning management system) across the higher education sector, not just to facilitate collaboration but also to provide a more efficient and effective service to the community. This is not unprecedented: while the ALCT Exchange may not provide a total solution for collaborative services across the sector, it does provide resources that individual institutions will no longer need to provide for themselves.

Decentralised and Centralised

Our original project was inspired by the loosely connected nature of Web 2.0 services. We have also seen the need to experiment with approaches that offer more stable and managed systems that could integrate with core university systems. In this regard we have been using OpenAcademic (http://openacademic.org/) and their work, to build the Content Management System (CMS) Drupal (http://drupal.org/) as a functional social networking environment. Some of our work and feedback has contributed to the GPL (General Public Licence) release of the Drupaled code base (http://www.drupaled.org/). Drupal has a strong reputation in the field because of its capacity to support both individuals and communities with their web needs from personal web sites or blogs, to community web portals, e-commerce applications or social networking applications. As detailed on the Drupal website (http://drupal.org), the current release of Drupal (Version 6.2) supports a wide variety of uses including:

- Content Management Systems
- Blogs
- Collaborative authoring environments
- Forums
- Peer-to-peer networking
- Newsletters
- Podcasting
- Picture galleries
- File uploads and downloads.

Perhaps the key point in the debate around the use of centralized or decentralized technologies is not really about whether the technology sits inside or outside the institution's firewall but rather how can universities better manage the interconnectivity in a way that is truly student-focussed? As Wilson et al. (2007) explain:

The devolution of technology management from higher education institutions to students is an important step in promoting the transfer of responsibilities, as higher education offers an environment with substantial resources for support, guidance, and community forming. If universities do not make a strategic change to their policy on IT provision, there is considerable risk that education becomes a 'technology ghetto' that offers an increasingly restrictive and un-engaging technology environment that requires constant and expensive care, and feeding by harassed IT staff. (p. 1395)

CONCLUSION

It is clear from the mass popularity of social technologies that a generational shift to working with peers has already occurred in contrast to the individualism that characterised earlier generations, and that we should be capitalising on that social trend in more technologically-mediated ways than we are currently doing. Our approach over the past decade in higher education has been to add a measure of 'group work' to our assessment tasks, but rarely have we deliberately taught the skills of productive groupwork and collaboration to our students: we have simply assumed that groups will 'form, storm and norm' intuitively. However, consider the way MySpace friendship groups develop: the 'intent' is to create the group, not to produce an outcome in the form of an assessment task. We have assumed that students can use their mobile technologies to undertake group work, even if they do not always come to campus to work as a group. But we have not built into our programmes even the simplest of ways to engender a learning group ethos. Nor can we expect our students to make their own connections between formal education and their leisure use of social media. Mass use of such media will always be for diversion, leisure, for 'grazing' and informal interest-driven learning, as Franklin & van Harmelen (2007) have noted. That does not mean we should not make the effort to locate and use the potential of social media for our educational purposes.

Finding creative ways of using technology to expand and enrich the social base of learning in higher education will become increasingly important to lecturers and instructional designers alike. This project represents one small step in testing the applicability of social software to these contexts. While many of our students are already using various technologies to maintain and develop their social networks, it remains to be seen if these offer viable uses in more scholarly settings. Projects such as this, and the Ramsay project mentioned above, provide some baseline data on current students' familiarity with various social technologies, and the efficacy of learning applications of these technologies. Clearly, we are not yet in a position to measure with any validity how Web 2.0 technologies will affect the experience of higher education for our students, but this project, and others, flag ways we might further consider the role of peer learning in universities.

ACKNOWLEDGMENT

The authors thank Dr. Peter Donnan, University of Canberra, for contributing some appropriate references.

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KEY TERMS

CMS: Content management system. A general description for a database-driven Web site that allows web-publishing.

Drupal: A popular opensource content management system that allows both individual and community web publishing whose functionality can be extended with an extensive range of add-on modules.

Facebook: A popular social networking site launched in 2004 and originally designed for university and college students.

Firefox: A Web browser developed by the Mozilla Foundation that features numerous add-ons and extensions.

Google Groups: A free groups and mailing list service from Google that includes access a searchable archive of Usenet.

GPL: General public licence. A popular license for free software.

MediaWiki: The opensource software that runs Wikipedia and its related projects.

MySpace: A popular social networking site launched in 2003 and owned by Rupert Murdoch's News Corp.

MyToons: A social networking site designed for animators.

Web 2.0: A term coined by Tim O'Reilly to refer to the shift from static web pages to more interactive web applications controlled by the user.

YouTube: A popular video sharing Website.

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 885-890, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 4.5
Using Social Software for Teaching and Learning in Higher Education

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ABSTRACT

This chapter focuses on discussing the use of social software from a social constructivist perspective. In particular, the chapter explains how social constructivist pedagogies such as collaborative learning and communities of practice may be supported by the adoption of social software tools. It begins by briefly discussing the social constructivist perspective considering certain pedagogies such as collaborative learning and communities of practice. Then, it explains how these pedagogies are reflected in actual practice by using a variety of social software tools such as discussion boards, blogs and wikis. Finally, the chapter presents the implications of using social software based on the impact of certain factors such as teachers' understandings of, and beliefs about, teaching in general. The purpose of this chapter is to support higher education practitioners in theory-informed design by distilling and outlining those aspects of social constructivism that addresses the use of social software tools. It is perceived that a gradual introduction of social software to institutional Virtual Learning Environments, with a strong focus on collaborative learning processes and engagement in online learning communities, will highlight the need for discursive tools, adaptability, interactivity and reflection.

DOI: 10.4018/978-1-60566-208-4.ch019

INTRODUCTION

The diversity of perspectives on, and approaches to, the pedagogical use of social software can prove overwhelming to practitioners and researchers alike. In order to make sense of this, this chapter explains how social constructivist theories such as communities of practice and collaborative learning may be assist in the use of social software. This chapter aims to explain the different pedagogical responses to social software tools and social networks regarding specific characteristics of learning, which may inform practitioners in their use of such tools. This is particularly useful in the context of e-learning where higher educators and researchers seek a clear understanding of the affordances of social software and guidance on how to use and integrate these into their educational practice. This may draw practitioners' attention to the relationship between espoused theories and theory in use (Argyris and Schon, 1974) and also for acknowledging curriculum design as a social practice (Conole et al., 2004).

Teaching and learning using social software may require teachers to rethink their beliefs and approaches in order to develop patterns of learning that at least allow and preferably encourage collaboration as a process of planning, criticising and evaluating. This could also allow learners to personalise their learning within a framework where teachers may monitor their progress. In this context, a better articulation and mapping of different pedagogical processes, tools and techniques may provide a pedagogical approach that can be regarded as more consistent and with teachers' theoretical and practical perspectives for teaching and learning using social software. As Downes (2005) argues, educators and practitioners should recognise that social software is not a technical revolution but is about encouraging and enabling collaboration and participation through applications and tools that can support the social constructivist approach to learning. However, adopting teaching and learning activities with the use of social software in a way that promotes interaction and collaborative knowledge building does not mean that it will result in learning per se. These practices require from the teachers an awareness of how students learn and this adds an increased responsibility for teaching and learning. Twigg (1994) argues that many students are concrete-active learners, that is, they learn best from concrete experiences where they engage their senses, and their best learning experiences begin with practice and end with theory.

The purpose of this chapter is to support higher educators for theory-informed design by outlining current issues of social constructivism in a way that assists the use of social software tools but also taking into consideration that creating a network of interactions between the instructor and the students may not lead to effective communication and collaborative knowledge building. For example, the design of a group project may not necessarily lead to the desired learning outcome. At best, it would appear that learning benefits can be achieved under certain circumstances. Students have to contribute to the learning process by posting their thoughts and ideas to an online discussion because learning is an active process in which both the teacher and the students should participate if it is to be successful. Research by Sharpe et al., (2005) provides examples, from a learner scoping study, about the roles of the teacher and the learner for ensuring and enhancing the quality of instructional design and how this relates to effective online learning processes. The scoping study highlighted the holistic nature of students' experiences of learning and proposed that learning design should focus on students' motivations, beliefs and intentions and the meanings they attach to e-learning. For example, as is well known, collaborative learning may not suit everyone (Laurillard, 2002, Mason and Weller, 2001). So a plethora of questions remain about how to design online learning activities whose purpose is understandable by the students. The important issue to note, from research in teaching and learning, is that there may be contradictions between what teachers and students conceive as effective teaching. Highlighting such differences may be helpful in assisting teachers to design learning activities that are adjusted to students' needs. For example, Jones et al., (2004) used semi-structured interviews to compare the student and the teacher perspective of what is good teaching. Students emphasised effective feedback, teacher enthusiasm, encouragement and good organisation and direction for learning. Teachers mentioned these but gave less attention than students to feedback, but added that disciplinary knowledge and technical expertise are important for students' learning. Laurillard (2002) and Thomas et al., (2004) also identified the importance attached by students to feedback, as well as teacher availability and approachability.

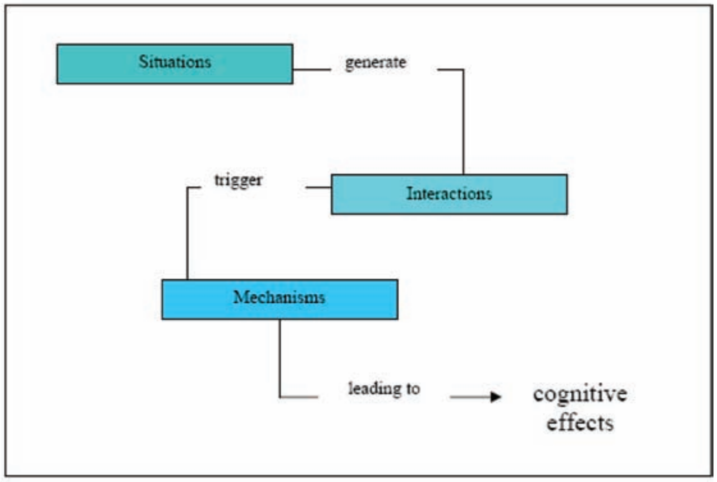
This chapter continues by briefly explaining social constructivist theory. This is important because it allows pedagogies to be described and related to social constructivist theory in terms of the use of specific technological tools and resources. It then discusses pedagogies that could be mapped to a social constructivist perspective such as collaborative learning and the idea of communities of practice. A number of issues related to these pedagogies will be highlighted. Then it explains how these pedagogies may be reflected in practice by using a number of social software tools such as discussion boards, blogs and wikis. Social software could be defined as technologies for the social construction of knowledge that emphasise the design of teaching and learning activities which promote collaborative learning processes and group interactions. Finally, the chapter discusses emerging issues regarding the use of social software in educational contexts. It is perceived that a gradual introduction of social software in the institutional context with a strong focus on collaborative learning and the creation of online learning communities may encourage teachers to design learning tasks which afford the use of these tools while at the same time taking into consideration students' own perceptions of e-learning and how they use technology to learn more effectively.

RETHINKING PEDAGOGY FROM A SOCIAL CONSTRUCTIVIST PERSPECTIVE

The social constructivist perspective views learning as a social activity which is created by the process of conversation, discussion and negotiation (McConnell, 2002, Ernest, 1995). In addition, social constructivists argue that a learner may be able to understand concepts and ideas by teachers or peers who are more experienced. This collaboration between teacher and student may be achieved in learning activities that are situated in real-world contexts. From this perspective, meaning making is the process of sharing perspectives and experiences through collaborative processes and within communities of practice. Therefore, learning can be derived from meaningful discussions with other peers who have similar or different perspectives based on their own experiences.

An important context for thinking about social constructivism is in relation to particular learning processes that are described from two concepts: (1) Vygotsky's 'Zone of Proximal Development (ZPD)' (the term became part of mainstream thinking in pedagogy since the translation of his Mind and Society in 1978), and (2) 'Intersubjectivity' (Jonassen, 1999; Lave and Wenger, 1991). Vygotsky defined the ZPD as the distance between a learner's current conceptual development, as measured by independent problem solving, and the learner's potential capability, as measured by what can be accomplished under the assistance or in collaboration with more capable peers (Vygotsky, 1978). With practice and personal support, learners may increase their learning skills, until they can manage on their own (Cole, 1992). 'Intersubjectivity refers to the mutual understanding that has been achieved between students through effective communication. The social constructivist theme is reflected in the way in which learning occurs through the process of intersubjectivity in the Zone of Proximal Development. That is, learning occurs through negotiation of meaning and com-

Figure 1. Situations, interactions, mechanisms and effects (Excerpted from Dillenbourg, 1999)



munication between students and teachers within a context of real-world activities. Peal and Wilson (2001) summarise the design of web-based tools as ZPDs by adopting the following features:

- Learning activities that are part of real or simulated activity systems, with close attention to the tools and interactions, characteristic of actual situations
- Structured interaction among participants
- Guidance by an expert
- The locus of control passes to the increasingly competent learners

At the same time, there is a wide range of pedagogies that can be mapped to a social constructivist perspective such as collaborative learning (McConnell, 2002) and the accounts of community facilitated by technology with social and situated views of learning. That is, the idea of communities of practice (Lave and Wenger, 1991).

Collaborative Learning as a Process of Interaction

Given the potential of more able peers to help less able ones, researchers have tried to identify the characteristics of collaborative learning. For example, Goodyear (2003) argues that collaboration may be viewed as a mechanism for causing interaction among students which may enable certain processes such as explanation, disagreement and social negotiation of meaning. Dillenbourg (1999) offered an account of collaborative learning processes in terms of developing ways to increase the probability that learning interactions will occur within an educational context (Figure 1).

One way to think about these mechanisms constructively is to consider how these situations can be designed for online learning activities and how these activities can generate interactions between students. At the same time, a key challenge is the question of how to use these mechanisms in order to empower learners to engage actively with the range of tools and resources of the online environment. For example, online discussions may provide learners opportunity for reflection through creating explanations and by posing alternative positions, where negotiation of meaning between peers may occur. In addition, an alternative online activity such as a group-based task within an online learning environment, peers may share learning tasks for ensuring mutual engagement and cognitive load especially when students' skills within group are in advanced level In each case, however, less able peers in particular areas may develop their understandings by observing the more able ones in conducting particular learning activities. An interesting challenge is to think the types of situations that can create collaborative processes within learning communities where learners may give their own interpretations of different views. This might be encouraged by creating and engaging students in communities of practice.

Communities of Practice

The notion of community facilitated by technology have been explored by many researchers with social and situated views of learning and the idea of communities of practice in Computer Supportive Collaborative Learning (CSCL). Accounts of situated learning (e.g. Brown et al., 1989; Lave and Wenger, 1991; Wenger, 1998) have had a particular influence for e-learning. Wenger (1998) argues that issues of education should be addressed primarily in terms of identities and modes of belonging, and secondarily in terms of skills and information. This view regards pedagogy for e-learning not just in terms of procedures and techniques for supporting the construction of knowledge but in terms of their effects on the formation of identities (Mayes and Fowler, 1999). The essence of a community of practice is that, through a joint engagement in a particular activity, learners form identities and develop and share practices (Mayes and de Freitas, 2004). A community of practice has been defined by Wenger (1998) based on three aspects:

- What is about – as a joint enterprise as it is understood and continually renegotiated by its members
- How it functions – as a mutual engagement that binds members together into a social entity.
- What capability it has produced – the shared repertoire of communal resources members have developed over time, e.g. routines, sensibilities, artifacts and vocabulary.

Involvement is central here because it means making conscious commitment to a group. Shaffer and Anundsen (1993) refer to this as 'conscious community' and as described by Wenger (1998) this is a community that emphasises participants' needs for transformation and personal growth, as well as the social aspects of the community. In some instances these learning communities may be more interesting and stimulating because they involve participants with similar objectives and interests. This aspect may be a part of what differentiates community for social networking (e.g. Facebook, YouTube or My Space) and communities that nurture personal growth and development.

The attraction of applying communities of practice in higher education is whether or not students are motivated for conceptualising learning as a process of guided construction of knowledge. This means that teachers need to focus on the student's cognitive activity otherwise there will be no useful learning. For example, Rohde et al., (2007) proposed a design of practice-based courses where students created a community of practice. The online community's purpose was to facilitate the view of knowledge as a construction of students' online interactions within the community and remains within the virtual domain to be accessed, challenged and developed further by other members in the community. At the same time, Goodyear (2003) gives an account of communities of practice as knowledge-sharing by describing a cycle of learning, moving through phases of externalisation (of tacit knowledge) sharing, discussion, refinement and internalisation.

The design of online learning tasks is central here. Goodyear (2003) distinguishes between a task (what gets set by the teacher) and an activity (what follows as the learners' response to the task specified). A number of taxonomies of task types exist, and these can be useful for teachers to decide what specific tasks to set according to the desired software tools to be used. Paulsen (1995) has reviewed a wide range of e-learning and teaching techniques and has produced a taxonomy of online learning tasks. At the same time, in face-to-face mode these learning tasks may be accomplished through the use of simulations, group activities and small-group projects and by encouraging students to pursue topics of their own interest. A sense of community in the classroom may emerge from these activities which may allow students to create physical interactions.

USING SOCIAL SOFTWARE TOOLS FROM A SOCIAL CONSTRUCTIVIST PERSPECTIVE

Successful collaborative processes and the creation of online learning communities emerge and are shaped by their own members. The teacher as a member of that community may influence the structure and the character of the community but not the creation of that community. The teacher, therefore, may set up or modify learning tasks, select and design software tools that may assist to the emergence of the learning community where each student may customise these tools to meet their own needs. The design of these tools may be modified to meet the requirements of a new learning task on which students are working. For example, the teacher has assigned an online collaborative learning task for students to share opinions and ideas. The teacher could initiate that particular task by designing supportive organisational forms and structures necessary for establishing an online social network. These supportive organisational forms may include social software tools for triggering students' action. Social software can be broadly defined as 'software that supports group interaction' (Owen et al., 2006). The most common type is likely to be discussion boards. However, applications like weblogs, and wikis are now widely used for teaching and learning. According to Owen et al., (2006) some of the key attributes of these tools, in relation to higher education, are that they:

- Deliver communication between groups
- Provide gathering and sharing resources
- Deliver collaborative collecting and indexing of information
- Enable communication between many people
- Support conversational interaction between individuals or groups ranging from real-time instant messaging to asynchronous collaborative teamwork spaces
- Support social feedback
- Deliver to many platforms as this is appropriate to the teacher, student and context

Weblogs are updatable personal websites, often used as personal journal, consisting of brief paragraphs of opinions, information and links, called posts (Anderson, 2006). Wiki software allows learners to easily upload content and easily edited by anyone who is allowed access (Owen et al., 2006; Anderson, 2006). One of the well-known examples is the online encyclopedia Wikipedia (http://www.wikipedia.org/). The principle behind the operation of Wikipedia is that a wiki may be regarded as a collaborative tool that may facilitate both the needs of a large group but also may be used as an asynchronous social tool for the particular needs of small groups (Owen et al., 2006). Flexibility, ease of use and open access are some of the many reasons why wikis and blogs are useful for group working.

This section will consider a range of social software tools such as discussion boards, blogs and wikis in relation to the two social constructivist

Table 1. Paulsen's taxonomy of online learning tasks

Techniques	Example methods
One-alone	Online databases; online journals; online applications wikis, blogs, social bookmarking; software libraries; online interest groups, social networking
One-to-one	Learning contracts; Apprenticeships; interviews, collaborative assignments, roleplays, wikis, blogs, social networking
One-to-many	Symposiums; lectures; role plays; interviews, wikis, blogs, social networking
Many-to-many	Discussion groups; simulations; games; debates; case studies; brainstorming; Delphi techniques; Forums; project groups, wikis, blogs, social networking

perspectives: collaborative learning and communities of practice. The particular approaches proposed may provide, to teachers, a starting point for reflection on how collaborative learning and communities of practice may be mapped to teaching and learning using social software. However, there are a number of elements that determine the level of learning that can be achieved by using social software. These limitations may often be apparent to the design of learning activities because students may perceive their engagement, for example, into online learning communities differently often causing lack of engagement, interaction and participation. Social presence becomes a critical element in community building in a way that the instructor should empower students to participate in the community building and exploration of content (e.g. Goodyear, 2001; Ellis et al., 2007). Also, establishing guidelines as a starting point for collaborative processes in a group may serve as a means by which the group defines shared goals and purposes (e.g. Goodyear, 2007; Kanuka, 2007).

Using Social Software for Engaging in Collaborative Learning Processes

Collaborative learning may be instantiated in actual practice by using a number of different tools. For example, discussion boards and blogs may be used to create processes of collaboration and interaction by introducing online discussions through linking and posting information and resources. The interactive nature of online discussions assists in promoting discussion among learners by creating a forum for sharing opinions and ideas. By engaging students in online discussions, teaching and learning may be transformed from a one way instructional approach to a highly interactive approach to learning (Ellis et al., 2006). Additionally, reflection and reflective practice may be seen as one of the most valuable affordances that online discussions can provide. This is particularly useful when face-to-face discussions and online discussions complement each other. For example, the online discussion may be planned not just to be an 'add on' but to be an integral part of the learning environment. Therefore, by integrating blogs or discussion forums for engaging in online discussions into the teaching and learning flow of the classroom, students have the time to foster a habit of reflective practice, critical thinking and articulating online, which can subsequently further develop during in-class discussions.

Research findings show, that online discussions often focus on similar kinds of learning tasks such as the encouragement of participants to put their thoughts into writing in a way that other peers can understand, promoting self reflective dialogue and dialogue with others. That is, effective online discussions through the use of social software tools foster effective collaborative learning (Ellis et al., 2007). However, students may only achieve this deep reflection on the online postings made by other peers, if the purpose of the learning activity is understood by them (Ellis et al., 2004).

For the purpose of developing student's understanding, teachers should view the reflective practice as a part of an active learning structure, for the use of blogs and discussion boards, which facilitate the sharing of different viewpoints and ideas. This is central here, particularly for using blogs where a permanent record of a student's thoughts is provided for later students' reflection and debate, by automatically saving the messages posted in the discussions. This may create a network of interactions, which may form a social network. For example, if blogging activity is combined into two models which can function simultaneously then the particular application can be both user and content focused or a mix of either. The user - focused model may be designed for the purpose of interaction, sharing and formulating social networks. The content –focused model may be used for assigning learning content which can be written from a personal point of view, with students expressing their own range of interests, rather than on an assigned project or a course topic. This provides to students the ability to create their own content by adopting a research-based approach. For example, Britain (2004) argues that the teacher should gradually engage students in collaborative learning by primarily focusing on making explicit students' conceptions of the phenomenon in question which, in turn, they will determine their prior knowledge of that phenomenon. The second stage is to help students to be aware the level of knowledge they already have and this could be accomplished by engaging them in online discussions for exchanging opinions that would assist on experiencing other students' views on the same issue (e.g. McLoughlin and Luca, 2001). Interaction may occur throughout the students' group instead of between students and the teacher within the group setting and therefore, the teacher is acting as a group member who is contributing to the learning process thus, encouraging students to form different communities with different knowledge-building practices. Such communities may be academic or vocational, at a first instance, and ideally students should recognise that both the creation and the application of knowledge within the community are well-understood and have value for the members (Goodyear, 2007).

Creating Communities of Practice With the Use of Social Software

Conceptualising the use of a blog from a content-focused approach, there is the possibility to build learner knowledge networks. That is, the design of a Knowledge Forum, as Scardamalia and Bereiter (2003) addresses it, aiming at supporting learners to pool ideas and reflecting to these by developing supportive arguments. In the form of content, like notes, a multimedia community knowledge space is created through students' different perceptions, models, theories, evidence and reference material in a shared space. Through this space, students may develop a collective responsibility for the solution of knowledge problems, and the teacher is assisting students to grow into that responsibility. The learning activity includes the development of ideas and explanations which then are shared with a group of peers. Then, refinement of these ideas is important as new ideas develop. In this way the use of a blog as a Knowledge Forum has the potential to include an interplay between socially defined knowledge and personal experience which is mediated by a membership of the group. This provides a learning situation that negotiates both an individual's experience, and the knowledge that the individual takes from, or brings to, the community. Consequently, the use of a blog as a Knowledge Forum supports the creation of communities from a focus of carrying tasks and activities to a focus on the continual improvement of ideas and creative problem solving (Scardmalia and Bereiter, 2003).

An important element for social software is linking as it may deepen the conversational nature and also the sense of immediacy (Anderson, 2006). From a user-focused perspective, the process of linking to different communities may lead to 'boundary crossing'. For example, through linking, students can be members of online learning communities that include other cultures, experiences and ages. By this way, students have the opportunity to move beyond their particular social community and enter other communities where new skills are developed with the assistance of more experienced members of the community. In particular, White (2006) argues that teachers may start thinking about strategic approaches to using blogs as a medium for community development. That is, in terms of (1) technology and design: the impact of blogging tools on the community and (2) the social architecture: locus of control, power, identity, interaction processes and the role of subject matter. White (2006) distinguishes blog based communities in three main patterns: The blog centric community, the central connecting topic community and the boundaried community.

The main difference between these kinds of blog based communities is based on locus of control power and identity. In blog centric communities the power is firmly held by the blog owners as they can set the rules and norms of engagement. The topic centric blog community's power and identity is distributed across the community because there is no technological platform and bloggers may select their own tool. In boundaried communities, blogs and blog readers are hosted on a single site or platform. Learners may become members of the community where are offered the opportunity to create a blog. Often boundaried communities have other social software tools such as discussion boards, instant messaging and wikis. Power in boundaried communities is held partly by the owner of the platform, who may impose rules but also is exercised by bloggers in terms of the frequency of posting and interest as measured by how many comments a blogger gets. An example of adopting a boundaried community for teaching and learning would be to design a learning activity where each student would have the chance to log in a Virtual Learning Environment (VLE) where there would be collections of other students' blogs for the students to post their opinions and ideas for the issues discussed. This may lead to faster social connections and community building. However, these blogs are not replacing the forum instead they offer a new community activity because bloggers have more control of the message than in a forum in terms of controlling the pace of the postings and determining their relevance according to their own learning experiences. Therefore, blogs can be regarded as a more personal part of the VLE where the students reflect, criticise and control different posts based on their personal interests.

An interesting point made by White (2006) is that blog communities may take the form of a network since they are not bounded by the technology and may grow beyond the ability of an individual to keep track of the network. With the perspective of social architecture including the roles and forms of interaction within each type of blog communities, teachers may be able to design their blog community while taking into consideration the role of content or subject matter, their role as facilitators and the role of the technology. In essence, the view of online communities provided by White (2006) may form pedagogical approaches for designing and nurturing blog communities by distributing control, power and identity.

A strong element of this socio-cultural view of using blogs and other social software tools is online identity or social presence – what persons become when they are online and how they express that person in virtual space (Palloff and Pratt, 2007). For example, an introverted student, who tends to have more difficulty establishing presence in face-to-face teaching, may become more extroverted by establishing presence and interaction with other peers online. This notion of changing identity when interacting with technology may be caused by the fact that introverted students process information internally and are more comfortable spending time thinking about information before responding to it (Palloff and Pratt, 2007).

Consequently, introverted students may have less difficulty creating a blog for exchanging opinions within a boundaried community where the establishment of a social presence may be easier than in-class. It can be argued, therefore, that the degree of social presence that may be developed within a boundaried community may be attributable to the particular technological tool in use. For example, introverted students may still be introvert when using a synchronous chat because it may be perceived as a "noisier" space where they have to post instantly their thought without having available time for reflection, but when they use a blog they may become more extrovert as they have a sense of control and time to reflect their arguments before posting. However, recent studies that investigated social presence have suggested that the medium does not affect the development of online presence. Instead of the particular tool, the way that the student interacts and behaves with other peers impacts on the development of online presence (Wenger, 1998; Polhemus, Shih, and Swan, 2000; Stein and Wanstreet, 2003).

Learning through an online community may not be accomplished only by designing online learning activities that promote interactions between a learner or learners and an environment that is carried out in response to a task with an intended learning outcome (Beetham, 2004) but by focusing also on the process of learning and on the learning activities that students carry out to develop understanding. Although the teacher is responsible for designing appropriate learning activities that facilitate the process of participation, interaction and expression of different opinions and ideas, students also have to contribute for achieving successful online learning activities. Therefore, in order for the students to be considered 'active' in an online community, they must not only access the online learning environment but they must post a comment of some sort. By posting comments students are considered as active participants and as a result ideas can be collaboratively developed and socially negotiated.

This ability to collaborate and create meaning communally is a clear indicator that students are actively participating in the learning process. For example, an active student who participates and generates knowledge may be the one who gives substantive feedback for other students' ideas but also provides additional resources that other peers may want to review. This development may be considered as a successful learning outcome because the student is able to critically evaluate other students' comments and at the same time being able to gather additional learning resources that go beyond the material assigned, thus developing their skills and their confidence as researchers. At the same time, teachers may offer some guidelines for achieving minimal participation, making it more likely that the students will participate in the learning process. Palloff and Pratt (2007) note that this expectation of participation differs from face-to-face teaching and learning because the discussion can be dominated by more extroverted students giving the impression that the class is engaged.

The opportunity for reflection and the ability to think before responding to a post may help to create a level of participation and engagement that may be greater than a face-to-face discussion. For this reason, the instructor needs to be actively engaged in the process and motivating students to participate by posting interesting topics for accomplishing the desired learning outcome. This may encompass the development of a learning community and not just a social community where knowledge about the learning content can be understood and the ability for collaborative knowledge building can be achieved.

However, research studies reported that students may be uncomfortable to engage in online environments for openly criticizing each others work (MacDonald, 2003), engaging them in peer feedback (Ramsey, 2003) or shifting the power from the tutor to them (Crook, 2002). Sweeney et al., (2004) conducted open-structured interviews with 12 students in a blended course where some sessions were conducted face-to-face and some on discussion boards. Sweeney et al., (2004) concluded that there were students who perceived discussion boards as requiring reflection and hard work whereas others perceived them as offering freedom of speech and deep learning. These variations in students' perceptions may be related to students' understanding of their learning, the role of the learning environment and the activities that are engaged within that. Ellis and Calvo (2006) attempted to investigate these relations by exploring the student experience of learning through discussions in an undergraduate engineering subject. A quantitative approach was used by giving three questionnaires for providing a comprehensive investigation of the qualitative variation in students' experience. They suggested that if students do not understand how discussions could help them reflect on and revise their ideas, they tended not to approach face-to-face or online discussions in ways likely to improve their understanding. They conclude:

"It would also seem necessary to strengthen the relationship between the purpose of the discussions, whether online or face-to-face, in relation to the learning outcomes of the students… Without such strategies, poor approaches to discussions, negative perceptions of workload and a general lack of awareness of the value of discussions for learning will hamper the quality of learning experienced in discursive learning contexts." (p. 67-68)

IMPLICATIONS FOR USING SOCIAL SOFTWARE FOR TEACHING IN HIGHER EDUCATION

Since the use of social software promotes communication, interaction, sharing of resources and social feedback, it is difficult to talk about pedagogically driven practice in terms of using social software without investigating teachers' conceptions, beliefs and intentions of teaching, in order to sketch their main approaches to using social software. However, uptake and implementation does only depend on teachers' beliefs and intentions to using social software but also on students' conceptions of teaching and learning, their conceptions about the learning environment and their conceptions about the subject matter. Part of this section focuses on teachers' conceptions in terms of distilling the main outcomes they imply.

Kember (1997) identified five conceptions of teaching which could be located from a continuum, from a teacher-centered, content oriented conception of teaching to a student-centered and learning conception of teaching as follows:

- Teaching as imparting information
- Teaching as transmitting structured knowledge
- Teaching as an interaction between the teacher and the student
- Teaching as facilitating understanding on the part of the student
- Teaching as bringing conceptual change and intellectual development in the student.

It is apparent that the first two categories have practical implications for using social software. At a first instance these conceptions heavily rely on declarative conceptual knowledge, contemplative forms of analysis and use of textual representations (Barnett, 1997). Therefore, the aim is for the students to absorb predefined knowledge relevant to the discipline's objectives. The main kind of learning outcome associated with these conceptions is the ability to recall prior knowledge and use it for the construction of arguments or for problem solution more generally (Goodyear, 2003). On the contrary, the following three conceptions converge more with the pedagogical assumptions for using social software because the student is supported to handle with confidence concepts, theories and ideas and communicating them with peers and teachers. Also these conceptions encourage informed but critical action by understanding the power and limitations of the field as a resource for action (Barnett, 1997).

These conceptions of teaching may imply that the way social software tools are used depends on the educational beliefs and presumptions of teachers. This also implies that the use of social software is likely to have varied uptake and implementation because of differences in conceiving how these tools may be used between teachers and also between the educational presumptions inherent in these tools. Connected to this observation, teachers may rethink their conceptions, towards a more social constructivist approach for using social software. Teachers that wish to support the use of these tools may plan curriculum design as a social process by:

- Allowing learners to personalise their learning but in a framework that monitors their progress
- Collaborating with experts in a particular domain so students can participate in discussions and become knowledge creators
- Developing learning tasks that encourage collaboration and sharing of ideas
- Supporting the learning experience in terms of designing different learning tasks outside class environment
- Creating organisational structures and deploying appropriate tools for online learning communities to emerge.

These suggestions involve a detailed consideration of the nature of using social software, which may also influence teachers' conceptions of teaching in general. Therefore, for using social software teachers may need to decide what concepts, tasks and methods to introduce based on their conceptions of teaching and the demands of the curriculum. This suggests that particular beliefs and intentions for teaching may bring certain affordances and constrains to the use of social software. This indicates that there is a need for sustained and influential research to understand teachers' conceptions of using social software for teaching and learning.

Another important implication is the integration of social software tools into institutional Virtual Learning Environments (VLEs). Institutions support that these environments reflect the organisational reality. This means that a VLE provides the student with tools such as discussion boards, email, noticeboards, whiteboards, etc and connects the user to university libraries, resources, regulations and specific content such as assessment and modules. The argument is that since VLEs contain all this data, there is the potential to change the particular learning environment (such as the type of learning tasks, learning resources, type of tools, complexity of material, etc) to the student's preferences. However, practitioners now question whether the idea of a VLE can support the integration of social software tools (Anderson, 2006). In response to these concerns, Johnson et al., (2006) investigated the development of a Personalised Learning Environment (PLE) as having a significant effect in managing personal goals in the context of personal development planning and for introducing the integration of social software and e-portfolios.

CONCLUSION

This chapter explained how the social constructivist perspective can inform the use of social software. Certain pedagogies from a social constructivist approach were discussed including collaborative learning and communities of practice. Then, this chapter discussed how these pedagogies may be used for social software. This is particularly useful for mapping the social constructivist approach against specific characteristics of learning, which may enable teachers to design specific learning tasks for social software tools.

This also may allow teachers to make the link between pedagogy and theory more explicit. It is perceived that using social software tools for helping students to engage in online discussions will promote collaborative learning and interactions amongst learners as well as reflective practice. Furthermore, providing the appropriate organisational structures and technological tools enable learners to develop online learning communities where the sharing of learning material and the construction of new ideas, with the help of more experienced peers, may lead to user-generated content. From a user-focused perspective, an important element of social software is linking which gives the opportunity to students to enter other communities, with different cultures and experiences to create new knowledge and skills. This may generate a network of interactions, which can result in the formation of a social network community. Personal identity and social presence are important for establishing internal dialogue for formulating responses which can be potentially different from how students may respond to face-to-face teaching and learning. The discussion and acknowledgement of these issues support the development of control, power and identity in the online community by designing pedagogically informed learning activities. However, we must acknowledge that designing such learning activities may not lead to intended learning outcomes because students' conceptions of teaching and learning and how they intend to engage in the online learning environment may vary.

Teachers' conceptions of teaching seem to be an important consideration for using social software from a social constructivist approach. Teachers may need to decide their teaching strategies (nature of learning tasks, curriculum design, teaching approaches etc), in terms of using social software, based on their particular understandings of the teaching process. This is particularly useful in the context of e-learning, because through teachers' conceptions of teaching, researchers could investigate the impact of factors such as individual perspectives, cultural and discipline differences in terms of using social software.

Further empirical research is needed to understand the role of social software from a pedagogical perspective by investigating how the use of these tools can support students' learning experiences. Social software tools are currently perceived as technologies that imply a different relationship between institutional boundaries and social forms (Jones, 2008) so further investigation is needed to see how current institutional VLEs can afford the opportunity of greater peer-based pedagogy to allowing more radical or diverse learning activities by integrating social software or whether it is preferable to rely on publicly available social software resources which can be used for teaching and learning.

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This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 269-284, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 4.6
Social Networking Sites and Critical Language Learning

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ABSTRACT

This chapter looks at the potential use of Social Networking Sites (SNSs) for educators and second language learners. It views SNSs broadly through the lens of Critical Language Learning (CLL) and looks at specific issues of identity formation, student empowerment, learner autonomy, and critical literacy as they relate to the use of SNSs. This chapter also reports the results of an initial project to make use of the MySpace social networking site for Japanese learners of English. It is hoped that this chapter will raise awareness of some of the complex issues surrounding the use of SNSs by language learners and that it will lead to further research and consideration of these issues.

DOI: 10.4018/978-1-60566-190-2.ch013

INTRODUCTION

As technological innovations of all kinds push our society forward at ever increasing speeds, the basic nature of social interaction is being transformed. Social networks are now being formed in ways that no one would have imagined 50 years ago. Currently at the heart of this phenomenon is the massive rise in popularity of Social Networking Sites (SNSs) like MySpace, Mixi, Facebook and others; sites designed specifically for the purpose of developing and sustaining interconnectivity amongst users. Though English may currently be the language favored by the majority of users of SNSs, it certainly does not have a monopoly on this trend. The SNS Mixi, for example, which functions exclusively in Japanese, currently has over 11 million registered users. Indeed, according to recent global trends in blog posting, the Japanese language has actually surpassed English in regards to the number of blog posts per language, with Japanese now generating 37% of the total contribution to the blogosphere (Sertan, 2007; Sifry, 2007). The global ubiquity of SNSs means that second language learners can easily find themselves in contact with native speakers anywhere in the world. Clearly the popularity of the sites, combined with the opportunities for meaningful interaction that they present, potentially make them a powerful platform for second language acquisition, and, in fact, research into how best to take advantage of this opportunity is beginning (Godwin-Jones, 2006; O'Hanlon, 2007; Murray, 2005).

There are complex questions to be considered however; questions that relate specifically to changes in the meaning of identity and the forms of social interaction that occur online. How, for example, can the complexities of second language identity formation be interwoven into one's online identity formation? Or, what new types of literacies are required for decoding and interpreting information in multi-modal, peer to peer environments like SNSs? (Dieu, Campbell, & Ammann, 2006). Could we also consider an analysis from a constructivist perspective? Social constructivism, particularly as it relates to education, places primary importance on the need for mediation and social interaction in the development of meaning (Pasfield-Neofitou, 2007; Vygotsky, 1978). Web 2.0 technologies are, after all, primarily about the construction of meaning through interaction between and amongst users. Some research recently has looked to constructivism and in particular Vygotskian social constructivism as a way to interpret and assess some of the potential benefits of the type of peer editing and collaboration that can take place on wikis and SNSs (Lavin & Claro, 2005). This chapter will attempt to lay a framework for a discussion of these questions and others by looking at SNSs and other associated Web 2.0 technologies from a Critical Language Learning (CLL) perspective and by considering a recent case study looking specifically at the use of the MySpace SNS to facilitate the acquisition of English amongst Japanese university students. Specifically, this case study had three primary objectives:

1. To assess Japanese students' interest level and motivation regarding the use of SNSs to improve their English skills.
2. To consider the use of the MySpace SNS through the framework of the issues of identity formation, learner autonomy, critical literacy, and student empowerment (Pennycook, 1997).
3. To map out potential difficulties and opportunities for further research into the potential use of SNSs for English learners in Japan.

This case study and its associated research relating to CLL and the potential applications for SNSs in the second language classroom is one of the first of its kind, particularly in a specifically Japanese context. It is hoped, however, that this chapter will lead to further discussions and considerations of the relationship between the changing nature of social interaction in the age of the Internet, and the potential opportunities and challenges that these changes present to the second language learner.

SOCIAL NETWORKING SITES AND CALL

Social networking itself is not a new phenomenon. Indeed, our innate need for social interaction has always drawn people together to form real-world social networks where members sought to build and maintain a sense of community through interconnectedness with others. Though CMC (Computer Mediated Communication) has existed in various forms for most of the last 50 years, it is only recently, as the Internet has begun to work its way further into the lives of individuals all around the world, that CMC has become both immediate and global (Lam, 2004). The massive rise in the popularity of SNSs should come as no surprise when we consider two main factors. First, SNSs have become wonderfully efficient at what they propose to do, namely to allow users to share information and interact with one another in a dynamic and multi-modal environment. Secondly the social networking phenomenon fills an essential niche in a modern society that is increasingly finding itself lacking in face-to-face interaction. Some descry this development and the decline in social and interpersonal skills they perceive to be associated with it. However it is equally possible to perceive a future where new technologies empower and enable people to interact with others in meaningful new ways and also allow people to create and shape identities for themselves that would otherwise be impossible.

Whether or not one is optimistic about the future potential of SNSs to transform society, we cannot deny their current popularity. Indeed statistics now show well over 250 million unique visitors to various SNSs around the globe, with interest in certain sites like Facebook up 270% from June of 2006 through to June of 2007 (Comscore, 2007). It should come as no surprise then, that forward thinking teachers and educators across the globe have for several years been involved in considering how to take advantage of both the popularity of SNSs themselves, and the various Web 2.0 applications associated with them (Lantolf, 2000; Murray, 2005; Cummings, 2007). In order to best understand how Web 2.0 technologies may be applied for educational and, specifically, for language education purposes, we should first look at where these technologies fit into the development of Computer Assisted Language Learning (CALL) itself. Some writers (Warschauer, 1999; Warschauer & Healey, 1998; Trotman as cited in Davey, 2005) see CALL as having progressed through three main phases of development: behaviourist, communicative and integrative, with each of them representing higher phases of technical and innovative complexity (Davey, 2005).

CALL itself, in a broad sense, owes much to the growth of the Internet, particularly as a reference tool for both students and educators, but it is specifically in the area of CMC where some of the most significant recent changes are taking place (Hata, 2003; Cummings, 2007). Educators are continuing to look for new opportunities and ways to take advantage of technological innovations associated with CMC. Wikis, blogs, synchronous and asynchronous chat, SNSs, these are just a few examples of potentially beneficial tools for the language learning process that teachers are beginning to turn to in their attempts to blend student interest, technological innovation, and quality pedagogy (Hata, 2003; Lavin & Claro 2005; Murray, 2005). Aside from the technological advances associated with CALL in its present form, we are also seeing a pedagogical shift towards a more socio-cognitive view of how CALL can and should take place (Davey, 2005). Though the technological and pedagogical advances have not necessarily developed simultaneously, it is important to note that they have also not developed in isolation from one-another. In fact, it is not difficult to see that current interactional and social constructivist notions of L2 learning and acquisition may fit nicely with what the Internet can presently offer language learners (El-Hindi, 1999). While the possibilities offered by the Internet to both the teacher and student are only beginning to be explored, it could be argued that the Internet, combined with other multimedia and peer-to-peer technology, has already become a fundamental tool for many in both groups.

WEB 2.0

The concept of Web 2.0, which has become a popular buzzword in the fields of CALL and educational technology since 2004 (O'Reilly, 2005), does not in and of itself represent any significant singular technological innovation. Rather, it has come to be understood in a broad sense to refer to a new series of applications all designed to take advantage of the Internet's potential to allow individuals to participate in new ways in the online experience. According to a recent report by the OECD, the Internet is based on a principle of participation in which collaboration and customization are important factors (OECD, 2007). As an entire new generation is now growing up without questioning the ubiquity of the Internet, individuals are making use of new technologies to share and communicate with one another through user-created content.

The explosive growth in the popularity of blogging is one clear example of the way in which individuals and end-users have sought to take control of the creative process online and generate content of their own. Blogging has, in a very short period of time, become a truly global phenomenon. As noted earlier, recent statistics show that Japanese has now surpassed English in terms of overall blog entries, with other languages like Italian and Farsi showing dramatic increases (Sifry, 2007). Wikis are another area where the users themselves are creating and constantly updating content. Wikipedia, the original online wiki/encyclopedia is among the most visited sites in the world (Comscore, 2007) and its content is almost wholly user-generated and edited. As users across the world are becoming more comfortable and confident with these technologies, either in first or second languages, it is becoming increasingly possible to consider the educational opportunities associated with them.

SOCIAL NETWORKING

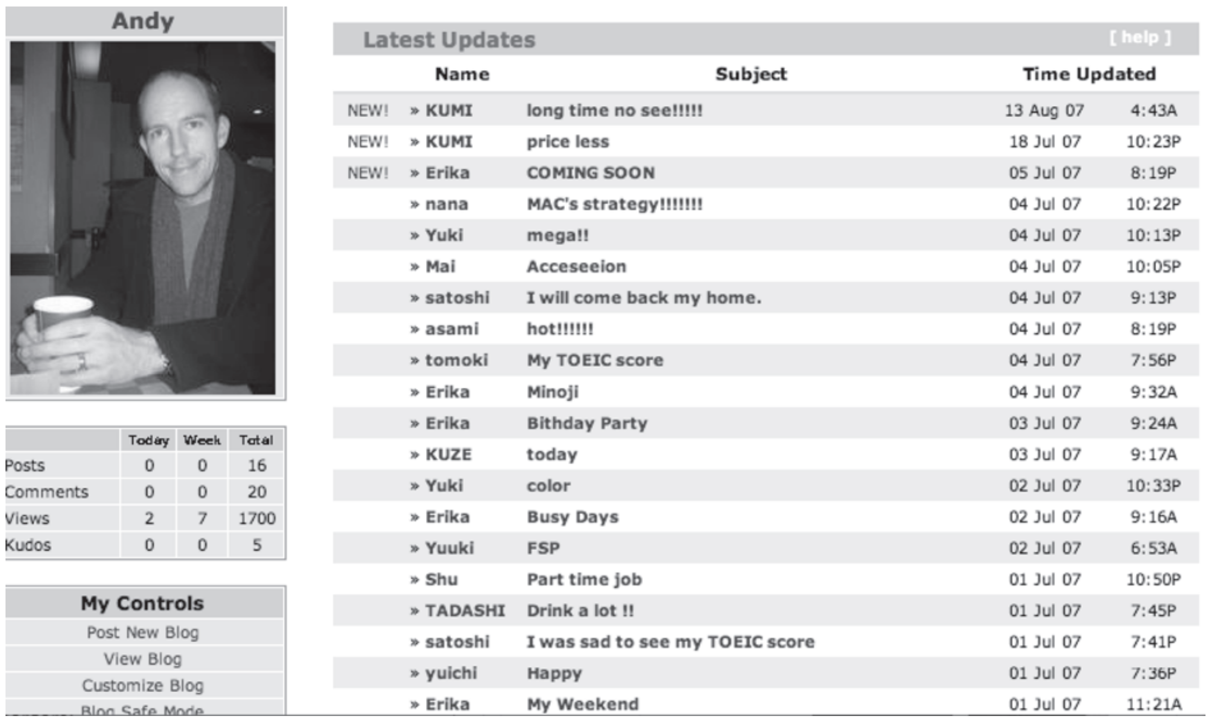
As CMC has gone global, so too has the social networking phenomenon. On sites like MySpace, Facebook and Mixi, millions of users are currently online, sharing photos and information, chatting, blogging, editing friend lists and generally creating and recreating their online identities both through the content they generate and the connections they make with others.

In Japan, the popularity of social networking has tended to center around Mixi. The site, which launched in 2004, has a registered user base of over 10 million people, virtually all of whom are Japanese as their exists no international version. In a review of Mixi, Serkan (2007) wrote that the primary appeal of Mixi seems to be in the simplicity of the interface. Features of the site, including blogging, photo and music sharing, and the establishment and maintenance of friend lists, are essentially equivalent to those of other SNSs like MySpace. Kageyama, however, noted that Mixi has been highly successful in Japan partly because it has a less "me-oriented" focus (Kageyama, 2007) than other SNSs like MySpace. Mixi has successfully found a way to capitalize on Japan's strong emphasis on group relationships, making friend networks the primary focus of the service, whereas MySpace, particularly in the US version, has focused more on making the individual creator of the site the center of attention. This subtle difference in the two sites may go far in determining the future success of the Japanese version of MySpace.

As mentioned, the functionality of both MySpace and Mixi are similar, although MySpace provides a particularly effective blog management tool, allowing users to easily subscribe to the blogs of friends and see instant updates to friends' blogs. Figure 1 shows the blog management interface for MySpace.

Whether it is MySpace, Mixi, or one of the other SNSs being used, they all contain certain similarities. Two key features of SNSs are the ways in which they facilitate user interaction, including, chat, blogging, messaging, file-sharing and other interactive services, and the ways that they allow users to build peer groups based on the recommendations of others.

Figure 1. MySpace blog management screen



It is not difficult to realize why some educators have begun to consider the possibilities and educational implications for wikis, blogs, SNSs and other applications often associated with Web 2.0. From the educational perspective, and particularly with regards to second language learning and acquisition, there are a number of ways in which to frame the potential benefits of these types of technologies:

1. **Learner motivation:** As O'Hanlon (2007) suggests, the high usage patterns of social networking sites by American teenagers indicates their popular appeal. Much research has been done to suggest that learner motivation is a key feature in the process of language acquisition (Gardner & Lambert, 1972) and being able to capitalize on a phenomenon that has already captured the attention of millions of people all across the world has great potential. Though educators must guard against the adoption of technology purely for technology's sake, a further look at the potential possibilities offered by Web 2.0 applications may demonstrate real value for second language learners.
2. **Collaborative learning environments:** Wikis in particular offer a uniquely collaborative online environment where individuals or groups of users can interact with and respond to information generated by others. Even face-to-face collaboration between and amongst language learners, which until just recently was restricted solely to the classroom environment, can now take place in real time with learners spread all across the globe via synchronous video chat.
3. **Social constructivist approaches to education:** Some research recently has looked to constructivism and in particular Vygotskian social constructivism as a way to interpret and assess the potential benefits of the type

of peer editing and collaboration that can take place on wikis and SNSs (Lavin & Claro, 2005). Research along these lines seems promising, as there would appear to be a natural link between Vygotskian social constructivism and collaborative learning online. Vygotsky believed that knowledge was a social construct that individuals uniquely create as they interact with their environment and with others (Pasfield-Neofitou, 2007; Vygotsky, 1978). If we see the Internet itself as our environment, then clearly much of our knowledge of the world can be understood to be mediated through our interaction with that environment and the individuals we encounter within it.

4. **Critical Language Learning (CLL):** CLL is a broad term that can be used to bring together a variety of concepts including, but not limited to, student empowerment, identity formation, learner autonomy and critical literacy. Although some research has begun to look at how CLL can be seen as relating to the current phase of CALL and the various Web 2.0 applications discussed (Godwin-Jones, 2003; Hawisher, 2000; Pasfield-Neofitou, 2007), little consideration has been given to the language learners' use of SNSs from a CLL perspective. Thus, as mentioned earlier, this chapter will attempt to fill this gap by looking in detail at certain elements of CLL and how those elements can be complemented by student use of SNSs. This chapter will also consider in some detail the results of initial research which looked at two groups of Japanese EFL learners and their first foray into the use of SNSs for the purpose of language learning and acquisition. A brief description of the student groups and the tasks they took part in is included below.

PARTICIPANTS

27 students, 14 female and 13 male, from two separate courses spent one academic semester (14 weeks) experimenting with the use of the MySpace SNS both inside and outside of the classroom. These were second and third year Japanese students at a private university in Japan. The groups were of mixed English proficiency, ranging from high beginner (TOEIC score 300) to upper intermediate (TOEIC score 670) and their experience with SNSs, either in English or Japanese was very limited. Just one of the 27 students reported maintaining a regular page prior to beginning the project and 16 students in total reported being aware of SNSs in general, either in English or Japanese.

Aside from overall English proficiency, computer literacy skills were also varied among the two groups. Based on self-assessment data by the students collected prior to beginning the project, only 6 reported being either "good" or "very good" with their computers, whereas 7 students reported their computer skills to be "very poor." This information was supported by continuous observation of the students throughout the process, indicating that as many as one-third of the students struggled significantly with data entry procedures, particularly regarding the filling in of forms online (Appendix A).

RESEARCH OBJECTIVES AND QUESTIONS

As there has been relatively little research to date regarding the use of SNSs in the second language classroom, the objectives of this case study were primarily exploratory. Firstly, it was hoped that this study would show whether or not Japanese university students of English were interested in and motivated by the prospect of using MySpace as a platform for the learning and acquisition of English. It was also hoped that the issues of learner autonomy, identity formation, student empowerment and critical literacy could be viewed discreetly based on data and feedback from the project. Finally, in the interest of laying the groundwork for further research, this project hoped to identify both potential difficulties and opportunities in the use of SNSs in second language contexts. The specific research questions identified for this case study were as follows:

1. Can the MySpace SNS function effectively as a platform for second language learning and acquisition by Japanese university students?
2. How would their use of MySpace throughout the semester impact and relate to the issues of learner autonomy, identity formation, student empowerment and critical literacy in the two groups?
3. What factors seem to impact the students' interest, or lack thereof, in the process of using MySpace for second language learning?

METHOD

The two groups of students were selected based on availability. The students were pre-enrolled, by the university, and the MySpace project was a clearly defined component of their syllabus for the duration of the semester. Prior to beginning the project, data was collected in the form of a questionnaire to assess students' awareness of and interest in SNSs, their level of motivation to use MySpace as a tool for learning English, and their general perception of their own computer proficiency (Appendix A).

During the first two weeks of the project, students were directed, through formal classroom instruction, how to sign up for and log into MySpace. Basic explanations were also provided regarding the nature of SNSs in general and the various SNSs available, both in English and Japanese, and discussions were encouraged relating to how the use of SNSs could potentially improve the English skills of Japanese students. Weeks 3-6 were spent on basic page management skills, including how to customize pages and backgrounds, enter basic personal information in the profile section, and manage and maintain friend lists. Once all students had well established pages on MySpace, the remaining 6-7 weeks of the semester were given over to two particular tasks. First, the blogging feature of MySpace was introduced, and students were taught how to create a blog, update their blog, and comment on the blogs of other students. Second, using Audacity software, students learned how to record their own audio and upload audio files to their MySpace pages. The two groups of students, who had not previously had any interaction with one another, were made to interact through the use of the asynchronous email and blog commenting features of MySpace.

Regular blogging was a course requirement, and the content of the blog entries was both teacher directed and student generated. Students were also required to write regular comments on the blogs of others. The uploading of student created audio files was also a requirement, though the students were allowed to choose the content and topic of the files.

To conclude the project, a final questionnaire was completed by the students during the final week and informal interviews were conducted with the majority of the participants (Appendix B).

In general, initial student interest in the project was high, with 25 of 27 students reporting that they were either "interested" or "very interested" in the prospect of using MySpace for second language learning (Appendix A). During final interviews conducted at the end of the project, student feedback was slightly more mixed though overall responses were still highly positive. 19 of the 27 students reported that they "enjoyed" or "really enjoyed" using the SNS while 5 students reported that they had "not enjoyed" the experience as a whole (Appendix B).

The remainder of this chapter will be given over to a specific look at each of the four components of CLL mentioned earlier, learner autonomy, identity formation, empowerment, and critical and e-literacy, and a discussion of how each of these issues were touched on during the 14 week MySpace project.

CRITICAL LANGUAGE LEARNING

Norton (2004) explains that, "advocates of critical approaches to second language teaching are interested in the relationships between language learning and social change. From this perspective, language is not simply a means of expression or communication; rather it is a practice that constructs and is constructed by, the ways language learners understand themselves, their social surroundings, their histories, and their possibilities for the future" (p. 1). As the above quote makes clear, our use of language impacts more than merely our communicative ability. How we choose to use a language, and the degree of proficiency that we have with it, shapes who we are and who we are able to become in that language. From this perspective, CLL is concerned with learner empowerment and the degree to which limited proficiency users of a language will be able to shape, control and define their futures. CLL also considers a learner's identity in a second language and how that identity is able to develop, grow and change. Autonomy, and the degree of autonomy available to limited proficiency users of a language is also an important concern. Ultimately, CLL can be seen as a lens through which to examine issues of power, control, and autonomy in language learning.

There would seem to exist a somewhat natural link between the CLL perspective and some of the types of Web 2.0 technologies mentioned earlier in this chapter. A blog, for example, can give a second language student a clear form of autonomy from the traditional classroom writing environment, freeing them to choose topics of their own interest and write in a less structured and controlled environment. This could be said of journal/diary type writing also, something that second language writing teachers have advocated for many years, however, blogs have the added advantage of being relatively public and open to the suggestions and comments of peers. And what about the use of student generated content in wikis? Clearly empowering students to create content of their own promotes autonomy by de-emphasizing the role of the teacher in the language acquisition process. So it would seem that a connection is not hard to make between CLL and Web 2.0 concepts like user-generated content and the participatory and interactive nature of some of these new applications.

IDENTITY FORMATION

Web 2.0 technologies are changing the way individuals create themselves online and the way they are perceived by others. SNSs allow users a platform on which they can create, shape, and re-create their own identities. Through photos, blog entries, videos, musical selections, and friend lists, users are able to share their personalities and interests in an almost immediate fashion. Cummings (2007) sees this new type of identity formation as a dramatic change in people's willingness to share personal information; he writes, "we are starting to construct our identities, both anonymous and real, within the realms of Web 2.0 environments … at no other time in democracy have we chosen to expose ourselves to people we have never met, and will never meet" (p. 2). Some find this willingness to share unsettling, others may consider it a revolution.

For second language users, the issues of identity formation and the presentation of self online can be complex but sometimes liberating. Warschauer (2000) found, in a project looking at the use of the Hawaiian language, that online interaction freed students up to not only make more use of the Hawaiian language, but also to explore and further develop their Hawaiian identities. In a review of the Warschauer study and several others, Murray (2005) points out that second language users involved with CMC often develop both global and local identities to deal with the differing social and linguistic environments with which they are confronted.

A fair amount of research has been done in the field of SLA regarding the relationship between identity formation and language learning. In particular, researchers have considered how language use and proficiency in second language can contribute to, enhance, or hinder the development of a sense of self and unique identity in the new language (Belz, 2003; Hawisher, 2000; Norton, 2000). Belz notes also that some recent research has begun to consider the role of language play in second language learning, and she reports a study in which students studying German were "able to occupy third spaces from which they could both play with and reflect on multiple linguistic identities" (2002, p. 28).

It is not difficult to view the use of SNSs as a form of language play and indeed the enormous popularity of sites like Facebook, MySpace and Mixi demonstrates clearly that many millions of people around the world are already involved. Pasfield-Neofitou (2007) argued that, "online identity is largely constructed through one's textual behaviours, so it is important for learners to manipulate the language effectively" (p. 148), however, it would seem that, within the multimodal, peer-to-peer environments of current SNSs, this focus on text may be becoming less and less necessary. Users determine how they are perceived by others not merely through text and chat alone, but through their photos, music, videos, and shared friend lists.

For Japanese students in particular, it has been noted that second language identity formation may facilitate the development of a sense of ownership of the target language, something that has been a struggle for English language education in Japan. For example, Ha (2005) pointed out that English education in Japan has, up until now, had less to do with mastery of the language and the understanding of English as a tool for global communication than with the Japanization of English.

One significant aspect of the MySpace project was the possibility to witness and visually record the students' personalities taking shape on their pages. Because, as noted earlier, MySpace pages are almost infinitely customizable, all manner of characteristics can be displayed. Aside from color schemes, backgrounds and photos that quickly overwhelmed the pages, students also discovered the use of "theme music" that would begin to play as soon their pages were opened. Blog topics formed another component of the sense of self that came through in the students' pages, with topics demonstrating not just student interests, but also their day-to-day routines, political tendencies, and all manner of other things. In the post-project questionnaire students were asked to consider what aspect of the project they most enjoyed and it would seem clear that the ability to decorate, modify, or otherwise customize pages was one of the primary elements that students enjoyed about the project.

Other student feedback also seemed to indicate that the multi-modal nature of SNSs was significant in relationship to the mixed ability levels of the students. Those students with a greater proficiency in English were more able to manipulate the primarily text-based aspects of the project, including the blog entries and personal profiles, whereas students with less proficiency were not left out as they were able to express themselves through the photos, audio and video files, and backgrounds that they chose. In a follow-up blog posting, one student wrote that she "*liked to see the other peoples' pages. It helped me know them more*." The use of MySpace seemed to allow mixed ability groups to gain insights into the characters and personalities of other students in a way that

Figure 2. What part of the MySpace project did you enjoy the most?

Response	Number of students	Percentage
A. Writing my own blog	6	22%
D. Commenting on other blogs	3	11%
B. Putting pictures on my page	8	29%
E. Putting music on my page	5	19%
C. Recording audio	0	0%
F. Looking at other MySpace pages	5	19%

would not otherwise happen in a traditional classroom environment.

COLLABORATION AND STUDENT EMPOWERMENT

SNSs tend to be, by their very nature, collaborative and collaboration between and amongst language learners is of central significance in both constructivist and critical approaches to language acquisition and learning. When assessing the value of wikis from a social constructivist viewpoint, Lavin and Claro (2005) note that, "whereas in a discussion forum, it is easy to talk about something but not manipulate it directly, a wiki is suited to actually construct something (e.g. a knowledge base) collaboratively" (p. 10). Here again we see a distinction between earlier forms of CMC, that were primarily text based, and more current forms, like wikis and SNSs, that allow for a multiple modes of expression. Lavin and Claro were speaking of wikis and their usefulness as a platform for students to collaborate to create something. SNSs on the other hand focus more clearly on the identities of the users themselves and on collaboration between them as opposed to the collaborative creation of some kind of final product, as in the case of wikis.

Allowing for and encouraging student collaboration helps to empower students in two primary ways. First it de-emphasizes the role of the teacher and helps make clear to the students that learning can take place in a variety of contexts (Lam, 2004). Second, collaborative activities build a sense of community and purpose for students. SNSs for example allow users to easily identify and share common interests with other users. Groups of second language learners who are united through common difficulties with the language are empowered when they collaborate with others and realize that they are not alone in their frustrations. Regarding the participatory and collaborative nature of blogging, Godwin-Jones (2003) points out that, "blog entries are normally followed by a comment button, allowing readers to write a reaction, which is then logged and linked, along with all other comments, into the original text. While most blogs are created and managed by individuals, group blogs are also possible. Blogs

Figure 3. What part of students' English improved the most during the project?

Response	Number of students	Percentage
Reading	7	26%
Writing	10	37%
Speaking	5	19%
Listening	3	8%
None	2	7%

Figure 4. Comments regarding the use of MySpace for international communication

1. *It is my first time to use blog. It can communicate with people of all over the world.*
2. *We can make a lot of friends all over the world and our life will be much fun so I liked using My Space and I want use it from now on.*
3. *And using my space communicate with other countries people, and people who are learning English tell me how to write good English. Native English help me when I contact with foreign friends. Especially sending Email...*
4. *I liked using Myspace this semester because it can contact with many countries people, so I can enjoy it!! I can understand everyone's hobbies, and favorite music, so I thought we could know more each other.*

are easily linked and cross-linked, to create larger on-line communities" (p. 13). Group blogging, or topically themed blogging targeted towards groups (e.g. communities of students) has great potential for second language learners and SNSs offer a functional platform for this type of work as all major SNSs sites allow for personal blogging, linking and sharing of blogs, and commenting on the blogs of others.

During the MySpace project the clearest example of the benefits of collaboration came through in the level of peer support that developed both face-to-face in the classroom itself and on the MySpace pages. Differing levels of computer literacy were a major factor here, meaning that certain tasks were relatively easy for some students and much more difficult for others. Peer support was the obvious solution to this issue, and it developed spontaneously in both class groups. This type of collaboration was significant in that it allowed students themselves to temporarily take on the role of educator, thus de-emphasizing the role of the formal classroom instructor and at the same time encouraging and empowering the students. It is also significant that the face-to-face interaction and learner support that took place in the classroom seemed to naturally occur in the target language of English. This form of peer-to-peer support may partially explain the fact that 5 of the 27 students surveyed felt that their spoken English improved more significantly during the project than either their reading, writing or listening.

The shared sense of community was strong in both classes, the idea that they were involved in a project together, and that they were faced with similar difficulties along the way helped bind them together. In an interesting twist, difficulties that students faced with the project, for example how to properly upload their audio files, often led to social networking opportunities, with students sometimes using their MySpace pages to interact with one another to work through difficulties.

Relating to collaboration in general, one underdeveloped component of the project was the lack of involvement of a fixed group or groups of native speakers of English with whom the students could interact. The primary purpose of the project was simply the exposure of students to the concept of social networking and an introduction to page management, blogging, and the uploading and importing of content to pages. Although throughout the course of the semester many students did interact with native speakers of English, this was a by-product of the social networking project, not an expressed goal. Looking through student comments and feedback however, it is clear that one of the components of the project that generated significant interest was the potential that SNSs offered to bring them into contact with native speakers of English. A summary of several students' explicit comments regarding this aspect of the project is included in Figure 4.

From data like this, it was possible to define what a potential next step in a project of this nature could be. Namely, the introduction of a system whereby students are encouraged in some manner to interact with native speakers of English through the tools available on MySpace. The simplest way to do this would be to partner with another group of language learners (in this case native speakers of English learning Japanese) and set up a series of collaborative and interactive assignments. The drawback to this approach however would be the reduction in learner autonomy that would result from instructors directing and controlling the social networking process in this way.

LEARNER AUTONOMY

Learner autonomy, though linked in various ways to learner empowerment, is a slightly different issue. Raising learner awareness of their own role in the complex processes of language learning and acquisition is of central importance in the development of learner autonomy. Autonomy is also an integral part of what Web 2.0 technologies are coming to represent. That is, autonomy from the top-down, media and corporate driven content that dominates so much of 21st century culture. Web 2.0 is partly about allowing individuals the freedom to create and express themselves online, to author their own content, and to share that content with others in efficient and meaningful ways.

For language learners, authoring and sharing content of their own can be an exercise in the building of autonomy and independence. It can also be motivating. Hata (2003) points out that greater learner autonomy leads to both increased motivation and greater achievement. Davey (2005) also notes that "these tools [blogs] and facilities that allow the learners to become creators rather than passive recipients of material, again demonstrate the task-based nature of the Internet, which can easily be adapted to provide student-centered and communicative style tasks" (p. 212). The movement from recipient to creator can then be seen as an essential step in the development of learner autonomy and SNSs allow for this movement in a number of ways. The degree to which pages can be customized by users allows autonomy with regards to the page creation. Individuals are also free to create content designed specifically for their page (user profiles for example) and to import content from other sources. The degree of autonomy is so great in fact that the end result is most often a wholly unique and original expression of self online. When making use of SNSs for second language learners, the role of the classroom instructor may also be redefined and importantly, the learners' perception of the teacher's role may be reformulated also. Learner autonomy is related to the degree of independence that learners perceive that they have from the traditional classroom centered and teacher centered models. With SNSs, where learners are connected to one another through shared friend lists, the teacher may become simply another face on the list. This promotes a natural redistribution of the power relationship and puts the student and their page at the center of the learning equation.

Autonomy in computer mediated learning contexts is not without some difficulties however, and the primary concern is the degree of teacher support that is required to help students through the process. Murray (2005) points out that teachers often need to direct students through the websites and applications that they use in order to mediate level appropriacy and this type of teacher mediation contradicts the goal of learner autonomy – in conclusion he argues that teaching using technology needs to be carefully scaffolded. That is, not initially autonomous but building towards autonomy. In the case of SNSs for example, teachers may need to assist students in the process of setting up the pages and learning how to use the various features. This does not necessarily detract from the ultimate goal of learner autonomy however,

Figure 5. Comments regarding blogging and the use of audio files

1. *I liked using My Space because I could practice writing English. I made own my blog for the first time so I was very excited. I also could read English because most of people used in English so I was so happy to read them.* 2. *I like using MySpace this semester. Because I could know how to write blogs.* 3. *I liked using MySpace this semester because ... First it was fun to write to blog, make sounds file and put it on my website.* 4. *... it was fun to write about the topics and add comment to other persons.* 5. *And then, we can debate some topic by my space that we can communicate with another tutorial people, another person and my Tutorial member. It means that people checked my topic and me idea. It leads to growth of the knowledge by changing an opinion.*

because this type of teaching enables students to move towards a larger goal of beginning to author content of their own.

During the MySpace project, Murray's (2005) criticism of the potential for learner autonomy in a computer mediated learning environment proved accurate. Since students were, at each step in the process, essentially dealing with issues that were entirely foreign to them, a high level of teacher involvement and direction was to be expected. This, combined with the language difficulties inherent in such an undertaking in a second language, meant that the instructor's level of control over the project had to be relatively high, particularly in the beginning. Students were not completely free for example, to set up pages as they liked because their ability to do so was mediated by the need for instruction in how to go about this.

This is not to say that autonomy was a failure in the project. In fact, particularly in regards to the authoring and sharing of personal content, many students seemed to enjoy the semi-autonomous nature of the work. Figure 5 provides a brief review of some students' comments on blogging, and the uploading and sharing of audio files.

Some of these reflective comments demonstrate a strong learner awareness of the processes of language learning and acquisition. Evidence of this type of thinking is significant in that it is indicative of both a level of individual autonomy in the learner, and a type of critical awareness of their own role in the learning process.

CRITICAL READING, LITERACY, AND CRITICAL E-LITERACY

Many terms have been used to attempt to describe the new skill set required to make efficient use of all of the materials, tools, and resources available online. Digital literacy, web literacy, silicon literacy, information literacy – these are just a few of the terms in common use (Murray, 2005). One of the simplest and most effective of these may be electronic literacy, but even here, definitions are difficult. Godwin-Jones (2006) sees complexity in defining the term due to the increasingly rapid pace of technological change in society. He writes, "electronic literacy today is a moving target. How and why we read and write online are evolving at the fast pace of Internet time" (p. 8). There is also the question of critical literacy to consider, one's ability to sort through and effectively analyze information is mediated not only by decoding abilities within the language, but also by the ability to critically reflect on the content: "Web browsing and reading must be supplemented by abilities in sorting, navigation, and critical thinking. Integration of other media into texts complicates further the notion of literacy" (Godwin-Jones, p. 8).

A good deal of research over the previous 15 years has looked at how both computer mediated language instruction and general Internet use can enhance and develop critical literacy skills (Warschaeur, 1997; Davey, 2005). Critical literacy must be carefully considered in reference to Web 2.0 technologies in general, and the use of SNSs in particular because literacy itself has an inherent socio-cultural component (Murray, 2005). Belz, in a study of tellecollaboration between American students of German and German students of English noted in her recommendations that the study could have been enhanced had the students participated in "guided cultural sensitization on social patterns of communication" (Belz, 2002, p. 76). She went on to suggest that "more time could have been spent on critical comparisons of the two partner institutions as represented by their official websites. Students [could have been] guided in the development of their critical cultural awareness of both self and other" (p. 76). Her comments suggest that relatively less difficulty was encountered with literacy as it pertains to the decoding of text itself, whereas greater difficulties arose relating to critical awareness and the social nature of literacy.

As mentioned earlier, several of the students involved in the MySpace project demonstrated a level of critical reflection in their interviews and comments at the end of the project, mostly relating to a meta-awareness of the type of positive impact that SNSs could potentially have on their own language learning. Comments, for example, like, "*I liked using my space in this semester, because I think my space helped my writing skills and communication skills*, or, *it leads to growth of the knowledge by changing an opinion*," show that some participants were able to critically reflect on the learning opportunities that the use of MySpace presented to them.

Another factor to look at is that of electronic literacy in general and the impact it had on the project. With specific respect to the issues faced in this project, it may be helpful to look at both computer literacy (the ability to use the computer efficiently, cutting and pasting of information for example, or saving, storing and managing data) and online literacy (related to the ability to source information online and to sort relevant and irrelevant material).

Within both groups it quickly became evident that computer literacy skills varied widely between students. This was less of a problem that might have be imagined however, and, as noted earlier, it led to quality peer-to-peer teaching opportunities for more computer savvy students. It was an issue that was not lost on students however, and several student comments were related to it.

1. *I liked using my space in this semester because when I using my computer I think the class is faster than other class. I think using computer in class is enjoyable for students. So I think using my space in this semester is good thing for students.*
2. *We used PC that we can understand that how to use this site and PC, and we can know some good PC system and site for me.*

The second comment in particular speaks to the issue of the development of computer literacy skills and how this can benefit students.

Online literacy was another issue and here the difficulties were often language specific. As Godwin-Jones (2005) noted, web-surfing skills are critical in nature in that they require individuals to sort data based on relevance and to quickly skim through and analyze that data. Most participants in this project took a great deal of time when they were asked to source information (through Google search for example) and they were very often unable to discern relevant and irrelevant content. This fact led to an increased need for teacher-directed activities and, therefore, a decrease in learner autonomy. Though it is true that intermediate level users of a language can be taught certain techniques to enhance their efficiency online, the overwhelming amount of linguistic input makes this a problematic issue.

CONCLUSION AND FUTURE RESEARCH

Little research has as yet been done relating the use of SNSs to second language learning and acquisition, particularly in the context of the Japanese classroom (Dias, 2000). Hopefully this preliminary study has been able to lay the groundwork for future research in this area. Overall, MySpace appears to be a functional tool for use by English language learners in Japan. Japanese users of SNSs seem to prefer Mixi, either for ease of use issues or socio-cultural appropriateness, however, as there exists no English language version of this site, MySpace, with its multilingual interface and global appeal, is a viable alternative. Regarding the aspects of CLL mentioned in this chapter, particularly as they relate to Japanese learners and their use of SNSs, there would seem to be many interesting research opportunities available. It is clear for example, that a strong element of learner collaboration and support developed during this project. The work was empowering for the students in that they were freed up somewhat to express themselves in new and different ways. Further research in these areas could prove meaningful.

As this was a primarily exploratory study, it was limited in a number of ways. Firstly, the study made no attempt to measure student progress or change relating to their own sense of autonomy, empowerment or identity. Future research could look specifically, for example, at how students perceived their own degree of autonomy in the language learning process before and after a project of this type. Secondly, this study simply explored students' use of the MySpace SNS. It did not provide a comparison or control group, something that could help determine the effectiveness of the project. Also, this work with MySpace only very briefly touched on the possibility of the use of mobile phones for blogging and posting information to MySpace pages. Young people in Japan are often more comfortable interacting with a mobile phone than a personal computer, indeed entire novels are often composed solely on mobile phones in Japan. An analysis of the possibility of mobile phone use for MySpace would also be interesting and meaningful in the Japanese context. Lastly, as mentioned earlier, many of the participants in this project were excited by the prospect of interacting with native speakers of English. The addition of a fixed group of students to a project of this nature, possibly native speakers of English studying Japanese, would greatly enhance student interest and the potential for more meaningful language interaction.

Finally before concluding this chapter, I would like to look to the future, or more accurately, to the present, to consider briefly some current trends in CALL research, their potential relationship with CLL, and possible research opportunities they may present. One interesting area of development is coming from online gaming. Some recent research has begun to look at online gaming, and in particular the use of MMORPGs (Massively Multiplayer Online Role-Playing Games) in relationship to second language acquisition. This is interesting in how well it fits with the current focus on activities that are learner-centered, communicative, and collaborative. Bryant (2006) explains that MMORPGs are, "online role-playing games where players move, act and communicate with other players in an Internet-based virtual three-dimensional environment … players group together online to achieve certain goals and thereby progress through the game. Communication plays a central role in the game. Audio and video are embedded throughout the environment, and it is also necessary to communicate with other players in the game through audio messengers or text chat programs" (p. 1). Clearly this type of learning environment could be potentially motivating to language students (Toyoda & Harrison, 2002). It also demonstrates numerous similarities to the use of SNSs for language learning and has a strong connection to CLL. In particular it would seem that issues of learner autonomy and identity formation in the MMORPG context would be interesting to explore.

Another relatively new concept is the development of SNSs specifically for language learners. According to a recent *Japan Times* article, this is exactly what is being developed by Yang Yang Xi at Kyoto University. This project, currently called Lang-8, is designed to facilitate interaction between native speakers and language learners in a variety of languages. The article reports that the site, "allows people to write daily diaries on whatever topics they choose and in any language they want. These diaries are then edited by their friends on Lang-8, who are native in the particular language in which the diary is written" (Manlove, 2007, para 3).

This project is particularly interesting in that it addresses what was one of the key areas of student interest regarding the use of SNSs for language learning; the ability to interact with native speakers of the target language. It will be interesting to see how this project progresses and if it proves a success with language learners.

Finally a brief mention of the relatively recent phenomenon of "tagging" or "social tagging" online. In his 2006 discussion of emerging technologies, Godwin-Jones talks about the growth of tagging online and its potential to help users sift though the enormous amount of information available to them online. Tagging, or shared tagging, is essentially a bookmarking process that allows individuals to personally assign key words or phrases to information they find on the web. This allows for easy retrieval later on, as they are stored much as bookmarks are stored in your browser, and they are social in that tags that are ascribed to webpages or pieces of information can be accessed and referenced by others when made public. As Godwin-Jones points out, it is not possible to tag a website without the ability to critically analyze its contents.

This tagging concept is potentially of interest to second language learners online because, as many students involved in this project discovered, accessing and assessing information found online can be a great challenge. This idea also relates specifically to at least two of the aspects of CLL mentioned earlier. It is empowering in its reliance on social collaboration and peer support, and the act of creating tags requires critical and reflective reading skills. Clearly, interesting research is yet to be done in this area of social tagging by and for second language learners.

In conclusion, it would seem that viewing the use of SNSs for second language learners in Japan through the lens of CLL offers some interesting insights into various aspects of computer mediated language learning. Critical literacy, learner autonomy, student empowerment and identity formation are important components of the language learning and acquisition process and an analysis of the use of SNSs for language learning would only be partially complete without considering the relevance of these issues.

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KEY TERMS

Autonomy: For second language learners, autonomy has to do with the degree of independence that learners have from traditional teacher fronted classroom approaches and their ability to advance and progress as independent learners.

Critical Language Learning (CLL): CLL is a broad term for an approach that focuses on the social implications of second language learning. This approach is characterized by an interest in issues like student empowerment, identity formation, critical literacy and learner autonomy.

E-Literacy: E-literacy has been defined in a variety of ways but it generally relates to the skill set required to make efficient use of all of the materials, tools, and resources that are available online.

Empowerment: Within the context of critical language learning, student empowerment is concerned with providing students with access to the tools that they need to become independent and autonomous learners.

Identity Formation: In the second language learning context, identity formation refers to the development of one's unique identity in the target language. Identity formation can also relate to the development of on-line identity through social networking sites like MySpace.

MySpace: MySpace is one of many social networking sites currently in popular use. In June of 2007, MySpace was the most visited social networking site in the world with over 114 million users.

TOEIC: The Test of English for International Communication (TOEIC) is a highly regarded English language testing system that is especially prominent in Asia and taken by almost 5 million people throughout the world each year. The test consists of a listening and reading component, to which a speaking element has recently been added.

APPENDIX A

Questionnaire A

This semester we are going to use the MySpace social networking site to improve English skills. Please answer these questions before we begin. Circle the best answer for each question.

1. Are you familiar with social networking sites like MySpace, Mixi, or Facebook?

Yes No

2. Have you ever used a social networking site (MySpace, Mixi, Facebook, etc.) in English?

Yes No

3. Have you ever used a social networking site (MySpace, Mixi, Facebook) in Japanese?

Yes No

4. Do you have your own profile on a social networking site?

Yes No

5. Do you think using social networking sites in English could help you improve your English?

Yes No

6. What do you think about your skill in using a computer?

Very good Good Not so good Poor Very poor

7. What do you think about your typing on a computer in English?

Very fast Fast OK Slow Very slow

8. How interested are you in using social networking sites to help you improve your English?

Very interested Interested A little interested Not interested

APPENDIX B

Questionnaire B

The semester of using MySpace has finished and I would like to know how you felt about the project. Please answer the following questions honestly. Circle the best answer for each question.

1. How did you feel about using MySpace this semester?

Really enjoyed Enjoyed OK Did not enjoy

2. Do you think you will continue to use MySpace in English in the future?

Definitely Maybe Probably not No

3. Do you think your English improved through using MySpace?

Yes No Not sure

4. What part of your English improved the most?

Reading Writing Speaking Listening None

5. Would you recommend MySpace to your friends as a way to learn English?

Yes No Not sure

6. What part of the project did you enjoy the most?

A. Writing my own blog B. Commenting on other blogs

C. Putting pictures on my page D. Putting music on my page

E. Recording audio F. Looking at other MySpace pages

7. What part of the project did you enjoy the least?

A. Writing my own blog B. Commenting on other blogs

C. Putting pictures on my page C. Putting music on my page

E. Recording audio F. Looking at other MySpace pages

APPENDIX C

Comments taken from students' MySpace blogs in response to the question, "Did you like or not like using MySpace this semester? Please explain."

1. I liked using My Space because I could practice writing English. I made own my blog for the first time so I was very excited. I also could read English because most of people used in English so I was so happy to read them. I think My Space was a good place to practice writing and reading English so the students should use My Space. People can get opportunity very easily and we need only PC. If you want to practice English, you should register now. We can make a lot of friends all over the world and our life will be much fun so I liked using My Space and I want use it from now on.

2. I liked using my space in this semester because when I using my computer I think the class is faster than other class. I think using computer in class is enjoyable for students. So I think using my space in this semester is good thing for students.

3. I'm sorry. I don't like using my space because I don't like writing blogs. I think writing blog is not fun. I want to spend time to debate. Debate is very difficult, but it's enjoyable and helpful. And also, I need time to write graduation essay in class. other tutorial class students write essay in class.

4. I like using MySpace this semester because it made me enjoyed. It is my first time to use blog. It can communicate with people of all over the world. I want to use blog from now.

5. I liked using Myspace this semester because it can contact with many countries people, so I can enjoy it!! I can understand everyone's hobbies, and favorite music, so I thought we could know more each other. Another point is we can get ability of writing skills. For example, "Tobacco is illegal or legal" is title, and we should think and write own ideas quickly. Therefore it was very important for me to think about many things quickly. To use Myspace is very useful.

6. I didn't like using Myspace this semester because it was hard to use it. I couldn't understand how to use it. Therefore, this way takes extra time to me. In addition, we cannot do this without PC, so we had to bring PC every week. PC is very heavy so it was very hard. Sssss

7. I like using MySpace this semester. Because I could know how to write blogs. And this is little interesting for me. But I fell regret that I can't use all tools.

8. I think that I liked using my space in this semester, because I think my space helped my writing skills and communication skills. And using my space communicate with other countries people, and people who are learning English tell me how to write good English. Native English help me when I contact with foreign friends. Especially sending Email or letter. In addition, using my space give me chance to write English diary, so I'd like to keep writhing English using my space.

9. I like using My Space this semester because I am enjoyed this semester. We used PC that we can understand that how to use this site and PC, and we can know some good PC system and site for me. And then, we can debate some topic by my space that we can communicate with another Tutorial people, another person and my Tutorial member. It means that people checked my topic and me idea. It leads to growth of the knowledge by changing an opinion. So, it is very good, using my space for us.

10. I liked using MySpace this semester because…First it was fun to write to blog, make sounds file and put it on my website. Second it was interesting to talking about topics in each groups and represent it. And also it was fun to write about the topics and add comment to other persons.

This work was previously published in the Handbook of Research on Web 2.0 and Second Language Learning, edited by M. Thomas, pp. 237-258, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 4.7
Creative Waves:
Exploring Emerging Online Cultures, Social Networking and Creative Collaboration through e-Learning to Offer Visual Campaigns for Local Kenyan Health Needs

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ABSTRACT

The past few years have seen the promise of online collaboration vastly augmented by developments in online technologies and emerging creative practices. Through our work with the Omnium Research Group, the authors argue that design should never be a solitary activity and benefits from many levels of collaboration - never more so than when dealing with complex issues facing today's world. The highly connected global society in which many of us now live frequently uses web-technologies to enhance nearly every facet of day-to-day life. The authors strongly believe that design education should not isolate itself from such communal and collaborative potential. This chapter explores what happens when online creative collaboration is applied to a real-world design project tackling critical health issues affecting local communities in Africa. It offers an account of the most recent, fully-online Creative Waves project - Visualising Issues in Pharmacy (VIP) that saw over 100 graphic designers join forces with a similar number of pharmacists from over 40 countries worldwide to produce graphic proposals for public awareness campaigns about six health issues seriously affecting the people of a village community in Kenya. The three-month VIP project is explained in relation to its aims, objectives and graphic outcomes, as well as the online environment in which it took place. Creative Waves is a concept created in 2005 by the Omnium Research Group, based at The University of New South Wales in Australia, to form online communities of design students from many institutions around the globe. Consisting an array of enthusiastic students, teaching staff, professional practitioners and luminaries invited as special guests, these online creative communities have proved that amazing results can

DOI: 10.4018/978-1-60566-727-0.ch003

be produced through careful facilitation between distanced individuals who will most likely never meet. The Creative Waves concept has to date been offered twice in collaboration with Icograda and the Icograda Education Network.

INTRODUCTION: EMERGING ONLINE CULTURES AND SOCIAL CHANGE

Before we examine the role of online communities and global creative collaboration within the most recent *Creative Waves '07* project, offered by the *Omnium Research Group* (Australia) in collaboration with Icograda and its education network (IEN), it is important to take account of vast social and cultural changes emerging online over the last few years. As we will see, the philosophy of online creativity and collaboration from which Omnium was borne a decade ago has since become part of the fabric of many online cultures. Such change poses great impact in academic settings because students today are some of the most 'savvy' users of ever-evolving digital and web-based technologies. For the current generation these technologies, that have been the subject of so much academic research and speculation, are now so everyday that we need to take account of new ways of working, socialising and collaborating that have subsequently emerged. As we have argued elsewhere (Bennett, Chan, & Polaine, 2004), we are beyond asking "should we use these technologies within education?" and now have much to learn from a generation that have already been using them for most of their lifetime.

Quite apart from their use in educational settings, the impact of the kinds of collaborative processes we will outline below are affecting the world of professional practice and wider society in extraordinary ways. The Internet has clearly changed the nature of communications and communities in the last decade and this has led to new ways of living and working (Castells, 2000; Johnson, 2001; Rheingold, 2003; Leadbeater, 2008; Weinberger, 2007).

Blogs and blogging are possibly the most well known explosion in this area. Blogging has grown so fast that statistics are continually out of date (and thus hard to measure), but at in late 2007 the blog tracking service, Technorati, was tracking over 72 Million blogs and the 'blogosphere' was over 100 times bigger than it was just three years before (Sifry, 2007). YouTube, another famous online success story, was already serving 100 million videos per day and received over 65,000 video uploads daily back in 2006 (YouTube, 2006). These successes are not just digital – the Jubilee Debt campaign started with one person in a shed in London and gathered enough momentum and 24 million signatures which helped force Western governments to cancel US$36 billion of debt owed by Third World countries and developing nations (Leadbeater & Miller, 2004, p. 54).

There are three emerging and overlapping areas to examine in the context of the *Creative Waves* projects:

- Social networks and communities
- Collaboration, open-source and the rise of the pro-ams
- Organisational change

Social Networks and Communities

In recent years the rise of portable or time-shifted media (such as podcasts, the iTunes Music Store and the video equivalents), blogs and social networks have created enormous shifts in traditional relationships to everything from media, to education, to consumer and political behaviour. Collectively, web applications such as YouTube, Flickr, GoogleMaps, Digg, Facebook, MySpace, Last.FM and WIkipedia are known (and hyped) as Web 2.0 applications (O'Reilly, 2005); a term that describes some of the technical approaches to their creation, but generally describes the idea that users and their audience create the content and form communities around this content, sometimes known as the 'read/write' or 'living' web.

The very first Omnium project in 1999 (Bennett, 2000) was developed through an awareness that the landscape of design *practice* was changing and that design *education* was failing to keep in step with these changes. It is essential to explore these emerging trends in order to better understand the role of online creative collaboration within educational settings because our younger students are the age group that are at the forefront of this change (Lenhart, Madden, & Hitlin, 2005; McMillan & Morrison, 2006; Green & Hannon, 2007; Holden, 2007). How this demographic of young people experience the world will have an enormous effect on the way we all teach, learn and work. In fact, the *way* in which our students learn is possibly becoming far more important than *what* they learn.

The strength of social networks and online communities is that they provide both a way through the enormous amount of information on the web as well as creating social bonds and capital. The collaborative filtering evident in contexts like Amazon.com and iTunes ("people who bought X also bought Y") or recommendations from social networks like Last.FM are very different from the paradigm of searching, which is currently the process generally taught in information literacy courses in universities and colleges. When you *search* you know what you are looking for, you just need to find it. When you click through recommendations via *collaborative filtering* you don't know what you are looking for but find things of value to your tastes by following the connections that other people have made, often without realising it. *You find what you never knew you were looking for*. This is a very powerful process indeed, as anyone who has spent a fortune on Amazon.com in one sitting can confirm.

This process can either happen by accident (e.g., we don't pay that much attention to what we buy, but Amazon's tracking database does) or more deliberately by tagging content and adding our own connections to the group pool. People can also add to your tags and content and here we see the rich abilities of re-mix culture come into play, something that is central to the *Creative Waves* projects.

In terms of education, the value here is that we make connections between areas that appeared to be unrelated at first glance, and this encourages inter-disciplinarity. It also solves the oft-asked student question, "How do I know what to do when I don't know what I can do?" All the while strengthening the bonds between people with shared interests and creating communities of practice.

A final aspect to this is that people who are used to working in socially networked communities often harbour a set of values that are worth encouraging. Yahoo!'s Tom Coates (Coates, 2006) sums up the three main requirements for any social software application thus:

- An individual should get value from their contribution
- These contributions should provide value to their peers as well
- The organisation that hosts the service should derive aggregate value and be able to expose this back to the users (Coates, 2006)

This is an excellent blueprint for any endeavour, yet the ability of most existing educational structures to change in this direction is questionable. Indeed, providing advice and value to peers would often result in accusations of plagiarism, yet these are powerful *social values* in which the value of your own interests also creates value for those around you and the environment you are working in, much like open-source projects.

Collaboration, Open-Source and the Rise of the Pro-Ams

As Charles Leadbeater and Paul Miller argue in *The Pro-Am Revolution* (Leadbeater & Miller, 2004), a combination of technical and social changes have led to the rise of 'professional amateurs' or Pro-Ams. These groups generate a great deal of social, as well as financial capital and, according to Leadbeater and Miller, are "the new R&D labs of the digital economy" (2004, p. 67).

From astronomy to activism to software design and saving lives, the Pro-Ams are a powerful force and one in which collaboration, often via the Internet, is key:

Traditional innovation policies subsidise R&D and accelerate the transmission of ideas down the pipeline and into the market. Pro-Ams are helping to turn this closed model on its head... ideas are flowing back up the pipeline from avid users to the technology producers. (Leadbeater & Miller, 2004, p. 64)

Open-source software projects, in which many hundreds and thousands of people voluntarily contribute to the greater good, are the clearest example of this. Software projects are so complex it is virtually impossible for a single entity (even a company as large as Microsoft) to manage the process. By creating an open environment in which anyone can contribute changes thousands of workers and testers are brought into play and they can apply multiple minds to the complexity of the problem.

All these people contribute their time for free, on the understanding that the more they contribute the more they receive in the end (because the software is improved) and there is also a social kudos to this. Again, this is a valuable ideal for educational situations in which groups are collaborating, but it is also a powerful *social charter* that ripples upwards into the professional world as much as the corporate landscape is starting to change from above. Put simply, many hands make light work.

Organisational Change

Working Progress, also by Demos (it is interesting in itself that this research has not come from an academic institution, but an independent one who's motto is 'building everyday democracy' – they work outside of, but often advise the UK government), examines the nature of organisational change and the 'disconnect' between young people and employers (Gillingson & O'Leary, 2006). The authors reveal that organisations are finding it difficult to recruit graduates with the right skills even though they acknowledge that graduates are more highly qualified than ever: Graduates used to working in the peer-to-peer environment of the university find it hard to shift to organisational hierarchies and difficult to relate to their bosses (*Ibid.* p. 14).

At the same time, these organisations themselves are changing and the hope is that these two changing patterns, from what has traditionally been seen perhaps as the 'top' and the 'bottom', have a chance of meeting in the middle. They argue that hierarchical companies are slowly shifting and being replaced by the networked, organisational structures that we have already seen online.

Gillingson and O'Leary (2006, p.38) surveyed Human Resources directors from FTSE200 companies and the top four employee qualities the directors rated most highly were:

- Communications/communicating ideas
- Problem-solving
- Team-working
- Creativity and Innovation

These are several of the qualities we have researched and engendered in our past Omnium projects to date. For example, anyone can learn how to use Photoshop or Illustrator - they are tools just like a pencil - however design, creativity and collaboration *is* about process more than skilful practice (though it requires that too). The Creative Waves VIP project, detailed further in part two of this paper, was a collaboration between pharmacy students, lecturers and professionals as well as the same within design disciplines. It became clear during the duration of the project that many of problems relating to six health issues faced by the village of Winam in Kenya were not through a lack of medical knowledge or research, but a lack of communication of that knowledge effectively. Once again, we see that it is not the *specific knowledge of information* that it is important, for that is easy to come by these days, but *how to create new knowledge, make new connections and how to communicate* that are the fundamental qualities required of the 21st Century graduate and the rest of us:

If innovation flourishes within and across teams, then we need to be able to work within them. If the formalities of hierarchy are being overlaid with social networks inside organisations, then we need to negotiate our way through them. (Gillingson & O'Leary, 2006, p. 40)

The Omnium Project and Online Collaborative Creativity (OCC)

Initially founded as an individual research project in 1998, The Omnium Project has grown considerably through its ongoing online initiatives and creative activities to become a well-established research group based at the College of Fine Arts (COFA), the University of New South Wales in Sydney.

Omnium's continuing research focuses on exploring the notion of online collaborative creativity (OCC) and how the Internet can be best used to help geographically distanced individuals interact and work together creatively from any location worldwide. For nearly a decade, Omnium has offered a range of fully-online creative communities, facilitated a series of global and fully-online collaborative creative projects, as well as designed and written some ground breaking e-learning courses and programs. In addition, by designing and producing the unique Omnium® Software, specifically for online creative collaboration, and offering it as either a serviced package or an open-source option to other institutions around the world, Omnium has to date linked over 10,000 creative students, educators, professional practitioners, theorists and writers from over 50 countries worldwide.

Omnium has always maintained two underlying aims through all its online creative and e-learning projects and courses: to design, produce, test and evaluate:

- a revised online creative process through exploration into the generation of creative ideas and concepts, collaboratively, digitally, and across distance by individuals in collaboration via the Internet.
- a unique technical platform that enables the application of such a revised online creative process within a technical interface that uses 'virtual' space for its classrooms and studios.

In summary, Omnium bases its research investigations upon two significant and rapidly changing paradigms:

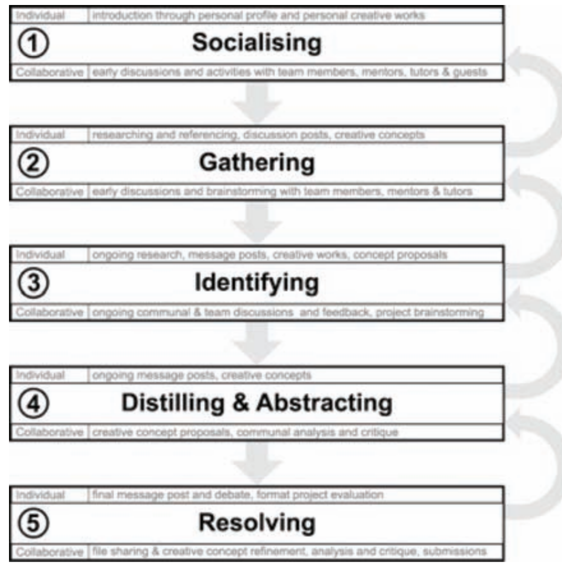
- **Education:** Observing and contributing to the changing face of education through the availability and affect of web technologies and how these are challenging many well established principles upon which many education institutions have traditionally been founded.
- **Creativity:** From predominantly individual production through to increasingly collaborative and collective approaches that have emerged increasingly over the last decade within many creative industries, studios and agencies.

Omnium's Five-Stage Process for Online Collaborative Creativity (OCC)

Although originally constructed by recollecting our own collective educational experiences throughout art and design colleges, and later our experiences in professional settings as designers and educators, we have continued to adapt and modify a five-stage online collaborative & creative (OCC) process by aligning our own perceptions to achieve an effective, analytical and intelligent working, teaching and learning methodology (Figure 1):

- **Socialising:** The first stage of Omnium's online collaborative creativity process aims to encourage initial individual involvement by all participants to not only introduce their own work, but introduce themselves through early discussions and autobiographies. Through construction orientation tasks requested by project facilitators participants are also subtly introduced to the technicalities of the user-interface without tedious formalities of a technical 'how-to-use' guide.
- **Gathering:** The second stage of the process aims to encourage initial individual contribution from all participants, while simultaneously producing process work that provides the project with a rich and varied mixture of cultural and personal backgrounds. It is a chance for each participant to feel they have contributed to the project and grow in confidence as a rich resource of visual research material, ongoing discussions and suggested links to other online resources grows. This stage is also the beginning of an array of feedback to the students in their working teams from the range of free-roaming mentors and invited special guests.
- **Identifying:** Following the more individual 'gathering' stage of the process, a project will subtlety evolve into a more collaborative community at this stage where emphasis is placed on each creative team recognising, via discussions and dialogue, points of contact, commonality, difference and overlapping interests arising from process works being produced as a result of the initial activities. It is also a stage within the process to begin identifying what a creative team may aim achieve as a result of the project and delegating roles for each member to take responsibility for.
- **Distilling & Abstracting:** During the *distilling and abstracting* stage each working team continues to discuss their intended creative direction and establish their collaborative working process. This stage breaks down ideas from the works produced from the preceding *gathering* and *identifying* stages and places an increasing demand on the participants' abilities to critically assess their combined creative outcomes through discussion and feedback. Working collaboratively as small teams, this stage is most interesting in regard to the collective decisions made to keep and/or discard ideas previously offered and challenges the notion of individual possession of ideas and promotes issues of collective ownership.
- **Resolving:** The final *resolving* stage ultimately leads to the production of collaborative final submissions. The execution of final works provides opportunities for participants to then reflect upon the entirety of their creative process: from the individual beginnings of a project to the collaborative and collectively examined outcomes. In a project such as Creative Waves 07, there is arguably a further stage of *implementation* where the outcomes are manufactured or produced and implemented to the communities that a project is aiming to assist.

Figure 1. The Omnium Five-Stage Online Collaborative & Creative (OCC) Process



The Omnium five-stage OCC process, described above, is not intended to be totally linear in progression, and would often be applied in different depths depending upon time available for a project. It would be recommended that participants using this process always reflect both individually and collaboratively on each stage and use a reiterative process en route. Each stage is designed to include both individual and collaborative components; contributions which steadily progress each student from a valued individual contributor with elements of collaborative discussion (stage 1), through to a fully interactive collaborative contributor who is still required to make individual contributions in terms of messaging, debate reflection and critique (stage 5).

On reflection, Omnium five-stage online collaborative creativity process shares many ideologies with previously identified characteristics of more traditionally defined creativity and creative interaction. Graham Wallas (1926) describes a four-phase process for creative thinking*: preparation, incubation, illumination, and verification.* This too was derived from his own introspection and observations, rather than systematic empirical observations, although has since become widely accepted by theorists of creativity. Catherine Patrick (1937) proceeded to confirm Wallas' process through a more systematic and psychological research study. Analysing her findings, she confirmed Wallas' four-phases although added revision to accompany the final *verification* stage.

The way in which Omnium's own five-stage OCC process is applied through a learning context also closely mirrors established models for learning within online environments. Perhaps the most notable of these is the Five Stage Model offered by Prof. Gilly Salmon (2000) in which a suggested progression for online learning is illustrated and described from both a facilitators and learners perspective. Salmon's Five Stage Model, describing processes of *access and motivation*, *online socialisation, information exchange, knowledge construction, and development,* also views the online learning process from both an e-moderating and technically supported perspective.

Throughout the entirety of the Omnium's OCC process, a project and its participants are supported by a series of specifically written lectures or readings, online activities to support those lectures and constant feedback from fellow students, project coordinators, roaming mentors and the invited special guests. It is the incredible amount of interactivity between participants in both social and working discussions that make Omnium's online studios consistently reported as highly social communities and free of the scourge of isolation reported by many e-learning or distance education offerings.

CREATIVE WAVES: AN OMNIUM INITIATIVE IN COLLABORATION WITH ICOGRADA

Having created and run several global online creative collaboration projects since 1998, in 2005

Omnium began an exciting collaboration with the International Council of Graphic Design Associations (Icograda) by conceiving a series of free and voluntary online design projects for students and their teachers around the globe under the banner of *Creative Waves*. Three significant projects have taken place under this banner to date (Creative Waves '05, Creative Waves '07 and Collabor8) that collectively have involved approximately 500 individuals from over 50 countries worldwide. Notably, the second Creative Waves project, that took place over three months in 2007 called *Visualising Issues in Pharmacy [VIP]*, progressed the *Creative Waves* direction to align with Omnium's more recent research activities that encourage online collaboration on more socially-aware design projects to aid people in less fortunate locations around the world.

The initial *Creative Waves* project, titled *03>04>05* and held over a seven-week period during March and April in 2005 saw a cross-disciplinary e-learning project between graphic design and photo-media students. The Creative Waves '05 project linked over 100 art and design students and their teachers from member institutions of the worldwide Icograda Education Network (IEN) and was structured to examine new ways of working collaboratively online and the prospects these open up for communicating visually with people around the world who would most likely never ever meet. By doing so, it continued Omnium's existing research that challenges traditional paradigms of individual creative processes and their championing of exclusiveness, isolation and sole-ownership of creative outcomes.

Throughout the project, the volunteer participants formed strong creative and social bonds with partners in distant parts of the world, receiving regular feedback and support from not only the variety of teachers who volunteered to take part, but also established creative professionals using the Internet as their sole communication tool. An added complexity of the project was the introduction of official mentors housed within each of the small creative working teams and the inclusion of invited special guests to add expertise and excitement to the proceedings.

In hindsight, the first *Creative Waves* project received a significant amount of acclaim, however, the real success of the project was not so much the creative work that took place, or that resulted, but the interaction and socialisation between so many distanced people that occurred. One of the main aims we intended for the project was in fact to open up discussion about the process of designing and in particular the critique of visual communication processes – to this end the project was a great success. Too often perhaps, especially in areas of graphic design, visual end-results are left to be viewed in isolation and to explain themselves, whereas this project aimed to address the prospect of discussion about works in progress and to be able to view the entire process of so many young designers around the globe and not just be presented with their end results.

Following conclusion of the *Creative Waves '05* project, the processes involved and the outcomes produced by the many participants were, as mentioned earlier, presented at numerous design and education conferences in many countries; including the 2005 Ascilite (Australasian Society of Computers in Learning in Tertiary Education) Conference in Brisbane, Australia. During this conference Omnium was awarded the 2005 Ascilite President's Award for the inaugural Creative Waves initiative as well as for the Omnium® Software used to host the entire event. Additionally though, the conference was to have a more important part to play in the next few years for Omnium's research. Following the presentation of the *Creative Waves '05* project at the conference, Omnium was approached by staff from the University of Auckland's School of Pharmacy who were interested in discussing some sort of collaboration to progress teaching and learning strategies for their undergraduate pharmacists. Like many other disciplines outside of the visual arts and design, pharmacy curricula

Figure 2. The visual progression of one team's work process from the first Creative Waves project

increasingly are able to include more and more visual and digital materials available to students and teachers.

Many of the more traditional scientific diagrams and tables used in previous texts are now being produced in highly graphic formats including movie files and 3D animations. In addition, students have a vastly increased resource of materials through the many avenues offered by the web. It was a suggested collaboration that seemed highly appropriate and an opportunity for Omnium to try to improve the opportunities for a completely 'new' discipline, in the same way that it had been doing for the visual arts for nearly a decade.

Around the same time, Omnium and Icograda were already in discussions again for a follow-up to the initial *Creative Waves '05* project; one that again could be offered to students and teachers globally. Omnium's intentions with a subsequent *Creative Waves* project was to include its new direction of offering a project that had more of a purpose and real brief; one that would align itself with the aims to help less fortunate people in remote parts of the world by connecting like-minded creative folk who could offer their own time to help such a cause.

Creative Waves '07: Visualising Issues in Pharmacy [VIP]

Following nearly twelve months of planning and preparation, which included the design, programming and introduction of a brand new version (v4.0) of the Omnium® Software, the *Creative Waves '07* project, titled *Visualising Issues in Pharmacy [VIP],* was ready to be launched. The new VIP project ultimately aimed to produce a series of visual campaigns to raise public awareness of six health issues that were chronically affecting small rural communities in Kenya, Africa. Through a combination of over one hundred pharmacy participants around the world, together with a similar number from design disciplines, the VIP project would attempt to produce campaigns to cover issues relating to:

- Malaria
- Tuberculosis
- Adherence (regarding the correct usage of medicines)
- Sexually Transmitted Infections (notably HIV/Aids)
- Chronic Disease
- Immunisation

As a result of a short promotional campaign, using a simple information website about the project built by the Omnium team, as well as announcements through both the Icograda and Icograda Education Network newsletters, hundreds of people had applied to take part in the *Creative Waves '07* project from over 35 countries worldwide. The combined project participants were split into four user-types: students; teachers acting as free-roaming mentors; invited special guests; and the six pharmacy and four design coordinators with the overall project was convened by the Omnium Research Group. In addition, the entire project was formally endorsed by, and offered as a collaboration between the worldwide professional governing bodies of Icograda (representing the graphic design side of the project) and the Federation Internationale Pharmaceutical - FIP (representing the pharmacy/health sciences side of the project).

When facilitating online projects on such a global scale, with clearly structured e-learning intentions, Omnium has for many years established and strongly recommended the need for two very inter-dependent foundations: a clear and well documented working process; and a highly user-friendly and technically proficient software platform. In regard to the technical platform (software), despite it being a crucial aspect to offering such projects and an aspect that has demanded huge amounts of time, expense and consideration over the last ten years, it is not the main focus of Omnium's projects or research, albeit a necessity. For the purposes of this paper, we will describe some of the software's features used as we detail the progression of the work but mainly concentrate on how the VIP project was facilitated and structured around Omnium's five-stage creative process for online creative creativity. We should also explain that the VIP project was separated into two overlapping seven-week phases (pharmacy and design) which both applied the five-stage process equally efficiently, although again for the purposes of this paper, we will concentrate on the latter design phase.

Creative Waves '07: Design Phase

Following an initial seven week start to the VIP project that saw over one hundred students, teachers and special guests from various areas of the health sciences and pharmacy collaborate together to ultimately form six detailed research reports on each of the recognised health issues (identified above) that affect the specific rural community of Winam in Kenya, an equal number of design participants took over the project for a further seven weeks - interacting with the pharmacy participants who in many ways acted as the clients and advisors.

Of critical importance to the designers, who resided in numerous countries worldwide, was to have a base of advisors located in Kenya itself, who could relay information about the culture, traditions, behaviours, living conditions and even folklore of the people whom the project was intended to assist and help. Such an important resource to a project of this nature included students, teachers, health workers, renowned professionals in the field and non-profit organizations who were familiar with or directly located in the targeted area. Two of the most influential contributors to the project were George Onyango and Salim Opere from the Help Heal Organisation, located in the village of Winam, Kenya and directly assisting the villagers facing the daily difficulties caused by the six identified health concerns. A highly evocative, frank and influential lecture written by George Onyango, could be argued as the catalyst to the entire project and a series of accompanying photographs, made available through the Omnium® Software galleries pages, gave participants the instant reality of the problems being faced.

Of the many discussions that occurred throughout the three-month Creative Waves VIP project, two discussion threads in particular generation an enormous amount of interaction and direct information from the location itself. The two threads, facilitated by George and Salim, along with many other Kenyan participants, together generated over 20,000 words of text in a series of questions and answers from participants to those able to advise from the location.

Following a highly structured format of progression through Omnium's five-stage working process, including daily news announcements, weekly lectures written by project coordinators and invited guests, live online chat sessions with luminaries in the field of design and health sciences, and progressive design briefs to facilitate the process of designing public awareness campaigns about eh six identified health issues, the project began to hone down a wide variety of suggested creative approaches until several focused studies were formed. It was interesting, as well as somewhat frustrating to observe, that the designers in their smaller design teams were arguably selecting specific ideas to work on too early in the process without fully investigating the scope of ideas that could be potentially created.

During the third *identify* stage of the project, the design convenors introduced the notion of "*worldstorming"* where each of the 100 design participants were asked to come up with ten quick ideas for campaigns that could promote awareness of the six health issues. Within a very short time, over six-hundred ideas were suggested which were in turn sent to the Help Heal workers in Kenya for their opinion and feedback. As a result it was decided that three sets of suggestions would be taken through stages four and five of Omnium's OCC working process – a game for school children to play with their teachers, peers and families; a series of stickers that conveyed simple messages about prevention and adherence; and designs for s set of soccer uniforms to be worn by both formal teams of young local footballers as well as the average kid in the street who would be wearing the outfits as simply trendy street wear as opposed to formal uniforms.

Figure 3. One of the outcomes of the Creative Waves VIP Project was a set of soccer kits with slogans about the dangers of HIV to engage the young men of Winam who play soccer a great deal. Here are the packages of the shirts being sent off to Kenya.

The designs for each set of campaigns were themselves taken through the five-stage process by students and mentors who had been arranged into new working teams until final solutions were presented at the end of the seven week design phase. Each of the final designs were versatile enough to be able to be adjusted and amended to deal with any one of the health issues and to date Omnium is in a stage where it is seeking sponsorship and/or assistance to have the design realised. On completion of the final designs being produced, each of the public awareness campaigns is to be sent to the village of Winam to be facilitated to the community by the volunteers in location.

All of the process work from both the pharmacy and design phases of the project can be viewed at the archive of the Creative Waves project interface – creativewaves.omnium.net.au – within the Galleries area, along with every other facet of the project including lectures, discussions, team work, transcripts of the live chat sessions and profiles of every participant who took part.

The third in the series of Creative Waves projects, titled *Collabor8* – creativewaves.omnium.

net.au/c8 – was recently run in 2008 and saw students from art & design colleges in Australia and China link together online to examine specific cultural, visual and language differences that affect creative work taking place between the two countries. For details of all the projects and to view the archives since 1998, visit the Omnium website: www.omnium.net.au

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This work was previously published in Collaborative Technologies and Applications for Interactive Information Design: Emerging Trends in User Experiences, edited by S. Rummler and K.B. Ng, pp. 39-51, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 4.8

Using Social Networking to Enhance Sense of Community in E-Learning Courses

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ABSTRACT

This chapter provides an overview and development of sense of community and social networking; discusses the potential uses of social networking in education; and presents a case study that integrates social networking into two graduate courses for the purpose of building a sense of community, improving communications and interactions, and promoting student-centered collaboration. The construction of class social networking sites, the implementation of these networks, and their effects on the students' learning experience are examined. In addition, an analysis of feedback from students on the value of social networking in learning is included.

INTRODUCTION

The rapid technological change and proliferation of information resources are lineaments of our contemporary society. Online information and communication are changing the way instructors and learners interact within the teaching/learning process. Online teaching and learning represents a new educational paradigm. The "anytime, anywhere" accessibility of e-learning courses provide students and teachers the opportunities to work at their own pace and at locations they are able to control (Berge, 1995; Edelson, 1998; Spiceland & Hawkins, 2002). Furthermore, as Richardson and Swan (2003) indicated, "[e-learning] allows students to reflect upon the materials and their responses before responding, unlike traditional classrooms" (p. 69). Currently, there are two main types of e-learning applications within higher education courses: (a) fully online applications in which teaching and learning activities take place entirely at an online computer-mediated communication (CMC) setting; (b) hybrid applications in which both traditional classroom instruction and online CMC are blended. In either online or hybrid applications,

DOI: 10.4018/978-1-60566-729-4.ch016

online learning content is typically provided by courseware authors/instructors, structured into courses by a learning management system (LMS), and consumed by students. This approach is often driven by the needs of the institution/corporation rather than the individual learner.

While online and hybrid courses are expanding and the numbers of participants are increasing, questions are being raised on conventional LMS based e-learning. For example, researchers are asking how best to foster community among learners and their instructors who are physically separated from each other, as well as separated in time (Palloff & Pratt, 1999; Rovai, 2002a, 2002b). Such separation may increase social insecurities, communication anxieties, and feelings of disconnectedness (Jonassen, 2000; Kerka, 1996). As a result of such separations, Sherry (1996) stated that "the student becomes autonomous and isolated, procrastinates, and eventually drops out" (¶ 27). Previous studies suggest that a sense of community, which is related to connectedness and learning, is essential for an e-learning course to occur (Yang & Liu, 2008).

With the emerging Web 2.0 technologies, more opportunities and possibilities to enhance existing e-learning courses are provided. For instance, social networks are collections of Web 2.0 technologies combined in a way that help build online communities. Social networking sites are on the rise globally and are developing rapidly as technology changes with new mobile dimensions and features. These sites are changing the ways people use and engage each other utilizing the Internet (Childnet International, 2008). Today's technology enhanced students have shown growing interest in social networking sites because of the community, the content, and the activities in which they can engage in the sites. Students can share their profile information, find out what their peers think about topics of interest, share music and playlists, and exchange messages with friends. Students use social networking sites to connect daily or even hourly for social as well as educational activities. They get to know their classmates through Facebook and share their lives with others on MySpace. Students use other social networking sites like RateMyProfessors and PickAProfessor to learn about their professors and choose their classes. In addition, they share their photos on Flickr and their videos on YouTube (The New Media Consortium, 2008).

Social networking sites are changing the social fabric of colleges and universities. In its fifth study of undergraduate students and information technology, the EDUCAUSE Center for Applied Research (ECAR) investigated the use of technology by undergraduate students in American colleges and universities. The *ECAR Study of Undergraduate Students and Information Technology, 2008* analyzed the Web-based survey responses of over 27,000 freshmen and seniors at 90 four-year institutions and eight two-year institutions, as well as findings from focus group discussions. The key findings of the Social Networking Sites section of the study included:

- Over 85 percent of respondents reported using social networking sites. The striking change over the last two years was in how many respondents now use social networking sites on a daily basis, from 32.8 percent in 2006 to 58.8 percent in 2008.
- Facebook was the most commonly used social networking site (SNS) (89.3% of SNS users), with MySpace as the second choice (48.3% of SNS users). Traditional college-age respondents (18 to 24 years old) used Facebook more than MySpace. However, older respondents used MySpace more than Facebook.
- Over 55 percent of SNS users spent 5 hours or less per week on SNSs, and about 27 percent spent 6 to 10 hours per week. Younger respondents reported spending more time than older respondents.

- Half of SNS users used social networking sites to communicate with classmates about course-related topics, but only less than 6 percent of them used social networking sites to communicate with instructors about course-related topics (Educause Center for Applied Research, 2008).

Social networking is already second nature to many students. Social networking sites not only attract students but also hold their attention, impel them to contribute, and bring them back time and again. Because of students' tremendous interest in social networking, many educational institutions are now evaluating existing social networking tools and even developing new ones, experimenting with social networking tools to support learning, and examining the effects of social networking in education (Educause Center for Applied Research, 2008; The New Media Consortium, 2008). Consequently, educators are beginning to recognize the popularity of social networking, to understand the importance and appeal of social networking among young people, and to explore the possibility of using social networking to enhance the sense of community in e-learning courses. This chapter provides an overview and development of sense of community and social networking. It then discusses the potential uses of social networking in education, and presents a case study that integrated social networking into two graduate courses for the purpose of building a sense of community, improving communications and interactions, and promoting student-centered collaboration. The construction of class social networks, the implementation of these networks, and their effects on the students' learning experience are examined. Also, an analysis of feedback from students on the value of social networking in learning is included.

DEVELOPMENT OF SENSE OF COMMUNITY AND SOCIAL NETWORKING

Sense of Community

The early research concerning community can be traced back over 30 years (Sarason, 1974). Sarason (1974) defined psychological sense of community as "the perception of similarity to others, an acknowledged interdependence with others, a willingness to maintain this interdependence by giving to or doing for others what one expects from them, and the feeling that one is part of a larger dependable and stable structure" (p. 157). Since then there have been various studies that attempt to describe and measure the sense of community (Buckner, 1988; Chavis, Hogge, McMillan, & Wandersman, 1986; Davidson & Cotter, 1986; Doolittle & MacDonald, 1978; Glynn, 1981; McMillan & Chavis, 1986; Pretty, 1990). The most influential and frequently quoted study is probably McMillan and Chavis (1986), who defined the concept as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (p. 9). They proposed that a sense of community was composed of four elements: (a) membership; (b) influence; (c) integration and fulfillment of needs; and (d) shared emotional connection. The dynamics among these four elements were demonstrated by McMillan and Chavis in the following example:

Someone puts an announcement on the dormitory bulletin board about the formation of an intramural dormitory basketball team. People attend the organizational meeting as strangers out of their individual needs (integration and fulfillment of needs). The team is bound by place of residence (membership boundaries are set) and spends time together in practice (the contact hypothesis). They play a game and *win (successful shared valued event). While playing, members exert energy on behalf of the team (personal investment in the group). As the team continues to win, team members become recognized and congratulated (gaining honor and status for being members). Someone suggests that they all buy matching shirts and shoes (common symbols) and they do so (influence). (McMillan and Chavis, 1986, p. 16)*

McMillan and Chavis's view of sense of community has been well supported and documented. Previous research studies indicated that spirit, trust, sense of belonging, interactivity, common goals, shared values and beliefs, and common expectations were the most essential elements of community (McMillan, 1996; Rovai, 2002a; Royal & Rossi, 1997; Shaffer & Anundsen, 1993; Strike, 2004). Rheingold (1991) and Hill (1996) suggested that the sense of community differed from setting to setting. Rovai (2002a) noted, "one such setting is the classroom where learning is the goal" (p. 201). Tebben (1995) found that student satisfaction and success were mainly attributed to the caring attitude of the instructor and the supportive environment created by classmates. McKinney, McKinney, Franiuk, and Schweitzer (2006) investigated the sense of community in a college classroom and found that six variables could significantly predict students' classroom attitudes, perception of learning, and actual performance on course exams: connection, participation, safety, support, belonging, and empowerment.

Wighting (2006) found that using computers in the classroom positively affected students' senses of learning in a community, and that students believed the connectedness with their peers was the most important variable in developing a sense of community. Bellah, Madsen, Sullivan, Swidler, and Tipton (1985), Rheingold (1991), and Wellman (1999) pointed out that the communities most important to people might not be defined within a geographical sense but instead consisted of groups of people who had common interests and may never physically meet each other. Accordingly, as Rovai (2001) noted, "community can be examined in virtual learning environments used by distance education programs" (p. 34). Studies on online environments have indicated that the sense of community could be created and supported through various interactive electronic media (Baym, 1995; Dede, 1996; Reid, 1995; Rheingold, 1993). Rovai (2001) explored the community of students in an asynchronous learning network course and found that the sense of classroom community grew significantly during the course in terms of spirit, trust, interaction, and learning. Rovai (2002a) refined the Classroom Community Scale focusing on: (a) connectedness, which represented the feelings of students regarding their cohesion, community spirit, trust, and interdependence; and (b) learning, which represented the feelings of community members regarding the degree to which they shared educational goals and experienced educational benefits by interacting with other members of the course.

Using the Classroom Community Scale, Rovai and Jordan (2004) examined the relationship of sense of community among traditional classroom, blended/hybrid, and fully online higher education learning environments, and found that blended courses produced a stronger sense of community among students than in either traditional or fully online courses. However, a large body of literature was somewhat limited in that it only assessed and reported the sense of community in CMC environments. Wilson (2001) pointed out that this type of research could be a useful component in tracking and assessing group cohesiveness, "while a reported sense of community does not itself establish effective community" (¶ 15). Rovai (2002a) argued:

Proper attention must be given to community building in distance education programs because it is a "sense of community" that attracts and retains learners. Educators who perceive the value of community must conceptualize how sense of *community can be nurtured in distant learning environments. (p. 199)*

Accordingly, there are a growing number of research studies on the sense of community through a complex interplay of social, instructional, and technological variables. Yang and Liu (2008) found that sense of community could be enhanced among students in e-learning courses through pedagogical, social, managerial, and technical functions.

Social Networks

Social networks are a social structure of nodes (individuals or organizations) and the relationships between the members. Social networks are usually built based on the strength of relationships and trust between the members (Liccardi, Ounnas, Pau, Massey, Kinnumen, Lewthwaite, Midy, and Sakar, 2007). Boyd and Ellison (2007) define social network sites as Web-based services that allow individuals to: (a) construct a public or semi-public profile within a bounded system, (b) articulate other users with whom they share a connection, and (c) view and traverse their list of connections and those made by others within the system. Social networking is when individuals or organizations are tied together through a similar objective or interest. There are many ways to participate in a social network. The most common is through the Web-based social network services that provide a variety of ways for users to interact, such as chat, messaging, email, video, voice chat, file sharing, blogging, discussion groups, and so on. Social networking sites focus on building online communities of people who share interests and activities, or who are interested in exploring the interests and activities of others (Wikipedia, 2008). Social networking sites allow users to create, develop, and manage their online presence.

Social networking sites have created powerful new ways to communicate and share information. Social networking sites are being used regularly by millions of people; and they keep people connected through a fast, free, simple, and an accessible way. Social networking sites play a role in social life, business, health care, and charity. People from all walks of life participate in social networking. Social networking sites are used not only for people to communicate on a local and global scale, but also to advertise their products and services, to network other business and industry professionals (e.g., Linkedln), to highlight individual physicians and institutions in the medical field, to connect with other patients dealing with similar issues and research patient data related to their condition (e.g., PatientsLikeMe), to locate pedophiles by many police investigations/trials using MySpace and Facebook pages as evidence, and to locate college students participating in illegal activities. Businesses and entrepreneurs have joined the young adults who connect through social networking sites. Also, companies use the sites to communicate with customers, promote themselves, recruit employees and conduct market research. (Wikipedia, 2008).

Childnet International (2008) reviewed the current range of social networking services available and grouped the social networking services into two main formats: sites that are primarily organized around users' profiles, and those that are organized around collections of content. In addition, social networking sites are classified into 6 categories: (a) Profile-based services (e.g., Bebo, Facebook, MySpace); (b) Content-focused services (e.g., Flickr, YouTube); (c) White-label networks (e.g., PeopleAggregator, Ning); (d) Multi-User Virtual Environments (e.g., Second Life, World of Warcraft); (e) Mobile services (e.g., Twitter); and (f) Microblogging/Presence update services (e.g., Jaiku, Twitter). Young people use social networking sites for various activities: (a) communicate with their contacts and develop friendships, (b) create and develop an online presence, (c) search information, (d) create and customize personal profiles to show their online identities, (e) create and upload their own digital media content, (f) add and share third-party content on their pages, (g) post public and private messages through message boards or internal email, and (h) collaborate with other users (Childnet International, 2008).

In the United Kingdom (U.K.), Ofcom's *International Communications Market 2007* report indicated that more adults use social networking sites than in any other of the European countries included in the survey (Childnet International, 2008). Also, a report published by ComScore (2007) revealed the European social networking community stood at 127.3 million unique visitors in August 2007 – reaching 56 percent of the European online population. The usage of social networking sites in the U.K. were heavier than the European average in terms of hours spent, pages viewed, and the number of visits per month. The average visitor to social networking sites in the U.K. spent 5.8 hours per month on those sites and made 23.3 visits. Ofcom reported that 39% of all U.K. Internet users use social networking sites, while the ComScore figures show 24.9 million individual social networking site visitors in August 2007 (Childnet International, 2008; ComScore, 2007). The most popular dedicated social networking sites in the U.K. and Europe are Bebo, Facebook Hi5, MySpace, Tagged, and Xing (Childnet International, 2008; Wikipedia, 2008). MySpace and Facebook are the most widely used in North America; Friendster, Orkut, Xiaonei and Cyword in Asia while Orkut and Hi5 in South America and Central America (Wikipedia, 2008).

Social networking sites such as Bebo, Facebook and MySpace facilitate informal communications and information sharing across the Internet. Many social networking sites target teenagers and young adults. Most of the social networking sites have a minimum membership age of 13 or 14, and may explicitly state that they are designed for individual 18 years or older. Services aimed at younger children typically have stricter privacy settings, greater levels of moderation and more limited user interactions. Some even require parental permissions for signing up and setting communication preferences (Childnet International, 2008). A research study by the Pew Internet and American Life Project (2007) indicates that 55% of teens between the ages of 12-17 use social networking sites. According to the study, older female teens use sites, such as Facebook and MySpace, primarily to reinforce pre-existing friendships, while male teens use them to flirt and create new friendships.

SOCIAL NETWORKING IN E-LEARNING

Digital Natives and Social Networking

According to Wolfe (2008), the worldwide generation Y population is nearly 2 billion strong and outnumbers the baby boomers, the previously largest generation. Generation Y is also known as boomlets, echo boomers, millennials, or net generation. Generation Y is born after 1980 and some of the older millennials already graduated and entered the workforce. Prensky (2001a) described the generation Y as digital natives and their predecessors as digital immigrants. Digital natives have been reared with technology, and most have had the Internet at their disposal during their younger years. So, this generation of digital natives is unique in that it is the first to grow up with digital and Web technologies and have had online and digital media access all their lives. They have made websites like YouTube and Facebook a massive phenomenon. Social networking sites like Facebook and MySpace are the backbone of their relationships with friends and family. Digital natives are comfortable with technology and the idea of sharing information via the Internet. By age 21, digital natives will have spent 10,000 hours on a cell phone, 10,000 hours playing video games, sent 200,000 emails, watched 20,000 hours of television, watched over 500,000 TV commercials, but spent less than 5,000 hours reading (Prensky, 2001b). Computer games, email, cell phones, mp3, flickr, Facebook, YouTube, and the Internet are integral parts of their lives.

As digital natives raised in an age of media saturation and convenient access to digital technologies, they have distinctive ways of thinking, communicating, and learning. Digital natives are highly connected, increasing mobile, interactive, and electronically social. They are visually-oriented, technologically savvy, and they see technology as an essential part of their lives. In addition, digital natives rely heavily on communications technologies to access information and to carry out social and professional interactions. They prefer multi-tasking and quick, non-linear access to information. Although they value education highly, digital natives learn differently from their predecessors. Digital natives prefer active learning rather than passive learning and have a low tolerance for lectures (Prensky 2001a, 2001b; Oblinger, 2003).

Social networking is deeply embedded in the lifestyles of digital natives. One of the popular technology tools the digital natives use to interact with others outside of school is the social networking sites such as Facebook and MySpace. Results of a 2007 national study conducted by the Pew Internet and American Life Project show that 55% all online American youths between the ages of 12 and 17 use social networking sites for communication. Forty eight percent of teens visit social networking sites daily or more often. Furthermore, 91% of all social networking teens say they use the sites to stay in touch with friends they see frequently, while 82% use the sites to stay in touch with friends they rarely see in person (Pew Internet & American Life Project, 2007).

The Office of Communications (2008) report, *Social networking: A quantitative and qualitative research report into attitudes, behaviours and us,* draws on numerous qualitative and quantitative research studies conducted in U.K. in 2007. The key findings of the report include:

- Social networking sites are most popular with teenagers and young adults.
- The average adult social networking users have profiles on 1.6 sites, and most users check their profile at least every other day.
- Two-thirds of parents claim to set rules about their child's use of social networking sites, although only 53% of children said that their parents set such rules.
- Social networking users fall into five distinct groups based on their behaviors and attitudes: a) Alpha socialisers, b) Attention seekers, c) Followers, d) Faithfuls, and e) Functionals.
- Non-users of social networking sites fall into three distinct groups: a) Concerned about safety, b) Technically inexperienced, and c) Intellectual rejecters.
- Only a few users highlighted negative aspects of social networking.
- Seventeen percent of adults used their profile to communicate with people they do not know. This increases among younger adults. Thirty-five percent of adults spoke to people who were 'friends of friends'.
- Facebook is the most popular site with adults followed by MySpace and then Bebo. For children aged between 8 and 17, Bebo was the most used social networking site.
- Some teenagers and adults in their early twenties reported feeling 'addicted' to social networking sites and were aware that their use was squeezing their study time.

Another study, *Creating and connecting: Research and guidelines on online social- and educational-networking,* conducted by the National School Boards Association (NSBA) indicates that American children are spending almost as much time using social networking sites as they spend watching television – around nine hours online, compared with 10 hours of TV. The report is based on online surveys of approximately

1,300 American children from 9 to 17 years old and over 1,000 parents. Additionally, telephone interviews were conducted with more than 250 school district officials. The findings of the study indicate that 96% of students with Internet access engage in social networking. Almost 60% of students said they use the social networking tools to discuss classes, learning outside school, and planning for college. Students also reported using chatting, text messaging, blogging, and online communities such as Facebook and MySpace for educational activities, including collaboration on school projects (National School Boards Association, 2007).

Digital native students are the most avid users of social networking sites, but older students are joining the social networking users ranks as well. Students typically join one or two social networking sites and do not change their profile often. They use social networking sites to keep in touch with their friends – most of whom they have already met in person – and to communicate with their classmates. These digital natives are not very concerned about privacy and security issues (Educause Center for Applied Research, 2008).

Social Networking for Teaching and Learning

Social networking has great potentials in education and will likely impact the teaching and learning process. The *2007 Horizon Report* described six areas of emerging technologies that will have significant impact on college and university campuses within three adoption horizons over the next one to five years. These areas are presented in priority order: (a) user-created content, (b) social networking, (c) mobile phones, (d) virtual worlds, (e) the new scholarship and emerging forms of publication, and (f) massively multiplayer educational gaming. The report further suggested that user-created content and social networking are the nearest adoption horizon. Social networking is already a fact of life on campuses across the world and examples are readily available. Social networking may be an important way to increase student access to and participation in educational activities (The New Media Consortium, 2007). Also, social operating systems are identified as one of six emerging technologies as likely being of increasing relevance to educators in the *2008 Horizon Report.* The time-to-adoption horizon of social operating systems is four to five years (The New Media Consortium, 2007). According to the *2008 Horizon Report*,

> *The essential ingredient of next generation social networking, social operating systems, is that they will base the organization of the network around people, rather than around content. This simple conceptual shift promises profound implications for the academy and for the ways in which we think about knowledge and learning. Social operating systems will support whole new categories of applications that weave through the implicit connections and clues we leave everywhere as we go about our lives, and use them to organize our work and our thinking around the people we know. (The New Media Consortium, 2008, p. 4)*

Many of today's learners use technology primarily for social networking, and they are quite familiar with using social networking sites (JISC, 2007). Social networking sites have the capability to deliver a platform for learning where the student is potentially at the center of activities. (Oradini & Saunders, 2008). Students are far more ready and comfortable using social networking sites than their teachers. Cengage Leaning (2007) conducted a survey of 677 professors teaching at two- and four-year colleges to examine faculty views on social networking sites and new media tools. The survey results revealed that 65% of the respondents are not familiar with social networking sites and those who used social networking sites used them for both personal and work purposes. Nearly 50 percent of faculty respondents who are familiar with social networking sites felt such sites have or will change the way students learn. Furthermore, nearly 90% of respondents who are familiar with social networking sites said they know about sites that allow students to grade or rate professors, and 67% have checked if they have been rated.

In recent years, social networking sites have received significant attention in higher education as increasing numbers of digital native students have made use of public systems such as Facebook and MySpace. Such sites, along with other Web 2.0 tools (e.g. social bookmarking and syndication technologies), help students find information, create work, and share knowledge (Oradini & Saunders, 2008). Many educators and researchers are now developing their own social networking system and exploring the uses of social networking in teaching and learning (e.g., Marsh & Panckhurst, 2007; Oradini & Saunders, 2008). According to Oradini and Saunders (2008), several universities in the U.K. have recently experimented with the provision of institutionally owned social networking (e.g. the University of Brighton's Community System, University of Westminister) or blogging systems (e.g. the University of Leeds). Marsh & Panckhurst (2007) conducted a pilot study to explore the opportunities for a more flexible learner-centered approach through the provision of an online social network. They set up a private community eLEN (eLearning Exchange Network) using Ning (www.ning.com) to provide virtual space with a social network environment. Two groups of graduate students from France and the U.K. were invited into the eLEN. Their study showed that collaborative learning could take place in a social network. Their social network (eLEN) gave the students a sense of belonging, a sense of freedom, and a sense of pedagogical innovation. Also, the social network provided a learning community for knowledge sharing.

Childnet International (2008) offers many ideas for school administrators to explore the use of social networking sites in education. Educators may use social networking sites for delivering staff development and digital literacy; providing information about a school, college, or organization; supporting e-learning; and developing ICT provision planning and personal learning environment planning. Also, there are many potential educational benefits to students using social networking sites: (a) allowing learners as social participants and active citizens to discuss issues and causes that affect and interest them; (b) developing a voice and building trust in a community; (c) allowing students to become content creators, managers, and distributors of their work; (d) supporting students to work, think, and act together as collaborators and team players; (e) encouraging discovery learning and helping students develop their interests and find other people who share their interests; (f) becoming independent and building resilience; and (g) developing key and real-world skills (Childnet International, 2008).

Social networking offers many potential uses in education. Social networking can be used in education for: (a) providing a casual place of learning; (b) developing literacy and communication skills; (c) providing effective communication and collaboration; (d) enhancing students' learning experiences; (e) building an online learning community; (f) offering immersion in a foreign language environment; (g) developing e-portfolios; (h) learning about data protection and copyright issues; (i) learning about self-representation and presentation; (j) learning about e-safety issues; (k) producing public showcases for work, events, or organizations; (l) forming communities of practice; (m) organizing and scheduling educational timetables; and (n) being where learners are (Childnet International, 2008).

While social networking shows great potentials for e-learning in general, little is yet known about how to integrate social networking focusing on building a sense of community, particularly in e-learning courses. As Wilson (2001) suggested, "[w]e need continuing development and publishing of specific teaching models and frameworks that can be studied and shared through research—the profession thus emulates the community behaviors we are talking about" (¶ 14).

CASE STUDY: INTEGRATING SOCIAL NETWORKING IN E-LEARNING COURSES

To obtain specific information about the process of the social network instructional approach and participants' perceptions on the use of social networking on the sense of community in e-learning, two courses in a blended learning or hybrid format were selected for this study. It should be noted that the participants were selected by the way of convenience sampling since one of the researchers for this study was the instructor of both courses. Furthermore, the sample size was relatively small. Therefore, instead of any strict inferential attempts, a descriptive research design was utilized in the study. The following questions guided this study:

- How could the researchers design and implement a social networking site for teaching an online or hybrid course?
- How did students feel regarding the use of a social networking site in learning?
- What were the effects of using a social networking site in a course on the sense of community among learners?
- Were there differences in the use of a social networking site and the sense of community among different learners (age and gender)?

Design of Social Networking Sites

A social networking site was created for each course using Ning (www.ning.com). The unique feature of Ning is that anyone can create their own customized social network for a particular topic or need, catering to specific audiences. Also, minimum technical skills are required to set up a social network, and there are no limits to the number of networks a user can join. Ning has a very good user-friendly interface that allows even novice Web users to create his/her own highly customized social network free of charge. Also, Ning has excellent functionality similar to that of more well-known social networking sites, such as Facebook and MySpace. Various features allow Ning users to read news or learn about related events, join groups, read and comment on blog entries, view photos and videos, and participate in forum activities. Other social network sites such as Facebook, MySpace, etc. were not chosen to use in the study despite the popularity of these social networking sites. Facebook and MySpace tend to be used by many students for personal or social extra-curricula networking tools. It was the belief of the researchers that a personal social networking site created with Ning seemed more appropriate and provided an exclusive and personalized learning environment for the students.

Each site allowed students to create their own profiles; upload photos, audio, podcasts, and videos; create and join discussion groups; send messages; and publish blogs and presentations. Each social networking site was designed for private use. Only class members in each course were invited to join the class social network. No guest or outsider was allowed to join or participate in the social network. Figures 1 to 5 show the main features of a class social network.

Participants

The participants were 30 students enrolled in educational technology classes from two universities during the spring semester in 2008. Specifically, the participants were enrolled in the course *Seminar in Instructional Technology* (Course A) at a state university in the southern region of the United States and the course *IT Management in School* (Course B) at a public university in Hong Kong. Both of these courses

Figure 1. The Social Network Main Page for Course A

Figure 2. A Personal Page on a Social Network

Figure 3. The Forum Page

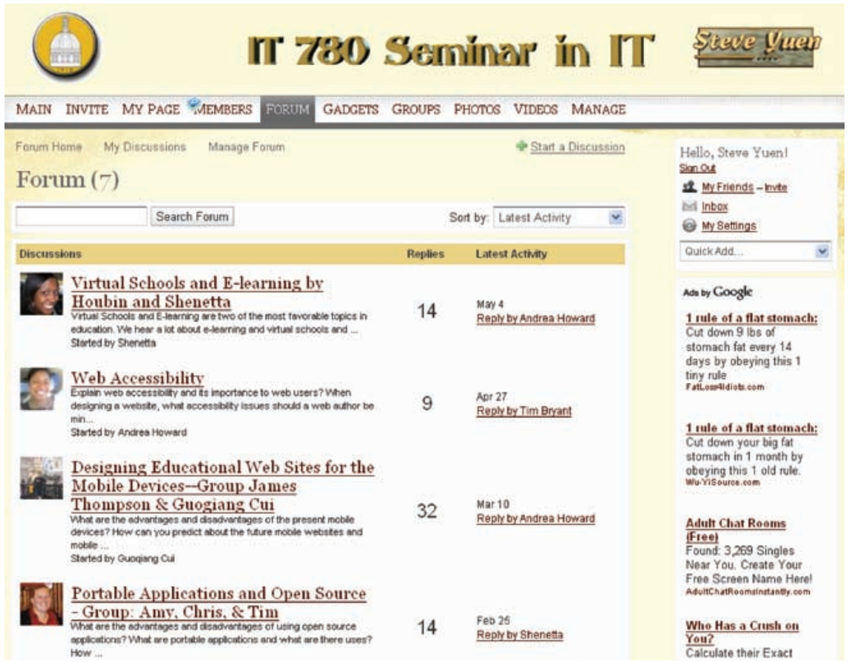

Figure 4. The Videos Page

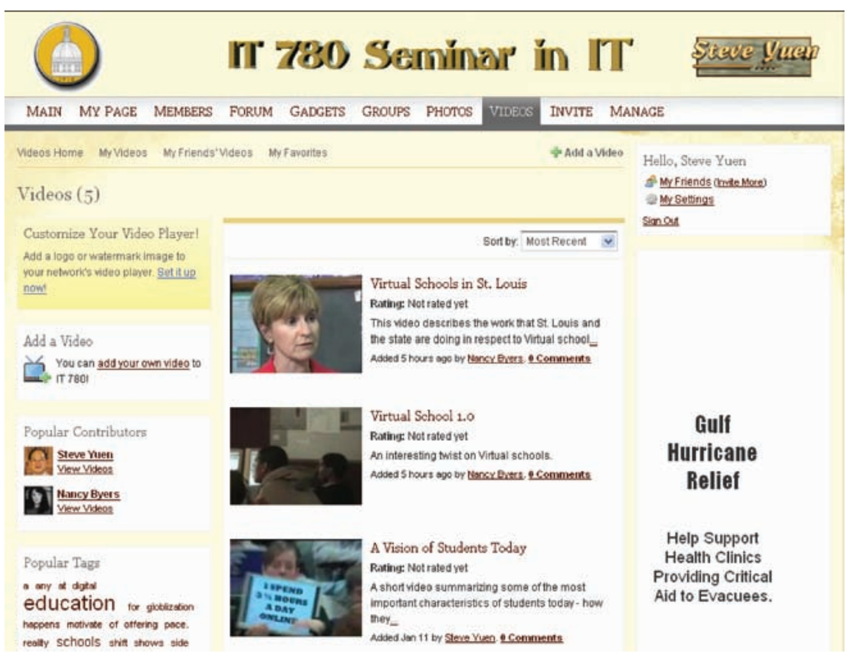

Figure 5. The Social Network Main Page for Course B

were graduate level courses in educational technology and were offered in blended learning or hybrid format, where approximately one-half of the course learning activities was scheduled in an online environment. Furthermore, the course *Seminar in Instructional Technology* was offered in a regular 15-week semester while the course *IT Management in School* was taught in an intensive 4 weeks format. The majority of participants in both courses were part-time in-service teachers who were pursuing a master's degree or a graduate minor in educational technology. In addition, one of the researchers of this study served as the instructor for both courses.

Implementation

Two social networking sites were designed and tested prior to the beginning of class with each having a similar layout and identical features and components. Both courses were taught by the same instructor/researcher in spring 2008. In the beginning of the semester, social networking concepts and the social networking sites were introduced in the courses. Also, the instructor/researcher gave a hands-on demonstration on using the social network site and explained how the social network could be used in the course.

Students in each course were invited to join the respective social network. No outside-of-class students nor the general public were allowed to join the class' social network. Each student was required to create a personal profile that included a personal introduction, current status, e-mail address, city of residence, personal Web site, instant messaging accounts, and interests. Also, each student was encouraged to post personal media (digital photos, music, and videos) as well as personal blog, podcasts, and videos related to the course content to the social networking site. Class information such as the course syllabus, schedule, assignments, instructor's blog, the links to the lecture notes and resource materials were provided by the instructor on the social networking site. Bi-weekly class discussions were facilitated by the forum on the social networking site. Each student was required to participate in the class discussions and shared their opinions on the current class topic. In addition, students were encouraged to form groups and initiate and moderate a forum for other personal or class activities. At the end of semester, students in both courses were requested to complete a survey designed by the researchers.

Data Collection and Instrumentation

A questionnaire was developed to evaluate the use of social networking in teaching and learning and assess its effectiveness on the sense of community among learners. The questionnaire consisted of three major parts. Part A consisted of 8 items to collect background information such as age, sex, types of Internet connections, Internet access locations, years of using computers, social network memberships, frequency of access to a social network, and numbers of friends in a social network. Part B consisted of 18 items which were designed to obtain students' feedback regarding the use of a social networking site in teaching and learning. A five-point Likert scale was used for the 18 items, with 4 representing a strong agreement and 0 representing a strong disagreement. In addition, two categorical types of questions regarding the access and profile and one open-end question were included. Part C consisted of a 20 item Classroom Community Scale (CCS) developed by Rovai (2002a). CCS was adopted to measure the sense of community for students on two factors: connectedness and learning. A five-point Likert scale was used for items 1, 2, 3, 6, 7, 11, 13, 15, 16, and 19, with 4 representing strong agreement and 0 representing strong disagreement. A five-point Likert scale was also used for items 4, 5, 8, 9, 10, 12, 14, 17, 18, and 20; but for these items, 0 represented strong agreement and 4 represented strong disagreement. The scores of odd items (1, 3, 5, 7, 9, 11, 13, 15, 17, and 19) were added together for the connectedness subscale score. The scores of the even items (2, 4, 6, 8, 10, 12, 14, 16, 18, and 20) were added for the learning subscale score. Scores on each subscale ranged from 0 to 40, with higher scores reflecting a stronger sense of classroom community (Rovai & Jordan, 2004).

To ensure the reliability and content validity of the instrument, the questionnaire was sent to a jury of experts to determine the appropriateness and content validity of the Part A and Part B of the questionnaire. Their comments and feedback were used to refine Part A and Part B of the questionnaire. Also, a reliability test was conducted for the 18 items of Part B, and a Cronbach's coefficient α was 0.93 indicating excellent reliability. According to Rovai (2002a), Cronbach's coefficient α for the full Classroom Community Scale was .93 and the equal-length split-half coefficient was .91, indicating excellent reliability. Cronbach's coefficient α and the equal-length split-half coefficient for the connectedness subscale were .92 each, and for the learning subscale were .87 and .80, respectively.

All students from both courses were requested to complete the questionnaire at the end of the spring semester. Thirteen out of 13 students' responses (100%) from Course A, and 17 out of 18 students' responses (94.4%) from Course B were completed and usable.

Findings

This section reports on an analysis of the use of social networking site by participants in two graduate courses at two different universities. Quantitative data was collected via questionnaires in the spring semester of 2008. Table 1 shows the demographic profile of the participants. Seventy-seven percent of participants were between the ages of 25 to 39. Sixty percent of them were female. Ninety-four percent accessed the Internet

Table 1. Frequency Distributions of Demographic Variables

Variable	Category	N	Percentage
Age	Under 20	0	0.0
	20-24	1	3.3
	25-30	10	33.3
	31-34	6	20.0
	35-39	7	23.3
	40 and above	6	20.0
Gender	Female	12	40.0
	Male	18	60.0
Internet Connection	High speed (Cable, DSL)	20	66.7
	T1/LAN/WAN	8	26.7
	Other	2	6.6
Internet Access Location	Campus	8	29.6
	Home	9	33.3
	Workplace	10	37.0
Computing Experience	<2 years	1	3.4
	5-7 years	2	6.9
	7+ years	26	89.7
Social Network Member	Bebo	1	3.3
	Classmate	6	20.0
	Facebook	17	56.7
	Friendster	3	10.0
	Linkedin	3	10.0
	Myspace	10	33.3
	Tagged	1	3.3
	Xanga	7	23.3
	Ning	7	23.3
	No social network	5	16.7
Access Social Network	Everyday	8	26.7
	Every week	9	30.0
	Every 2 weeks	4	13.3
	Every month	3	10.0
	Less Frequently	6	20.0
Number of Friends on Social Network	<10	11	36.7
	11-20	3	10.0
	21-30	3	10.0
	31-40	2	6.7
	50+	11	36.7

with high speed connections (cable, DSL, T1 and etc). Almost 90% of the participants had over 7 years of computing experience. The majority of them (57%) had a Facebook account while only 33% used MySpace and 23% had a Xang or Ning account.

Students' Perceptions of the Use of a Social Network

Most students indicated positive and favorable feelings of using a social networking site in both courses. Among the respondents on the Part B of the survey, 100% of them agreed/strongly agreed on items 2, 3, 4, 5, 6, 7, 8, 10, 13, 14, 15, 17, 18, and 19. Ninety-seven percent of the students agreed/strongly agreed on items 9, 11, 12, and 16: "My class social networking site allows me to communicate with classmates about course-related topics;" "My class social networking site provides collaborative learning opportunities;" "My class social networking site gives me a sense of belonging, and "Social networking can be used for professional development." Ninety percent of the students agreed/strongly agreed on item 1 "I feel comfortable using the class social networking site." In comparison of the two courses, as indicated in Table 2, the mean score on each item in Course A was higher than that in Course B. Furthermore, t-test analysis showed nine significant differences were found between respondents in Course A and Course B on items 2, 3, 3, 7, 8, 10, 13, 18, and 19 (p<.005). This indicated the students in Course A felt much stronger about the use of social networking in learning than students from Course B.

In addition to the 19 survey items, participants indicated they accessed the class social networking site every day (13.3%), every week (73.3%), or less frequently (13.3%). They changed their profile in the class social networking site daily (3.3%), several times per week (13.3%), monthly (23.3%), or once a semester (60%). Also, all participants (100%) in both courses indicated that their overall experience using the class social networking site were positive or very positive. Furthermore, participants were also encouraged to provide their personal feedback and comments on the survey. Here are their written comments regarding their class social network:

[Student 1 in Course A]

The more I used the class social network – the better I became at it. And we did share information. I enjoyed everything.

[Student 2 in Course A]

It is really a great experience. I like this experience to be communicating with others and this gives me more knowledge about the social networking, so I can set up my own social network.

[Student 3 in Course A]

I enjoyed using the social networking. There was almost never a moment of uncertainty. I could be in touch with anyone from class. Very good! Might very well be the BEST class I've taken! Very helpful and I honestly learned a lot!

[Student 4 in Course A]

This was the first course that incorporated a social network with the activities. The social network encouraged a laid back atmosphere that one could personalize and share with other classmates. It was different from the normal learning environment and I felt more apt to access the site than I would with your typical online course site (WebCT).

[Student 5 in Course A]

The class social networking site was very fun and meaningful. I enjoyed using Ning and creating anything I want. This was truly a remarkable project. I will use Ning continuously.

Table 2. Means and Standard Deviations of the Class Social Network Items

Item			Course A
			(n=13)
		M	SD
1.	I feel comfortable using the class social networking site.	3.08	0.76
2.	My class social networking site allows me to interact and build a learning community.	3.46	0.51
3.	My class social networking site allows me to personalize pages to express individuality and creativity.	3.62	0.51
4.	My class social networking site allows me to pose questions to the community.	3.54	0.52
5.	My class social networking site allows me to share photos, music, and videos.	3.62	0.51
6.	My class social networking site allows me to hold forums to discuss topics of interest.	3.62	0.51
7.	My class social networking site allows me to find and share educational resources.	3.62	0.51
8.	My class social networking site allows me to create study groups.	3.62	0.51
9.	My class social networking site allows me to communicate with classmates about course-related topics.	3.62	0.51
10.	My class social networking site encourages learner-centered activities.	3.46	0.52
11.	My class social networking site provides collaborative learning opportunities.	3.38	0.51
12,	My class social networking site gives me a sense of belonging.	3.08	0.76
13.	My class social networking site promotes knowledge sharing.	3.38	0.51
14.	My class social networking site is user-friendly.	3.54	0.52
15.	Social networking is a great tool for class communications.	3.69	0.48
16.	Social networking can be used for professional development.	3.62	0.51
17.	I will become more actively involved in courses that use social networking.	3.77	0.44
18.	I would like to see more social networking class sites used in other classes.		3.65
	Overall	3.51	0.35

[Student 6 in Course A]

I had a great experience using the social network and the site is easy to navigate through and user friendly. I enjoyed reading other people's view on different technology issues from reading and writing on different topics under the site. I have gained much knowledge on new technology.

[Student 7 in Course A]

I enjoyed using the site, working with peers using the forum was the most valuable. I wish the social networking site allowed a little more "personality." I would have liked to have a Wordpress plug-in for Ning.

[Student 8 in Course A]

Using a social networking site has helped me stay in touch with friends and classmates. The ability to share ideas with people worldwide is one of the best benefits I have experienced. I believe social networking sites have great potentials for teaching students in K-12 and college and for connecting teachers with each other in professional development.

[Student 1 in Course B]

It is useful to share experiences with classmates and get information from others.

[Student 2 in Course B]

The feeling of the site is rather formal making it less attractive compared with famous sites, like Facebook.

[Student 3 in Course B]

I started my class social networking recently and already loved it because it provides a good platform for students and colleagues to share their experience and post topics for discussion.

[Student 4 in Course B]

I liked using the class social networking site. I thought it was a great way to discuss topics and I could have used even more.

Connectedness

Most of the students indicated positive and favorable feelings of their cohesion, community spirit, trust, and interdependence from both courses. Among the respondents on the connectedness subscale of the CCS, eighty-seven percent of them agreed/strongly agreed on item 3 "I feel connected to others in this course;" approximately 83% of the students agreed/strongly agreed on item 1 and 11: " I feel that students in this course care about

Table 3. Means and Standard Deviations of Connectedness Subscale by Courses Learning

Item	Course A	Course B	Combined				
	(n=13)	(n=17)	(n=30)				
		M	SD	M	SD	M	SD
1.	I feel that students in this course care about each other.	3.38	0.50	2.82	0.64	3.07	0.64
3.	I feel connected to others in this course.	3.23	0.60	3.06	0.66	3.13	0.63
5.	I do not feel a spirit of community.	3.23	1.01	2.53	0.94	2.83	1.02
7.	I feel that this course is like a family.	3.23	0.83	2.77	0.75	2.97	0.81
9.	I feel isolated in this course.	3.15	0.90	2.83	0.88	2.97	0.89
11.	I trust others in this course.	3.31	0.86	2.88	0.60	3.07	0.74
13.	I feel that I can rely on others in this course.	3.23	0.93	2.59	0.71	2.87	0.86
15.	I feel that members of this course depend on me.	2.23	1.01	1.71	0.84	1.93	0.94
17.	I feel uncertain about others in this course.	3.00	0.71	2.24	0.75	2.57	0.82
19.	I feel confident that others will support me.	3.31	0.63	2.59	0.71	2.90	0.76
	Overall	3.13	0.65	2.60	0.29	2.83	0.54

each other;" "I trust others in this course;" about 83% disagreed/strongly disagreed on item 9 "I feel isolated in this course;" about 80% agreed/strongly agreed on item 7 " I feel that this course is like a family;" about 77% disagreed/strongly disagreed on item 5 "I do not feel a spirit of community;" about 73% agreed/strongly agreed on item 19 "I feel confident that others will support me, " about 70% agreed/strongly agreed on item 13 "I feel that I rely others in this course;" about 53% disagreed/strongly disagreed on item 17 "I feel uncertain about others in this course." In the comparison of the two courses, as indicated in Table 3, the mean scores on all items in Course A are higher than those items in Course B. The students in Course A felt much stronger in connecting with their classmates than students from Course B.

Most students indicated positive and favorable feelings of community members regarding the degree to which they shared their learning experiences by interacting with other members in both courses. Among the respondents on the learning subscale of the CCS, eighty-seven percent of them agreed/strongly agreed on items 2 "I feel that I am encouraged to ask questions;" approximately 80% of the students disagreed/strongly disagreed on item 20 "I feel that this course does not promote a desire to learn;" approximately 77% disagreed/strongly disagreed on item 14 "I feel that other students do not help me learn" approximately 73% disagreed/strongly disagreed on item 4 "I feel that it is hard to get help when I have a question;" approximately 73% agreed/strongly agreed on item 6 "I feel that I receive timely feedback;" approximately 70% disagreed/strongly disagreed on item 18 "I feel that my educational needs are not being met;" about 63% agreed/strongly agreed on item 16 "I feel that I am given ample opportunity to learn;" and approximately 53% disagreed/strongly disagreed on item 10 "I feel reluctant to speak openly." As indicated in Table 4, the mean scores on all items in Course A are also higher than those items in Course B. The students in Course

Table 4. Means and Standards Deviations of Learning Subscale by Courses

Item	Course A	Course B	Combined				
	(n=13)	(n=17)	(n=30)				
		M	SD	M	SD	M	SD
2.	I feel I am encouraged to ask questions.	3.31	0.48	2.88	0.78	3.07	0.69
4.	I feel that it is hard to get help when I have a question.	3.46	0.66	2.41	1.18	2.87	1.10
6.	I feel that I receive timely feedback.	3.15	0.90	2.65	0.70	2.87	0.82
8.	I feel uneasy exposing gaps in my understanding.	2.92	0.95	2.00	0.94	2.40	1.04
10.	I feel reluctant to speak openly	3.08	0.95	2.18	0.95	2.57	1.04
12.	I feel that this course results in only modest learning.	3.15	0.99	1.59	0.87	2.27	1.20
14.	I feel that other students do not help me learn.	3.08	0.86	2.53	1.00	2.77	0.97
16.	I feel that I am given ample opportunities to learn.	3.38	0.65	2.42	0.71	2.83	0.84
18.	I feel that my educational needs are not being met.	3.23	1.17	2.53	0.87	2.93	1.05
20.	I feel that this course does not promote a desire to learn.	3.61	0.51	2.53	0.80	3.00	0.87
Overall		3.23	0.54	2.37	0.44	2.75	0.65

A felt much stronger about sharing their learning experiences by interacting with other members than students from Course B.

Age and Gender Differences on Social Networking and the Sense of Community

A one-factor analysis of variance was used to investigate the differences in students' age and gender on their social networking experiences as well as their sense of community. The results showed that no significant differences were found in students' age and gender on their social networking experiences as well as their sense of community in terms of connectedness and learning.

DISCUSSION AND CONCLUSION

With the recent advances of Web 2.0 technologies, the role of social software has become increasingly popular in recent years. Social network applications have great potential in education because of their open nature, ease of use, and support for effective collaboration and communication. Today, social networking is very popular and digital natives already found social networking tools integral to daily life. Social networks could be used in education to enhance students' learning experiences. This chapter yields findings of previous research related to sense of community and social networking in the e-learning environment and indicates the social networking approach should be considered, designed and implemented for e-learning courses.

The findings of the case study indicated that the approach of designing and integrating a class social networking site into two courses were fun, worthwhile, and positive. Students in both courses welcomed the opportunity to experience and explore the use of a social network in teaching and learning. They had positive experiences using a social networking site in learning. They found the class social networking site was user-friendly and gave them a sense of belonging. All participants in both courses felt comfortable using the class social networking site, and they felt more actively involved in the courses that use social networking. Participants in both courses felt that social networking is a great tool for class communications and can be used for professional development. They used their class social networking site to pose questions to the community, share digital media, hold forums to discuss topics of interest, share educational resources, create study groups, and communicate with classmates. Furthermore, they indicated the class social networking site can encourage learner-center activities, provide collaborative learning opportunities, and promote knowledge sharing.

The study revealed that using a social networking site in a class could build a sense of community among learners. All items in CCS received moderate high means except item 15 “I feel that I can rely on others in this course.” Perhaps, students who rely more on self-regulation have stronger sense of community. It was interesting to note that participants in Course A had more positive and favorable feelings about the use of a social networking site in learning than participants in Course B. Also, participants in Course A had a stronger sense of community in both connectedness and learning than participants in Course B. Although both courses were taught by the same instructor and used a very similar social networking site with identical features, design and layout, Course A and Course B were offered in different countries and in different formats (regular 15 weeks for Course A versus intensive 4 weeks for Course B).

It appeared that the length of time using a social networking site in a class could be an important factor. As compared to participants in Course B, participants in Course A had a much longer time to explore, learn, communicate in a social network and develop a stronger sense of community. Also, it is possible that culture plays a role in social networking since Course A was taught in the United States while Course B was taught in Hong Kong. It appeared that students in the United States in general are more open and more acceptable for online culture and socializing. It is recommended that culture issues be investigated for further research.

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This work was previously published in Collective Intelligence and E-Learning 2.0: Implications of Web-Based Communities and Networking, edited by H. H. Yang and S. C. Chen, pp. 281-304, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 4.9
Publishing with Friends:
Exploring Social Networks to Support Photo Publishing Practices

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ABSTRACT

Publishing with friends is the account of an action research cycle in which a print-on-demand Web site, Lulu.com, became a classroom for second and third year digital photography students to publish their photobooks. Building on the earlier use of a blogging platform as a personal learning environment, this narrative explores the pedagogical prospects of the read/write Web, and illustrates the way in which students use social networks for creative produsage (Bruns, 2008). Students were positive about the pedagogical approach, and the opportunities to gain valuable hands-on experience in their chosen field of study.

INTRODUCTION

The web is coming of age. Predicted almost 20 years ago, users with relatively unsophisticated information technology skills are now able to use the internet as a medium to communicate and publish in what we have chosen to describe as the read/write web. (Also known as Web 2.0 technology, the "read/write web" seems to us a more descriptive appellation.) The increasingly ubiquitous nature of the web, and its unquestioned affordances, now challenge the academy to embrace technology in appropriate curricula and, in the process, to investigate the move from an industrial production model to the pragmatics of the web-led produsage, or user-led production, approach. Bruns (2008) focuses on the fluidity of the produsage process as a main characteristic – it is in the evaluation, the flexible leadership, its iterative nature and the attribution of social capital, rather than an end product, that the concept is defined.

Produsage in the higher education setting is the underlying theme of the chapter which maps this particular instance of produsage onto Bruns' model. In the process, it describes the pedagogical underpinnings of the inquiry through the account of

DOI: 10.4018/978-1-60566-826-0.ch013

the use of the read/write web as an environment to teach students of digital photography; discusses the design of learning tasks and the engagement of students in the design of an assessment and feedback rubric; and explores the findings from the students' evaluation of the research intervention. Lastly, the implications of the research for future iterations of the digital photography units are set out.

BACKGROUND

The roots of the read/write web were described by Berners-Lee and Cailliau (1990); they explained hypertext and foresaw two phases in its development: firstly the use of existing browsers to access information (the read web) and also ease of publication on the web (the write web) with "the creation of new links and new material by readers. At this stage, authorship becomes universal." The authors predicted that "this phase [would] allow collaborative authorship" facilitated by the annotation of existing data, linking and adding documents.

Almost two decades later, their vision has become a reality. Online participatory culture is ubiquitous, and evidenced by the popularity of social network and media-sharing sites, multi-player games and other applications generally know as social software.

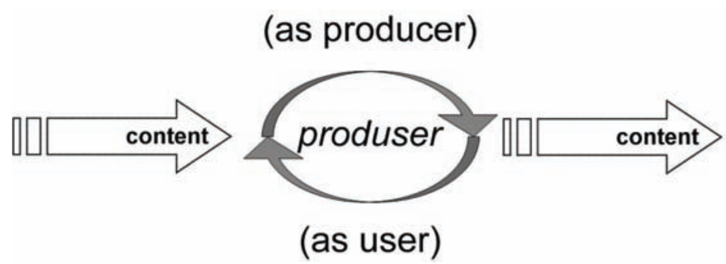
The academy is slowly entering this stage of "collaborative authorship". The term "classroom of the read/write web," coined by Richardson (2006), uses a familiar metaphor to translate this into a teaching and learning construct. Educators can assemble their own toolbox of freely available applications using the self-publishing technologies now abundant on the Internet; these may include weblogs, wikis, aggregators, social bookmarking, photo-sharing, rubric-making tools and many others. In his model, Richardson provides a pedagogical framework for the integration of these technologies in teaching and learning, in the context of the publishing affordances of the read/write web, and emphasizes the four core literacies – reading, publishing, collaborating and information management – that can be developed in the online environment.

In practice, the read/write web classroom demands major shifts in the ways we think about content and curriculum. Richardson (2006) identifies these as follows: the web is viewed as an open classroom; learning takes place 24/7 in interaction between online peers and experts; collaboration leads to the social construction of meaningful knowledge; teaching is democratized, a conversation rather than a lecture; knowing where to find information takes precedence over the acquisition (and regurgitation) of facts; students aspire to edit information critically, to develop active reading and writing skills; web applications are used as digital notebooks to store and share information found online; writing is lent richness by augmentation with photography, audio and video; mastery of skills is demonstrated and assessed in the product (e.g. digital content creation) and marked tests are dispensed with; and, finally, course materials and coursework are a contribution to a larger body of knowledge (the web), can be reused by others, and are not completed and discarded at the end of the semester.

This model of the open classroom is a major challenge for the academy. Many artists and designers already use the read/write web in their everyday life, but universities seem reluctant to make the transition from an industrial age concept of knowledge (production) to one more in tune with the information age model of user-led education (produsage). Bruns (2008) coined the word produsage to describe the process of user-led production in the setting of networked practices.

Engagement in the read/write web or, more specifically in this instance, in the contemporary online self-publishing environment, allows academe to explore novel opportunities for teaching and learning. These are underpinned by the four key principles of produsage: the implicit evalua-

Figure 1. The produser. (© 2008, Axel Bruns. Used with permission.)



tion by the community of users of artifacts prodused by individuals; the flexible leadership of projects which is grounded in personal strengths; the recognition of the iterative and inherently "unfinished" nature of the produsage process which is constantly revised by interested parts of the community; and the recognition of excellent individual contributions to the community by attributing social capital.

The model of the creative as an online produser (Bruns, 2008) is useful as it expresses the authentic practice of artist-teachers and artist-students. The term encapsulates the reality of artistic creative environments such as photograph- and video-sharing blogs, and social network sites like Flickr, YouTube, MySpace and Facebook and 3-D multi-user spaces like Second Life.

The focus is often on the personal content that circulates in these sites. While life caching (uploading of personal content for friends and family) may be one application of these platforms, specific groups of users have emerged which engage in the proper produsage of creative content:

… within such produser groups, content is exchanged not merely for its inherent personal or communicative value, but overtly as creative work to be showcased to and exchanged with other members of the community. Participants both comment on and critique one another's works; they collaborate on creative projects both by pooling together their individual collaborations to form a composite whole, and by directly editing, rearranging and remixing the material already provided by others; and in the process they in effect collaboratively curate an ever-expanding, constantly changing exhibition of the community's creative works. From such practices also emerge heterarchical structures of recognition and merit within the community. (Bruns, 2008, p229)

Specific studies on the impact of Flickr in photographic creative practices have revealed the personal and learning implications of the photo-sharing site. From her study, Van House (2007) reveals four social uses of personal photography: firstly, it is a memory device to build narratives of the self; it also serves as a form of self-representation or self-portrait; it may be a way of creating a relational sense of togetherness, an expression of sociability; and it can also have the purpose of displaying one's artistic and creative work, a kind of sociable exhibition. In the academic context, the use of Flickr in blended teaching for a first year photography unit articulates with the students' daily use of social networking sites for their photo practices (Robbie & Zeeng, 2008). Flickr's tools for commenting on and notating each other's images facilitates analytical critical reflection and feedback between students. It also situates their work in the nexus between students' studies and their professional practice; allows conversations to develop beyond the classroom, which addresses the balance between work and study; and is an affordable way of exhibiting images publically.

Studies of print-on-demand, and its relationship with photography and design communities, are also available. Lulu.com, in particular, is referenced in studies of the relationship between self-publishing and emerging online economies. Anderson (2006) explores Lulu as a prime example of the existence of long-tail markets, which are possible because of the unlimited shelf space provided by online digital databases. The reputation economy is a description of the self-promotion value attached to publishing; it explains the added attraction of publishing online, a motivational factor that outweighs the small sales volumes that characterise these niche markets. Specifically, the adoption of print-on-demand to self-publish photobooks allows emerging photographers to bypass the lengthy process involved in traditional publishing, with total financial independence – there is no need to fundraise – and full editorial control (Forrester, 2007).

Against this background, the possibility of teaching units on photobook publishing in an authentic produsage environment was a motivating factor in engaging in this qualitative pedagogical project. Other higher education projects using Lulu.com for graphic design are available (Philippin, 2008; Hochschule Darmstadt, 2008) but none comments on the pedagogical process involved in using the platform, choosing instead to present the students' work as an enquiry into the digital printing output achievable at Lulu. Our study explores the features of lulu.com that can be used as part of a "classroom of the read/write web" and discusses the results with reference to the self-publishing capacities involved in reaching the learning outcomes.

CASE STUDY: PHOTOBOOK PROJECT FOR PHOTOGRAPHY STUDENTS

There is an expanding field of inquiry into what constitutes artists' publications. Critical features of this interest are the combination of artistic approaches with networked practices, and the investigation of the latest technologies that many artists and publishing groups have started to explore as an alternative to traditional press. An artist's book, in this genre, is not an illustrated book characterized by high production values and a conventional separation text-image; nor is it a photo album containing the family's best moment's snapshots. Instead, it means working within a "zone of activity" (Drucker, 2004) at the intersect of conceptual art and photography, independent publishing, activism, fine art practice, sculpture, installation, book arts, performance, self-publishing fairs, and online produsage environments and social networks. The terms of reference for artists' publications may still be vague, but there is general agreement amongst practitioners and scholars that the final criteria rest upon the engagement of the work with the specific features of a book; this is the expression of the work's 'bookness'.

The emphasis of the photo publishing unit of this study is the genre of the photobook, "a book – with or without text – where the work's primary message is carried by photographs … an event in itself … a concise world where the collective meaning is more important than images" (Parr & Badger, 2006). This implies that the students come to think of the photograph in relational terms, develop skills as curators or editors, and learn to use current available digital technologies to publish and distribute independently. The genre has been developing since the conception of photography, but as printing technologies have gravitated towards a networked model, photographers have adapted their practices to take advantage offered by print-on-demand (POD) publishing models.

Teaching photographers to develop photobooks also means going beyond focusing on the 'best photo' to consider photographs as groups or collections. Free from the conventional photo-to-print relationship, the learner starts thinking in terms of the book's visual structure (Smith, 2005). The unit of meaning – the graphic layout as double page spread or as subchapter – conceptualises the narrative or meta-narrative aspects implied in grouping, serializing and sequencing the photos. Experimenting with the conventions of the book page becomes a key pedagogic strategy. The process allows deliberate disruption of conventional book flow – the distribution of text and image to create movement from page to page – to raise awareness of the relationship between page and image.

The book-making process starts with the creation of book dummies, 3-D mock-ups of the book that provide an excellent tool to play with the images and develop understanding of visual structures. Teaching the fundamentals of photobook publishing also implicitly equips students with in-depth knowledge of prepress, the steps necessary to prepare the work for a commercial printer. In the adoption of the desktop environment for publication design, creating a book means assuming responsibility for a series of processes: layout, typography and text formatting, preparation of images in Photoshop (color space and resolution), preflight and the creation of a robust .pdf file that the commercial printer will translate into a professional-looking photobook. Understanding and anticipating the printer's output environment is thus an important part of the learning program.

Why Teach Book Arts in a Produsage Environment?

While opportunities for self-publishing of photography online abound, few students take full advantage of the possibilities offered by the online photobook companies, like Lulu or Blurb. While students already use Flickr, deviantART and other photo-sharing sites for their photos, research shows that many photographers are exploring the professional photobook companies' sites for publishing their book works (Forrester, 2007). For our students, engaging in the professional environment represents the next step in their development; having completed a photographic brief, their focus changes to considering the editing of their work with a view to publication. Whilst other university assignments are produced for the teacher and the classroom, studying this unit unlocks the many possibilities of the classroom of the web.

With the availability of these technologies and the widespread opportunities for online publication, creating a photobook implies thinking beyond the screen and positioning the photographic work in the wider publishing context. Taking into account the current interest in e-books and readers, it is still a challenge in this unit to combine the best of digital technologies and paper-based media. Facilitating a semester unit on book-making for digital photographers means considering the book in the age of the digital press; the enterprise of the online print-on-demand photobook companies offering the latest developments in "digital/paper hybrid product" (Sarvas, Mäntylä & Turpeinen, 2007); and the paper-digital technologies that allow for both printed and online book publishing outputs.

An additional opportunity in such produsage environments is the uploading and sharing of images, mainly an individual activity, or the creation of personal sets of photos. The art of produsage, however, also offers other possibilities, such as the sourcing of images from pools, or creating groups on particular themes; this activity exemplifies a shift from the photographer-author to the photographer-editor, involved in the curation of collections. Such collective (or networked) projects are exemplified by photographers editing found photography (Brittain, 2006) or the management of photos uploaded by participants into paper-based publications, as in JPG magazine (Bruns, 2008). Thus, the opportunity of teaching students to work as editors of someone else's material is indispensable to publishing practice and in this instance the involvement in social networks is an essential way of sourcing images.

The unit aims were to:

- identify and analyze the context of self-publishing practices, as evidenced by participation in rubric-led assessment and feedback, and the participation on e-tivities at Lulu.com;
- demonstrate a critical understanding of the genre of photo publishing, as evidenced by the output of two photo publications (a photobook and a photo magazine);
- develop skills in visual communication, as evidenced by their work with the structure of the visual book including creating a book dummy, using InDesign to layout photo and text; and
- use the print-on-demand publishing model, as evidenced by the use of Lulu publishing and networking platform.

Research Methodology

This study is shaped by an action research methodology. A qualitative research paradigm, the aim of an action research cycle in an educational setting is to identify an area of practice that might benefit from improvement, to design an intervention and implement it and then to observe the effect on the learning experience (Arhar, Holly, Kasten, 2001). This case study describes a single iteration of this "reflect, act and observe" cycle with relation to the two cohorts of students that participated in the research; it builds, however, on an earlier intervention described below and anticipates a further cycle in the final reflection.

The Choice of a Produsage Environment

The project built on an earlier photo publishing unit, from the first semester of the 2006/07 academic year. In this earlier (level 3) unit, the digital photography students used WordPress blogging platform, to publish their coursework and Lulu.com to publish the finished photobook. As they were entering the final year of their studies, it was important to address the acquisition and consolidation of a series of digital literacies and capacities that allowed them to engage critically with these online environments, whilst simultaneously creating quality professional work in them. This included the publication of their critical writing as well as their photographic portfolios and, in particular, introduced the use of the digital press for the publication of paper-based photo books.

We noticed, however, that not all students participated at the same level of engagement. Whilst some engaged with the produsage environments, finding and analyzing pertinent information and contributing to the conversation via posts and comments, others needed extra support to actively engage with the produsage tools. We also found evidence of what Bruns describes as a new form of digital divide, "between those already tuned in to the produsage process and those not yet motivated to participate, as well as between those who already have the skills and capacities to contribute ...and those for whom participation in such environments remains an apparently insurmountable challenge." (2008, p.338)

The development of a blended learning pedagogical approach with the selection of Lulu.com as the main produsage environment – both as a digital notebook and publishing platform – and the inclusion of e-tivities and rubrics to encourage peer feedback aims at improving on the earlier pedagogical framework.

According to a recent study (Forrester, 2007), there are more than 55 online photobook companies all offering similar print-on-demand services. In each, the user downloads the company's software (or the software is browser-based), inserts the photos and text in pre-designed templates, chooses a binding and cover format, and places an order which is printed and delivered, typically, in 10 days.

Lulu, however, has special produsage features that make it a preferred choice for teaching: it

Figure 2. An example of a student's book page from Lulu.com

may be viewed as a two-sided produce-sell (or dashboard-storefront) platform. The dashboard is a private node (accessible only when the user is logged in), which accesses 'my projects' (a catalog of all the user's books), as well as the user's storefront, blog, groups, message box and friends. Additional account management features such as account preferences and access to the files associated with the user's publishing activity are also available from the dashboard.

On finding a (prod)user's name in Lulu (often through a search box), one is directed to their storefront – a public-facing interface which can be fully customized by the seller, and which provides a variety of information about their associated activities: a profile, list of lulu friends, group memberships, lulu interests, published books, blogs and other feeds (del.icio.us bookmarks, for example).

An important storefront feature is the book page, which offers information about the book: a preview, publisher and licensing information, a description of the book content, and the book specifications (number of pages, use of color or black-and-white, format and binding). The page also states the prices for printing and downloading (which may be different), the book's tags, categories, reviews, and sales information such as the lulu sales ranking and other books bought by the customers who bought the book. A link to the shopping basket allows the viewer to place an order, pay and enter a (virtual or actual) shipping address. If the book download is free, clicking on the 'download now' button initiates its download. Opening the tags or categories reveals a catalog of other publications with similar tags and categories, and the licensing link accesses the licensing deed: either copyright or a chosen variation of creative commons.

The Lulu community supports forums, groups, a newsletter and the Lulu blog. The forums, in a variety of subjects related to self-publishing such as cover art, or storefront, are maintained by Lulu experts and archived in a variety of self-publishing related threads, easily accessible via search menus. International forums provide support in a wide number of languages, and users can also start their own group for more focused interests such as book promotion or teen literature.

Of all the online photobook companies, Lulu is the one that offers the platform with the most interesting blend of features with which to teach digital photobook publishing. In the first place, the dashboard is the most project-oriented of all the photobook companies; it allows students to design their books using InDesign, the desktop publishing software used in class, and to upload the resulting PDF file, while other companies require the use of their own software. Further, unlike other companies that keep the design document in-house for printing-on-demand purposes only, Lulu allows the design document to be accessed and shared digitally.

The online store also offers two methods of making the content available: the print version delivers a paperback that can be purchased using the online ordering process (shopping basket; online payment and delivery to the shipping address); and the download version, either as a paid or free PDF download. Whilst other companies may offer an online store, they do not offer access to the digital files. The dual options of the Lulu online store integrate well with the principle of common gains/individual rewards of the produsage environments.

Blogs, another of Lulu's tools, create opportunities to publish works-in-progress and to receive feedback from peers; the comments feature encourages analytical reflection and an extension of the online conversation beyond the classroom. The groups and friends' lists (social networking features) promote working as a group and extending classroom support into the online space.

Lastly, the forums in which users and experts exchange information on topics related to many aspects of digital online publishing offer a pool of extra teachers, available 24/7, that are supplemented by live help from Lulu, a feature that makes possible to obtain support from a company representative via a chat board.

The Design of Learning Tasks

The embedding of the teaching in this produsage environment was achieved by using a blended pedagogical framework, which consisted of twelve weekly face-to-face meetings in the media lab interspersed with eleven weekly e-tivities.

A particular intention in the design was a balance between individual expression and group work. The first project, an individual photobook, called for the selection of photos from students' own archives, the development of a visual structure for the book, the preparation of a book dummy, and the final production of the photobook. This project carried 25% of the marks for the unit. The second assignment was a collaborative one: working as editorial team, each group created a collective photo magazine using photos selected from a social network situation. They were required to prepare and submit a magazine dummy showing the visual structure, and to publish the photo magazine in Lulu.com. This, too, accounted for 25% of the marks for the unit.

The balance of the assessment was by way of weekly structured e-tivities (Salmon, 2004), posted to Lulu.com. The e-tivities supported the process in which students were required to analyze the production process and to reflect on online research and peer feedback. Each week's e-tivity was designed to further embed the online publishing environment in the students' experience, and dovetailed with the face-to-face activity for the week. In week one, for instance, the e-tivity was designed to help students become familiar with Lulu's tools. Subsequent e-tivities explored the definition of photobook, the structure of a visual book, how to create book and photo magazine proposals and dummies, participation in group forums, customizing the storefront for a book, bookmarking using del.icio.us, and book reviews. The last e-tivity required the students to reflect on their Lulu experience.

In addition to those available in Lulu.com, students used a variety of other digital tools for this project, including proprietary software and a free online platform. Adobe CS3 software was used for photo publishing. This package has been developed for desktop publishing and includes InDesign (for publication design), Photoshop (for color space management and photo optimization) and Bridge (for photo management). All the pre-press was handled in InDesign.

To operate in the Lulu.com environment, students created personal profiles and learned to use the various features related to managing publishing projects; they customized their blogs and storefronts, and developed a social network with their peers and the lulu community. In order to participate in the weekly e-tivities, they learnt how to blog (using the Lulu.com blogging tool), how to create links and post images, and how to reply to each other's messages. To collaborate during the design phase, they subscribed to the group's forum and participated by posting their questions and replies. To share their research on photo publishing with each other, they learned how to create a del.icio.us account and to use the features of social bookmarking.

Creating a Framework for Feeding Back and Assessing the Process and the Product

A fundamental philosophy underlying the development of this unit was Biggs' constructive alignment (2002). In this approach, it is the articulation between the stated learning outcomes, the teaching (and learning) activity and assessment that results in a meaningful learning experience. The approach to assessment that was used in this unit is commonly referred to as "criterion-referenced". Biggs (1999) states that there is "no *educational* justification for grading on a curve" (emphasis in original), a reference to the relatively common practice of measuring students' performance against that of the rest of the group. We believe that assessing against criteria measures more objectively the extent to which students have achieved learning outcomes, and that, for this reason, it is a more student-centred approach.

It is apparent from the statement of the learning outcomes and the description of the learning activities that there is a causal connection between the two. This is no quirk of fate; the relationship was built into the design of the unit by adopting a constructive alignment approach. Similarly, attention was paid to the crafting of the assessment criteria. They were developed by the students in a joint activity with the teacher; in the process, the students not only gained insight into the purpose of assessment but were also empowered by the process of identifying the most important criteria against which to evaluate their work.

Using the learning outcomes as a point of reference, the learners were required to develop assessment criteria that would be used in rubric form to mark their projects. They were provided with a list of questions to guide their discussion, and were asked to engage with the following tasks: firstly, they had to develop six assessment criteria that articulated with the learning outcomes; then they were asked to rank these criteria, from most to least important; and finally, each group presented their two top criteria to the whole class.

During this report back process, all the groups' top criteria were written up on the board, and the whole class agreed on the four criteria that articulated most closely with the learning outcomes for the unit; these criteria then formed the basis of the assessment. This engagement in formulating the criteria against which their work would be measured empowers students with a sense of ownership, and a real interest in their own learning process (Stix, 1997). Andrade and Du (2005) point out the added value of using rubrics "to clarify the standards for quality performance, and to guide ongoing feedback about progress toward those standards." The incorporation of rubrics into learning design helps the students to visualize what it means to successfully address the learning outcome and to adjudge the quality of their own and others' work; in this sense, rubrics can also be said to be an instructional tool.

Once the assessment criteria were agreed upon, the class created an "irubric"which was developed using RubricStudio software from FacultyCentral.com. We define an irubric as a carefully crafted matrix that lists the assessment criteria and qualitatively describes different levels of excellence in achieving each criterion. This matrix constitutes the marking grid used by the teacher and students. The assessment criteria were listed down the left side of the rubric and the excellence descriptors for each criterion were entered in columns headed 0-5 (the potential marks for each criterion). The irubrics were used in two distinct ways: firstly, they provided a frame of reference within which to generate peer and tutor feedback. They were also used by the students and the tutor, as well as the second marker, as the statements against which the students were graded.

Different Approaches to Feedback

Rubrics are often used for assessment, but our review of literature on rubric-referenced assessment revealed that they can be a good tool for both assessment and feedback. Mertler (2001) points out that the analytic nature of the rubrics offers added advantage: the degree of feedback offered to students – and to teachers – is significant, and students receive specific feedback on their performance with respect to each of the individual scoring criteria – something that is unlikely to occur when using other forms of feedback.

In addition to this use of what we term "rubric-referenced feedback", students were required to provide feedback on the development of their peers' projects in the e-tivities. In that this second kind of feedback takes place in the distributed learning environment of the students, we have chosen to call it "distributed feedback".

It is clear that working online guarantees neither student participation nor feedback. E-tivities (Salmon, 2004) are, however, a useful approach to increase online peer-feedback and their potential was explored throughout the 12 week teaching semester. In addition to the articulation between learning tasks and the e-tivities, outlined above, the e-tivities were used to enhance the feedback activity in various ways. Firstly, students were required to give feedback each week on each others' posts (the e-tivity defined the task to be completed and the requirement to respond to peers' work). Then Salmon's weaving technique was used to integrate the themes of the students' posts and to create a weekly summary that was posted to the blog. In two e-tivities, learners were asked to contribute to group discussions on photo publishing, and in another, they were asked to swap reviews of each others' books and post them to each others' storefronts. The last e-tivity required that learners reflect on the Lulu.com experience: their work, their peer's feedback about the course and the technology used. Figure 3, below, sets out the last e-tivity:

THE FINDINGS: STUDENTS' PERCEPTIONS OF THEIR ENGAGEMENT IN THE READ/WRITE WEB ENVIRONMENT

We have described, this far, the rationale for (and the design and implementation of) the interventions that engaged the digital photography students in the produsage environment of the read/write web. In this section, we will report the students' own perceptions of the experience.

While students were free to write about any of the issues suggested in e-tivity 11, four emerged as particularly important to them: digital pedagogy; communities of practice; the value of publishing as a group; and the comparison of the Lulu.com environment with other social networking sites.

Figure 3. E-tivity 11: My Lulu experience (after Salmon's e-tivity model, 2004)

E-tivity 11: My Lulu experience

Purpose: Now that you are an expert in photo publishing, Lulu and print-on-demand, it's time to review all that happened, and share what you've learnt. This can help you put your experience in perspective and also help other people who are still on the look out for a way to publish their photobook. The best thing you can do to help others is to share your experience with them!

Task: Write about your experience in photo publishing with Lulu. Your reflection should include at least one of the following issues:

- Digital pedagogy: what are the differences between learning digital media in online and in offline environments?
- Communities of practice: what does it means to learn in a community that extends the classroom into the publishing market?.
- Vernacular versus academic culture: what are the implications of circulating the work in the field of popular culture side by side with non academic, 'amateur", production?
- A challenge to the hierarchical nature of the institution; what is the personal and social impact of starting publishing while you are still a student?
- The meaning of self-publishing: what does it mean to publish independently of a selection by committee (editors/ curators)?
- The value of publishing as a group, relying on the support of your peers' network.
- The advantages/constraints imposed by the POD templates on the format of the photobook.
- The lulu environment compared to other (publishing) social network sites.

Digital Pedagogy

The Lulu.com environment forced a steep learning curve for both teacher and students. While really good for publishing, Lulu is not particularly appropriate for communication and group work; searches for information are painful, the menus badly organized, and the navigation system awful! Nonetheless, students identified positive benefits from the experience. The novelty of the method was deemed appropriate by students: *"Learning mostly online through practical demonstrations and experimentation on various related websites with self-publishing and online collaborative rubrics to assess our projects provided a new experience, for me at least",* and *"Personally I believe anything that challenges the norm and gets you thinking in different ways is a good thing. This module is not presented to us in a traditional, stuffy, listen and take notes old school university style. We are studying a new art form and our lecture methods should reflect the move away from tradition."*

Another student remarked on the benefit of the hands-on approach: *"It is easier in my opinion to learn digital media practices on the Internet as opposed to the classroom or lecture hall – personally I am a more practical individual and feel the need to actively do something to learn effectively"*, which underscores the need to recognize different students' different learning styles. There was also a link made between the day-to-day online activities of students and the shift towards the Internet as a teaching medium: *"I welcome online learning as an idea very warmly. As most of my generation is connected to the Internet one way or another anyway, it's only a matter of when digital pedagogy becomes a standard."*

A caveat against seeing online learning as a silver bullet came from two students who showed their appreciation of more traditional approaches. *"Learning about digital media in an online environment as opposed to a more traditional format (i.e. a classroom) has been slightly chaotic at times. It's an unfortunate fact that sometimes you simply need a person on hand to help with problems, and online learning cannot always provide this."* and

"The printed handouts on prepress fundamentals for InDesign were very useful too, as most of the class had not used this software previously."

Communities of Practice

Students explored the concept of community of practice in a very practical way in these units. This student seems to doubt the personal value, but clearly recognizes the benefits to classmates: *"Learning by way of a community has been great for this unit, though I have not myself benefited from being part of a community it has clearly been a help to some members of the class who find websites and concepts such as those we have been studying more difficult than the theoretical issues in photography."* Another student came face to face with the diversity to be found in such a group: *"Become* [sic] *an online community was an interesting look at the class and how each person expressed themselves. There was such an array of difference in style of each person's e-tivities and how they coped with doing them."*

A particularly interesting comment was from a student who clearly found the online community too large for their liking but who had come to recognize that there were certain benefits. *"Like many others in our class, I found publishing our work online and making it available for anyone in the world to buy a very exciting aspect of the unit, and probably one which we would be keen to explore in the future. Publishing on Lulu however does put our work in with thousands of similar pieces, some interesting pieces and some rather less well put together. It would be good to find a more specialist online publishing site for our photobooks & photomags, however this would mean losing the huge numbers of visitors to Lulu. It's a trade-off I guess."*

The Value of Publishing as a Group

The principle value related to working as a group that was identified by the students was that help was immediately available: *"The support of the group was very helpful, especially the ability to post questions to the online forums and answer other's queries very quickly."*

Another student valued the collaboration in the community, too: *"There was a lot of help being given through blogs, forums and in person between all classmates during this period. Considering so many seemed unfamiliar with Indesign only a few weeks ago we all managed to create and upload an interesting mix of books into the Lulu store."*

It is interesting that none of the students identified any of Johnson and Johnson's five pillars of group work (n.d.): positive interdependence; group interaction; individual and group accountability; interpersonal skills; and group processing as valuable in the course of this unit. Their focus appears to be at a micro- rather than a macro-level.

A Comparison of Lulu with Other (Publishing) Social Networking Sites

There were varying opinions about the usability of Lulu.com relative to other social networking sites. One student commented that, *"Other social networking sites feature the same kind of real time features that Lulu does but many offer better usability and are far more effective."* Another clearly felt that the social side of the site was a positive: *"Lulu.com has much more of a social side to it than most other self-publishing websites"* but agreed with the critique on its usability: *"Whilst the design of the site is at the very least questionable, it does for the most part work well if you have the time and patience to figure it out!"*

This student pointed out that the cost effectiveness of Lulu was possibly outweighed by its design. *"To be able to publish your work cheaply and easily is a great asset afforded to us as a group, but Lulu seems to be experiencing problems with the way it functions. It is tricky to use and everything seems to take a long time to do. Unlike other sites that involve social-networking, Lulu suffers from a lack of user friendly features."*

In addition, she offered some useful comments on the overall impact of using a better managed site: *"Overall, I see Lulu's merits and potential and also value certain aspects of the site but I think that with a better technical support and development the site should be more accessible and thus would have more of an impact and not come across as amateurish as it does now. Would the site be more interactive like Facebook with constant technical updates which facilitate the use it would be more popular and more people would use it, thus creating a bigger market for self-publishing."*

Possibly the view of the majority is summed up in this student's comment: *"Unfortunately, Lulu.com is not exactly a user-friendly environment and it isn't welcoming enough for constant digital activities like blogging, commenting and change of information. There are other, far more sophisticated environments for that (e.g. Facebook), which make users want to spend as much time as possible online."*

It is apparent from some of these remarks that the students lost sight of the requirement to compare Lulu.com with other publishing social networks. Nonetheless, their comments clearly indicate that they were at times frustrated by the Lulu experience.

Other Themes that Emerged from the Students' Writings

Some additional themes surface in the reading of the students' reflections. Firstly there is a concern about the ownership of their work: *"Another issue that was voiced by a large amount of our group was the fact that, while publishing as students, we do not control the simple intellectual copyright to our work. This is instead handed to the University who could, in theory (I hope not practice), profit from our work and charge us royalties for what is essentially our own personal art."* They also expressed a lack of experience and a lack of confidence with the medium: *"Having set tasks within Lulu really made me play around and explore the system, something I have previously not done before. I do tend still to be scared of computers and really have no idea what they are capable of doing for me. Throughout this term I have had to face this fear and play around, do a lot of problem solving on my own and learn that these systems actually have everything explained for you if you use their 'help' and 'search' options."* Another student said: *"This has been a great struggle for me as I rarely use the Internet for social networking, I barely knew what a blog was. This unit was not something I enjoyed but I feel it helped me to get an understanding of how modern photographic practice operates on the Internet. I have learned how to produce my own book, which will be useful in the future I'm sure"*, which is a confident note upon which to wind up this discussion!

OVERVIEW OF OTHER FINDINGS FROM THE STUDY

From this study about the use of social networks for self-publishing, and engaging the students in the design of assessment criteria and the provision of feedback, we can confidently say that in a self-regulated learning environment, students can become a valuable source of feedback for their peers. It is also apparent that, with the right technology, feedback can be a tool for students to monitor their learning and guide them to achieve their learning outcomes.

In the Lulu.com domain, students viewed feedback through their familiarity with other social networking sites (SNSs). Throughout the semester, there was incidental collection of data which, when viewed holistically, points to cohorts of students who were generally comfortable in the online environment; who wanted a critique of their work in the form of feedback from the tutor, peers and the wider digital publishing community; and who would like to retain the benefits of face-to-face interaction in the classroom.

From a survey on their experience of SNSs, it was plain that the majority of the students (more than 90%) were competent in their use; almost 60% actively participated in more than one such site. While some of the students use SNSs to post pictures and stay in touch with friends – with some showing a preference for one SNS over another – their primary interest was to get feedback on their creative practice. One student explained, *"I use Flickr as a means of receiving feedback on my photographs and as an online portfolio - I prefer its emphasis on the work I produce and not on social aspects prevalent in many other sites with similar intentions"*, while another said, *"I use deviantART - a large artistic network which supports other artists and generally gives lots of feedback."* A third said, *"I use deviantart.com - to showcase my photography and receive detailed critiques based upon them. Also used to socialise with people who have similar interests. Research tool."*

This desire for feedback carried over into the Lulu environment. While Facebook, MySpace, Flickr and deviantART are used to post images and communicate with friends, they are also perceived as a way to get feedback about their creative practice from a like-minded community of artists. In the same way, students expected similar opportunities for feedback in a pedagogical project that is situated on a SNS; some saw this as a major advantage of delivering the course on Lulu as opposed to the classroom: *"The support of the group was very helpful, especially the ability to post questions to the online forums and answer other's queries very quickly."*

But others expected more! *"I do not see any advantages from publishing my book in a group (apart from getting one review) as only a few people downloaded it (which I cannot change and it's okay) and even less left comments in my development blog, which was incredibly disappointing as I put a lot of work into it and hoped to get some good feedback and constructive criticism. However, this is not lulu's fault but more the group motivation so I think next time there is a unit with such a heavy reliance on online media there should be more emphasis on the importance of this online activity and networking."*

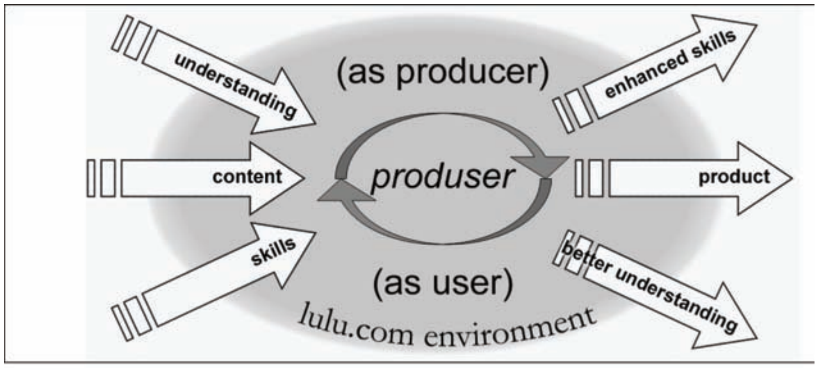
DISCUSSION

This study explored the features of read/write web to teach digital photobook publishing in a higher education context. The choice of Lulu.com as a software environment was partly a response to the hybrid digital-paper nature of the print-on-demand photobook project. The variety of tools available on the Lulu.com platform allowed us to view in context the core capacities of the digital art worker, the 5Cs of creative, collaborative, critical, combinatory and communicative work that characterize the art of produsage (Bruns, 2008). Figure 4 depicts the Bruns' produsage model in the context of this study.

Using the software to explore the meaning of **co-creativity**, and developing new work in dialogue with other creators was successful; meaningful learning was achieved in the group process, from establishing the cohort's online community to engaging in authentic group work by publishing the collective magazines. As has been noted, however, the technologies that support this interdependency are still in their infancy and in need of further development. Lulu.com is no exception. Studies have shown that people use social networking sites and media-sharing platforms to find people they already know with whom to work. If the interfaces make it difficult to find such friends and classmates, this can be a major barrier (Boyd & Ellison, 2007). The social browsing, for example, that is such a great feature of Flickr and Facebook, is still very limited in Lulu; enhancing this tool to the level of other SNSs would be a great asset. There is, in general, a need for better interfaces to facilitate produsage (Lerman & Jones, 2006).

As social networks grow, it will be impossible for users to keep track of their contacts through

Figure 4. The produser in the Lulu.com environment. Adapted from The produser (Figure 1 above.)



the kinds of simple interfaces now offered. Better interfaces, for instance ones that create personal Explore pages by finding 'interesting' images from among those produced by the user's contacts, are a feasible solution to information overload. (p8)

The **collaborative** aspects associated with sharing one's work on the Internet require an understanding of appropriate legal frameworks, and this is greatly encouraged by Lulu's support of varied licensing deeds. The software's embedded licensing menus – with scope for creative commons licensing – provide a good opportunity to discuss the licensing of creative work, whether this is available as a free download, or as a profitable POD. The legal framework for this project – the Creative Commons Attribution Non Commercial Share Alike 2.0 negotiated with the University's copyright lawyer – offers a context within which to discuss issues of intellectual property in the academic environment. For the students, the principle of sharing their photographic work as a free downloadable PDF can be a watershed; this may be the first occasion in their time at university that their work is placed online, and made available for others to use.

The **critical** tools embedded in the software – the use of blogs for commentary and feedback, and the potential for peer review in the book pages – generated possibilities for giving and receiving constructive feedback as part of the ongoing collaborative process. The traditional domain of the "crit" session in art and design studio practice was partially moved into an online environment: this is a way of addressing the changing patterns of student learning and the students' push for independent learning (Percy, 2004).

In the read/write environment, students can explore each other's work in their own domain and engage at their own pace; the opportunity appears greatly appreciated as time pressures arise as a result of the new work/study balance (Robbie & Zeeng, 2008). There are also issues raised that relate to an understanding of the students' needs and expectations in relation to online critical engagement. When used in the context of book reviews, the peer review in Lulu.com can be as effective as that on fanficton sites where beta-readers working in the same genre can help emerging authors develop genre-specific skills (Black, 2005). On the other hand, using the software to facilitate feedback can be disappointing, for instance when students invest a lot of effort in customizing their blogs and there is a lack of comments or, specifically, substantive ones (Stern, 2008).

The process of breaking down the complex assignments of photo publishing into a granular sequence of simpler tasks (from photo editing to online publishing) engaged the students in a series of mix and remix **combinatory** processes, and encouraged them to harness individual chunks of information. This is associated with engagement with multiple literacies; additional online tasks such as customizing profiles and storefronts, creating links, and uploading images side by side with text all encourage the development of all-round skills, and create a measure of granularity that is reinforced by drawing on the software's ability to aggregate feeds. This multimodality hallmarks young people's creative online practices (Thomas, 2007) and is connected with the aesthetic of remixing. It is a sign of new networked material, intelligences and tools (Perkel, 2008) that characterizes the photobook and photo magazine assignments through the remixing of one's own work and the work of others for the photo magazine.

The **communicative** aspects of the software, used by the students to publish their book analysis, pitch for their proposals, post questions and get technical help, were central to eliciting mutual constructive criticism between the participants; overall, the publishing of the work process as a digital sketchbook serves as "tangible evidence of participation" (Soules, 2001). This archive of works in progress and the development of ideas is still available online at http://stores.lulu.com/photocultures, and can be accessed by others.

Lastly, the platform provided an opportunity for the students to publish a photobook and a photo magazine in 12 weeks, a work flow that is only possible using an online photobook company. They did this with no financial burden and with total editorial control, a real achievement considering the limited opportunities available and the restrictive editorial policies of most established publishing houses. Whilst the field of artists' publications has always been strategically associated with independent publishing initiatives, self-publishing is still considered a stigma for some (Forrester, 2007). With the increasing availability of print-on-demand it may be the best opportunity for emerging and established photographers alike to embrace it.

FUTURE IMPROVEMENTS AND RECOMMENDATIONS FOR PRACTICE

Feedback received from students and colleagues has been used to develop the latest version of the course, which is currently running with 34 level 2 digital photography students. For example, we removed the magazine brief and concentrated instead in the photobook, so that students can focus on developing critical thinking in the process of creating a single photo publication.

This is complemented by a move to reduce the number of e-tivities. Developed by Professor Gilly Salmon of Beyond Distance Research Alliance at the University of Leicester, *Carpe Diem* is quick prototyping methology to repurpose existing material for online delivery. Feedback from a *Carpe Diem* workshop that focused on this unit helped us to identify and retain the most successful e-tivities and discard the rest. The four e-tivities that remain address two particular areas: two encourage students to write about their own photobook and publishing practice, and the other two involve writing about their peers' photobooks and publishing practices. This allows for both self-reflection and collaboration, and students are supported by particular readings that coincide with the start of the e-tivities and help them to develop reflexive and critical skills in the analysis of photobooks, a zone of critical activity.

Finally, in response to the critique of the social aspects of Lulu as a networking environment, we decided to diversify. In addition to Lulu.com as the publishing site, in the latest action research cycle we use Facebook as the main social networking site for group communication and Blackboard, the University's virtual learning environment, as the repository/archive for all course documents.

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This work was previously published in Educational Social Software for Context-Aware Learning: Collaborative Methods and Human Interaction, edited by N. Lambropoulos and M. Romero, pp. 222-240, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 4.10
Technosocial Space:
Connecting People and Places

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ABSTRACT

The chapter is based on a study of Internet cafés in Norway, and interrogates the way space and place is produced in interconnections between people and technology in the Internet café. Drawing on actor-network theory and practice-oriented theories of place and space, the Internet café is understood as technosocial spaces producing connections between people and places at different levels. Firstly, the Internet café can be understood as a hybrid, a site where users and technologies as well as space are coconstructed in entwined processes where gender, as well as other identity markers, are central in the way the technology, as well as the cafés, develop and are understood. The next level looks at the production of Internet cafés as technosocial spaces. Despite being perceived as an "urban" and "global" phenomenon, Internet cafés are configured based on local circumstances, in urban as well as rural communities. Differing images of what the cafés want to achieve, as well as material constrains, are at play in this process. Finally, the chapter shows how Internet cafés are places of connections, producing space beyond the walls of the café, linking the local into a translocal sphere.

DOI: 10.4018/978-1-60566-020-2.ch005

INTRODUCTION

In recent years, we have seen several studies exploring the intersection of space and new information technology. Much of the early generation writings about the Internet suggested a placeless character in which electronic media implied a loss of sense of place (e.g., Meyrowitz, 1985), where the online experience gave a feeling of being "nowhere" or "everywhere," independent of the place you are located physically (Negroponte, 1995), and where you could live a "life on the screen" separated from "real life" (Turkle, 1995). Manuel Castells (1996) argued for an emergence of a network society structured around a bipolar opposition between the "Net" and the "Self," and in which "spaces of flows" will replace "spaces of place." These studies may serve as examples of what Daniel Miller and Don Slater (2000) call the "early generation" studies of the Internet, which talked of cyberspace and virtuality and how the Internet was built up by spatial metaphors. However, there was as Stephen Graham noted in 1998 (p167): "little conscious thought put [in]to thinking conceptually about how new information technologies actually relate to the spaces and places bound up with human territorial life."

Although recognizing that virtual communities may exist based on shared interests and feeling of community independent of geographical location, this chapter will argue against the placeless character of electronic communication. To understand the uptake and use of new technologies, it is important to study the variety of places and social circumstances in which it is used. Most studies on the use of ICTs in particular places have focused on computers in the home or office or among young people in schools. Few studies have gone out of the home and work spheres and looked at how computers and the Internet are integrated in public leisure places. This chapter takes us to the Internet café, a contemporary meeting place resembling any other café, where at the same time new forms of socialities develop in the intersection of the technology present and the clientele. The study is based on ethnographic studies of four Internet cafés in Norway conducted from 1999 to 2002.

In line with other recent research on the Internet (e.g., Miller & Slater, 2000: Valentine & Holloway, 2002; Woolgar, 2002), I will show how the Internet, as well as Internet cafés, are integrated in practices taking place in the spaces of everyday life and thus must be understood according to local context. This is, however, not just a study about technology "in space." Following Henri Lefebvre (1991), I shift the focus from *things in space* to the *production of space,* where the Internet café is seen as a mediator in different ways within the local community, as well as reaching out of the local community through the Internet. To understand this process, a concept is required that sensitises us to the need to integrate space, social relations, and the materiality of technology, when studying phenomena like the Internet café. The point is to emphasise that technical or material, social, and spatial aspects need to be analysed, not as causal relationships, but as intersecting and transgressing moments. This will be developed in the following, drawing on theories from cultural and social geography and science and technology studies (STS), in particular, actor-network theory (Latour, 1987; 1999; Law & Hassard, 1999).

STS is founded on the idea that the social and the technical/material must be seen as part of the same entity rather than as opposites in a causal relationship to each other. Social and cultural geography, on the other hand, challenges common conceptualisations of space as frame in which social practice occurs, but sees the social and spatial as integrated in practice. I take my point of departure from an understanding that merges all these elements together; technology, the social and the spatial are entwined or interwoven in a "seamless web." From an STS point of view, this implies a greater awareness of the spatial aspect in the study of socio-technical relations, an awareness of how place and space matters in the design and use of technology, but also how design and use of technology do not just occur in space. In fact, technological artefacts and agents are forces or mobile actants that produce space. From the view of social and cultural geography, on the other hand, this approach implies a greater awareness of the role of technology in the production of space, not as a more or less determining structure, but as actants that, through relations to other human as well as nonhuman entities, are actively involved in the production of space.

PRODUCING SPACE IN THE INTERSECTION OF THE SOCIAL AND MATERIAL

From the 1990s, there has been an increased focus on space in social theory. This is partly related to the increased focus on globalisation, but also prevalent in studies focusing on situatedness and the body. However, as Kirsten Simonsen (1996) noted in the mid-1990s, there is maybe less consciousness as to how space is conceptualised; what do we mean by the concept? This question is still highly relevant, in particular, when discussing space and spatiality in interdisciplinary contexts.

Among works that do problematise space and place, Simonsen (1996) identifies three main conceptualisations that, put together, form a triangle implying they are all somewhat interrelated despite their difference. The probably most common understanding is to see space as *material environment*, the natural or culturally produced surroundings we all live in. This conceptualisation is common within architecture and traditional regional and landscape geography, but is also prevalent in some sociological studies, particularly those of urban space. It claims, to a greater or lesser degree, that physical surroundings have causal or conditional power on social phenomena. Space as *difference* is the second category that Simonsen identifies in postmodernist and poststructuralist thinking as well as in economic regional geography based on critical realism. This conceptualisation focuses on how places and localities are different in material as well as immaterial sense and thus, provide different conditions for social practice and processes. The problem, however, is that little is said about how these differences are produced. Space thus still becomes a background or a container in which social action takes place.

Simonsen's point is that although both these categories of space address important issues, within social theory, it is only by taking the starting point in social, or more specifically human, practice that the relation to material environment, as well as spatial differences, can be understood and explained (*ibid*.). She continues to say that in social theory, materiality has to be studied, as mediated through and subordinated to social practice. This can be done in three modes; as study of the production, the use of, or the ascription of meaning to the material environment. The differences that space makes are also created through social practice. This brings us to the third, and for Simonsen, the preferred conceptualisation of space; *space as social spatiality.* This is in line with much writing within human, particularly cultural and social geography in the last couple of decades, where practice or doing is seen as constitutive for, as well as constituting space (see for example Massey, Allen, & Sarre, 1999; Thrift, 1996). I take the point of departure in practice when I develop the concept technosocial space. However, in line with the thoughts of, amongst others, Nigel Thrift (1996), Nick Bingham (1996), and Sarah Whatmore (2002), I do not follow Simonsen's ideas in the way she treats the material. To me the concept of practice does not only include interaction between human beings. Material objects are also included, not as frame or structure, and not as entities with causal power in themselves, but as *actants* that, through relations with other nonhuman as well as human entities, may have agency in the production of space.

Technosocial Space: The Material and the Social

In recent years, a few studies have merged insights from science and technology studies (STS), particularly actor-network theory, into social and cultural geography (e.g., Bingham, 1996; Graham, 1998; Kirch, 1995; Laurier & Philo, 2003; Murdoch, 1997; Thrift, 1996; Whatmore 2002). Common to these authors is an attempt to integrate material objects and other nonhuman entities into social theory, not as a determining structure, but as actants that, through the way they relate to humans as well nonhuman entites, are active in the production of space. This builds on a relational understanding of agency as an effect distributed through a heterogenous arrangement of materials rather than as the intentional activity of human beings (Law & Hethrington, 2000). The main inspirations for this thinking are actor-network theory (Callon, 1987; Latour, 1987; 1999; Law & Hassard, 1999) and the cyborg metaphor as developed by Haraway (1991; 1997).

Actor-network theory takes a rather pragmatic approach in its concern to describe how things occur; in particular how things are moving and are moved; how actants move each other. Imbued in this is a call for symmetry in the analytical treatment of nonhumans, including material technical objects, and humans; arguing that there is no a priori difference between the two when analysing socio-technical relations. The point is to identify properties borrowed from the social world to socialise nonhumans and likewise, properties from the nonhuman world in order to naturalise and expand the social realm (Latour, 1999). One of the main points is to deconstruct the dichotomies of the subject and object and the human and nonhuman, thus defining social in a very different way from the way it is traditionally perceived (*ibid*.). Nonhumans are, as Latour says, the "missing masses," knocking on the door to be counted into the fabric of social theory (Latour, 1992). They participate in building heterogeneous networks that bring together actants of all types and sizes, and neither simple technological determinism nor social constructivism are sufficient to describe these networks (Akrich, 1992).

Agency in this context is not defined as intentionality. The material-semiotic approach argues that entities like material objects take their form and acquire their meaning in relation to other entities (Law, 1999). Thus, entities have no inherently essential qualities. Following from this, agency is produced in the relation between actants, it is not a property imbued in the actants (Thrift, 1996). Agency is understood as mediations where nonhumans and humans are interlinked in such a way that we can talk of transformations; as opposed to understanding the relation between human and nonhumans as intermediaries where the action can be identified by its input and output (Latour, 1999). As Callon (1987) says, this goes against mainstream sociology (and social science in general), where practices or intentions of human beings have priority in the analyses, and humans are the only ones to be counted as actors.

The concept technosocial[1] space helps to highlight the role of technology in the production of space without falling into technological or social determinist traps. Following from this, technosocial space is produced through technosocial practices involving humans as well as technological artifacts. Technosocial practice means that technology, as well as its users, are part of the mediation or transformation that practice implies. These practices are in themselves spatial, at the same time as they produce space. Technosocial practice embraces the material "doing," the concrete movements of humans and nonhumans in space. In this "doing," we make use of symbols as well as discourses related to technology as well as other aspects of society; symbols and discourses that simultaneously are produced through technosocial practice. In the Internet café, as we shall see, the artefacts of the computers, the Internet connection, as well as the décor and design of the café space, are of importance for the technosocial practises that develop.

Internet Cafés as Technosocial Spaces

Internet café or cyber café is a label used to describe many different settings providing Internet access in public space, and have in the last decade become a ubiquitous feature of urban and, to a lesser degree, also rural space all over the world. While some Internet cafés are analogous to provisions to make other technologies accessible in public, such as telephone booths, or laundrettes, where there may be some social interaction between the users as well, others put a lot of effort into developing a good ambience where the sociality around Internet usage, as much as access in itself is the attraction. While there were several attempts to provide telecommunications in public contexts from the 1980s, the opening of Cyberia in London in 1994 launched the wave of Internet or cyber cafés as we know them now. Cafés have always found new ways of being centres for communication, as newspapers as well as financial institutions have developed closely knitted to cafés (see e.g., Sennett, 1977). Thus, computers put together with nice coffee in a trendy café ambience was a novelty in terms of public access to the new technology, but part of a history with long roots.

In the UK, although not providing financial support, the government saw commercial cyber cafés as one of many significant places for the distribution of access to the Internet (House of Lords Select Committee on Science and Technology 1996 cited in Liff, Steward, & Watts, 2002). The view of the UK government was that such cyber cafés would provide a supportive environment for new users, crossing boundaries between education and leisure through the café environment. They did, however, consider this as a transitory phenomenon and a means to achieve home access (*ibid*). Internet cafés have played a minor role in Norwegian policies on access to the Internet, and were not mentioned in the first significant policy report on Norway and the information society, published after the widespread utilisation of the Internet (Ministry of Transport and Communications, 1996). It seems that rather than developing new institutions, the idea has been to use existing infrastructure like work places, schools, and libraries in the strategies to include people to the Internet. Local governments have been involved in setting up Internet cafés in some places. Interestingly, however, this has not been linked to ICT policies, but to youth and rural development.

In 1998 and 1999, there was a heated debate on the future of the countryside in Norwegian newspapers, after statistics had shown the migration stream still going from rural to urban areas. A headline in Dagbladet suggested a simple prescription: "More Internet and cappuccino to the countryside," following up in the same article by quoting one of the youth interviewed saying "An Internet café would have been fine. [2]" This was before Internet cafés with cappuccino really had established themselves in the bigger cities, yet it was interpreted as an urban trend diffusing to the countryside. The Internet café, in this context, was not interpreted just as a place with Internet access, but with cappuccino and possibly other trendy features attached. Quite a few Internet cafés of this sort were opened in small towns and rural areas in Norway, and increasingly commercial Internet cafés have opened in the cities, some with cappuccino, some not.

Most of the socially oriented commercial Internet cafés in Norway are based around gaming, and may be seen as an extension of another phenomenon linking computers to sociality: "computer parties." These are noncommercial gatherings where youth meet in big sports halls and the like, bring their own computers, and link them together to socialize, play, and compete with programming and computer games (see Nordli, 2003). Internet cafés provide use of a local area network (LAN) as well as access to the Internet, and may thus work as a permanent mini-computer party. Some of the cafés also arrange organized events in LAN. The gaming community, in particular the enthusiastic players of a "first person shooter" game called Counter Strike, are, to a large extent, organized and identified through a network of game-oriented Internet cafés. Programming enthusiasts, however, would find the machines in an Internet café insufficient for their use. Many of these cafés put less effort into coffee and the like than the "trendy" version of the net café, and may be characterised as computer game centres or a modern version of pin-ball halls, as much as cafés. In this study, only one of the cafés is run as a commercial business, and this is the one that is most strongly linked to the game culture, being open around the clock and providing space for enthusiasts playing several days in row.

UK statistics from October 2001 showed that out of the 53% of the adult population that had accessed the Internet that month, 10% had done so from an Internet café or shop, the same figure as for libraries (Bowman, 2002 in Liff & Laegran, 2003). This shows that Internet cafés were significant as a point of accessing the technology. In Norway, monthly statistics on Internet access and use ask where access was reached, but the figure for other places than school, home, and work are too small to be presented in the statistics.[3] Based on the numerous interviews and conversations I had with the users of the Internet cafés, I can say that most, if not all, the users in this study have access to the Internet in other places as well. When they go to the Internet café it is not because it is a "last resort access" (Liff & Lægran, 2003). Rather, it is a positive choice because the Internet café has other attractions, such as faster lines, games, and a gaming community (particularly for online based gaming), and because they provide a venue to meet friends. The Internet café thus complements or enhances the experience of Internet access they could have elsewhere (*ibid*.)

CASE STUDIES: FOUR INTERNET CAFÉS

The chapter is based on a larger study of young people and technologies in and around four Internet cafés in rural and urban spaces in Norway. The empirical fieldwork consisted of interviews and group interviews among users of the cafés, including people working there, in addition to participant observation during several visits from 1999 to 2002. Before analysing the different levels at which space is produced, I give a presentation of the cafés.

The first case is a trendy café located in Fjordvik[4], a beautiful village situated by the fiord, with a particular cultural profile comprising a fine art gallery, a jazz orchestra, and other features not necessarily mainstream in rural villages. The café was started by a group of students at the secondary school with support from enthusiastic adults. The local government, as well as local enterprises, provided financial support. The design of the Internet café was in line with the artistic orientation, using the trendy interior including fine art from local artists, as well as cappuccino, in promoting the café. Together with the Internet, this contributed to the café being seen as a new and cosmopolitan invention in the countryside. The target group was defined as "youth between 0 and 100," and included pensioners who came to play bingo during daytime once a week. Quite a few adults would also drop by for a coffee, for instance, after a visit to the art gallery. Anyway, the main target group among the youth were those aged 16 to 20, mostly students at the upper secondary school. The Internet provided a new activity, but maybe more than that, it had significant symbolic meaning:

It's really cool that we have Internet at the café. Internet is in a way something that goes along with this kind of café – like those in the cities. But I go there just to meet friends – to do nothing with somebody (Boy, 18).

The Internet is important in constructing an "urban" atmosphere, but as this boy says, a lot of the clientele came to the café to have a meeting place to "do nothing" with mates. It soon became clear that there was a divide in interest among the clientele. Whereas young boys came to use the computers, most of the students (boys and girls) and adults (mainly women) came for the café atmosphere; the nice cappuccino and carrot cake. This actually created two different places within the café; the café, characterized by low-voiced talking and discussions over coffee, and the computer corner, characterized by a noisier and more frantic way of showing enthusiasm and eagerness. Occasionally, the café guests would go to the computer corner and check their e-mail, but they would often find that part of the café less inviting. After a period with some tension between the two groups, a wall was actually built between the computer corner and the café itself to prevent the noise from the computer corner disturbing the other guests. The trendy café and the somewhat nerdy image of computing did not go together as an integrated entirety. The wall, however, made the two coexist in the same space although in different places. The use of the computers behind the walls consisted mainly of game play in networks for the younger boys, and surfing of the Internet for information, discussion groups, and keeping in touch with friends elsewhere for the older youth.

The guidelines suggested the café provide a meeting place for all, possibly breaking down barriers between various groups of youth. However, the café seemed to communicate to few, in particular students at the branch for music dance and drama at the secondary school, whereas other groups felt excluded. This accounted in particular for a group of car enthusiastic young men who hung out with their cars at the petrol station. This group were sceptical to the cultural profile of the village as a whole, and saw the new café as yet another sign of artistic-interested youth "getting everything" whereas they themselves "got nothing." In this way, the Internet café, though meant to be a measure for young people as a whole, became an actant in a power struggle between youth groups and cultural profiles in the village (see Laegran, 2003a).

The Internet café in Fjordvik got a lot of positive attention in the media, and soon delegations from other villages in the region came to have a look and get inspiration. One group of young people and representatives from the municipality came from Fjelldal, a village in a mountainous valley in the same region. Inspired by what they saw, they went home and made plans to start a café after similar guidelines. The local government was more involved in Fjelldal. From the start, the idea was that this would be a café for everyone, not a youth centre, although young people as a target group were strongly manifested in the guidelines. Being located 45 minutes from the nearest town, the café would be a long-desired urban spot in the rural community. However, despite being initially built on the same idea, the Internet cafés in Fjordvik and Fjelldal evolved to be quite different from one another, as the implementation process and integration of the cafés took place within the respective local contexts. The trendy interior, including a fancy Italian coffee machine required to make urban cappuccino, turned out to be too challenging to accommodate for the local government. Arguably, it was hard to find money within tight budgets, but it also seemed like bureaucrats and politicians were quite ignorant or indifferent to the importance of design and trendy features, illustrated by this quote from one of the managers in the administration: "We already have enough cafeterias." Thus, the café atmosphere vanished before it was established, and the place became an indoor shelter for young people who had little to do in the evenings than hanging out in the centre of the village. Some of them came for the computers, whereas others came to hang out with friends and saw little point in the Internet. Unlike in Fjordvik, the Internet did not have a symbolic meaning as being cool and linking the local to an outside world; it was seen merely as a toy or game along with other activities.

The next café is in Landby, a town that constitutes the administrative centre for this mainly rural-based region. This café was also government funded and worked as an information centre for youth, with several government-funded youth projects having offices within the premises. The initiative takers knew that young people in this town, with their particular tastes, required more than a shelter, and thus insisted on funding for proper redecoration. The café section had a modern design, comprising cappuccino and the like, with four computers with Internet access. The café was open to everybody, but contrary to the previous two, it was never an aim to attract a cross generational clientele. Being located in a town where there were already other, also "trendy," alternatives for an older age group, what was needed was a place for the youth. Being run by two male youth workers and a number of conscious objectors, by definition men, the place got a certain masculine dominance. A few girls would drop in to check the Internet, but the community created at the café comprised mainly of boys and young men. Some of the boys were game enthusiasts, playing "first person shot" games such as Counter Strike. Most of the regulars, however, did not really use the computer, but came to meet friends to chat, and listen to the music played rather loudly from the sound system at the café. Interestingly, the few girls who came spent most of their time on the computers, playing quiz-games, chatting, and using e-mail. At the time I did the fieldwork, a separate room was about to be built for a Linux-programming club in the basement of the café. Programming requires better machines than the Internet café can provide, the room was, therefore, facilitated so the programmers could bring their own computers, but be together in a social environment.

The last case is the "City Internet café," which provided 30 computers spread over two floors and a limited kiosk service including filtered coffee. It is a franchise of a chain that was started by students and graduates who wanted to create their own business based on their interest in computers. Whereas the other cafés featured in this study have varied functions in the local community in addition to computer services, this was a more specialized café where the computers, in particular gaming, were in focus. It was open from 10 AM to 4 AM, and 24 hours on weekends. During the day, a varied clientele came to check e-mail and search the net, while the game enthusiasts dominated the place during afternoon and evening hours. They played online games such as Counter Strike and Ever Quest; linking up with other players around the world. The online links to the rest of the world are common to all the Internet cafés, but the City café is, to larger extent than the others, integrated in a national as well as global network of game-based cafés. Being, in fact, pretty much a game centre, the label Internet café attracted a more varied crowd during the days. However, some of the nongame customers did not really approve of the activities at this café:

It is an OK place to be during the day and in the afternoon, but in the night the "coke bottoms"[5] *take over and the place changes (Girl, 20).*

Rather than having different rooms, the technosocial practices at this place changed during the day; a business-oriented Internet-based sociality with little interaction between the clientele during the day, and a boy's room gaming community during the night. As we shall see later, however, the gaming community also produced different technosocial spaces.

In the following, we are going to look further into the coproduction of sociality, technology, and space in the Internet cafés.

Hybrids: CoConstruction of Users, Technology, and Spaces

Technosocial practice builds on the conception of the user and technology as part of a seamless web, where the user and the technology are mutually constituted or coconstructed. As space is integrated in, and produced through, these technosocial practices, space also becomes entwined in this coconstruction process. This implies that use of the Internet, despite the rhetoric of its "placeless" character, is influenced by the kind of place in which the activity occurs. This applies to space on various geographical scales: from the Internet café as a site in everyday life in contrast to home and school, to various local communities in urban and rural spaces. The very idea of putting computers in a public place illustrates that the café setting adds value to the experience of computing, be it using the Internet or playing games. The installation of a room, where people can bring their own computers in Landby, illustrates this further; it is not just the access in itself, but the technosociality of the Internet café that attracts a lot of people to these places. Playing with the computer is simply different according to where it takes place. One of the gamers illustrated it this way:

It is like playing football on the fields with friends or playing "keepie uppie" by yourself at home. It is more fun to play with friends in a café. (Boy, 19)

The particular technosociality that develops plays back on the space, as we see in the next section.

The Internet as technology was coconstructed with the users of the Internet cafés, and something to identify with or against, accordingly. This was particularly true in Fjordvik, where the position of the Internet café in a power struggle between different youth groups, in fact, made resisters of the Internet café also reticent, if not totally opposed to the idea of using the Internet (Laegran, 2003a; forthcoming). The technology was coconstructed with its perceived users and their culture, and rejected on that basis. Similarly, various constructions of "same" and "others" occurred in the other cafés, in Fjelldal, between the users and nonusers of the Internet within the café; in Landby between the gamers and the Linux programmers; and in the City café between those who dropped in to use the Internet during the day and the gamers at night. A further distinction was developed here between the calm Ever Quest players who could be in their online dream world several days in a row, and the more frantic and excited Counter Strike players. According to the players, which game you preferred reflected your personality, and continuing playing would reinforce certain aspects at the cost of others. The difference of the technosocial practices are illustrated by this quote from two Ever Quest enthusiasts:

Boy 19: *The CS people are different – they shout – oh my god.*

Boy 20: *Yeah, they are really troublesome – like if somebody has luck, they jump around in a corner and shout – you hear them screaming. Splints in the table – and the neighbours… If you play EQ you just sit still and write in a chatbox, whereas a CS player beats the table so that you leap into the air!*

Although playing with the same artefact, the computer, we see that the identification with the respective games is significant for how not just the game, but also the gamers are perceived. In this quote, the spatial and material aspects of the difference are striking. Although the game is online, the differences in game socialities have offline implications; Counter Strike players use the materiality of the place in a more explicit way than the Ever Quest players, as we shall look further into in the next section.

Technologies and spaces are also gendered through this coconstruction. In studies of young people and use of computers, the boy's room metaphor has been used to describe the particular competence boys gain through their play with computers in the bedroom (Gansmo, Lagesen, & Sørensen, 2003). Is the café, as a public place often with feminine connotations, an alternative to the boy's room, where also girls may take part in this competence building? In Fjordvik, the café had what we could say was a feminine-connoted design and was used by a majority of girls and women, but the computers were still largely the domain of the boys. The same tendency was seen in the other cafés as well, where girls were in minority also among users of the space as a whole. This is true in particular for games and extended use. This does not, however, imply that the Internet cafés live up to stereotypical notions of "nerdy" places; rather than one dominant form of masculinity, the computers, as well as the places, provide space for performing and negotiating a large variety of different masculine identities related to the café community as well as the technologies (Laegran, 2003b).

Connected Spaces of Connections: The Production of Internet Cafés

Despite being perceived as an "urban" and "global" phenomenon, the findings showed that Internet cafés are configured based on local circumstances, in urban as well as rural communities. Concepts and ideas that, at the start, were quite similar got different manifestations in different local contexts. The "trendy," "nerdy," and "healthy" are three images that the cafés consciously and unconsciously use in their configurations, both in their strategies to attract the desired clientele, setting up the computers, and with regard to the interior design of the place (Laegran & Stewart, 2003). Through the way different actors play with these dimensions, different places with different technosocial practices are developed, yet with some recognizable features.

Although the idea of the Internet and coffee represents something new and possibly trendy, the actual use of the computers consisted of largely mundane activities resembling reading a paper or playing a table game. Just like sending e-mails from an Internet café, writing cards or letters has always been a common activity to do from a café. The difference is, of course, that in the case of the Internet café, the communication may occur synchronically with people located at different places. The computer and the Internet represent interactivity both related to the machine directly, and to the machine as mediator between people behind their respective screens. This makes the technosocial practice in an Internet café different from in any other café or similar locality.

The computers, as well as other material objects, are significant in the way the spaces are produced. In particular, in the trendy café in Fjordvik, a lot of emphasis was put on configuring the interior, the computers, as well as the clientele, into creating a specific form of technosociality, although the trendy idea of computers and coffee, as integrated, failed.

The way the computers are set up influences the character of the place; computers without the most popular first person shoot games, like in Fjordvik, created a different atmosphere in the café than those with these games. From the City café, we saw, in the previous section, the two dominant games also created different technosocialities. Whereas Ever Quest players preferred sitting calmly with coffee and a smoke in front of the screen several hours if not days in row, Counter Strike players got excited by the game, shouting around and beating the table. There was a tendency to spatial differentiation between the group as the consists of two floor levels. The Ever Quest players kept mostly to the second level, where they could look down at the Counter Strike players on the first floor. There were two simple material reasons for this: The machines on the first floor were faster and thus better for Counter Strike play. Furthermore, the second floor was a smoking area, so Ever Quest players could have their smoke whilst sitting down calmly with their coffee, playing the game.

The City café, and the one in Landby were the only ones with broadband, and in particular, the City café was dependent on stable high-speed connections to facilitate their gaming community. This was a constant issue, a slight panic occurred several times when the connection broke down. The café in Landby actually saw the limitations of what a publicly funded place could offer in terms of computers and facilitated space where Linux enthusiasts could bring their own machines for their programming.

However, not only the Internet, the defining technology of the Internet café, is of importance. As the development of the café in Fjelldal showed, the coffee machine, or the absence of one, was seen as significant for why the café failed to gain a clientele beyond that of a youth centre. However, although coffee makers are seen as something that belongs to the Internet café, it seems to be hard to integrate the café culture with cappuccino, and the like, with the actual practice of using computers. It seems more typical that two separate spaces are developed; one café and one computer-oriented space. In Fjordvik we saw that a wall was installed to divide the two spaces. The interior and wall decorations are also important in the production of the Internet cafés as technosocial spaces. In Fjelldal the budget did not allow for decoration other than posters of pop and rock-stars brought by the regulars. The interior of the City Café, on the other hand, was strictly neutral and streamlined in order not to put off nonregular customers.

Three of the cafés were part of a strategy for rural development or youth policy, developed by the initiative takers with support from municipalities. In these cases, the Internet café is used as an agent to modernise the countryside, building on the idea that an informal meeting place with a touch of something modern may do something to and for the community. However, it seems that the presence of an Internet café maintains or reinforces the already dominant trend rather than creates something new. In Fjordvik, the Internet café was welcomed among people who already knew the concept; it fitted well with the art gallery and other features not necessarily associated with the rural. In this way, the coconstruction of the Internet café and the community reinforces a modern or "urban–like" feature of the community, but maintains the divide between those who subscribe to this perception of what the place should be like and those who stand for possibly more "traditional" practices, like car enthusiastic boys at the petrol station (Laegran, 2002; 2003a; forthcoming). In Fjelldal the Internet café, rather than being an agent of change, as intended by the original initiative takers, became domesticated and appropriated into the local community so that it became a popular place to hang out for some of the young people, but it did not really represent anything new or alternative culturally.

Connecting Places: The Production of Space from the Internet Cafés

Internet cafés are places with blurred boundaries; the Internet transgresses boundaries both locally and globally. The Internet café community consists not only of those who are there at the time, but also of the more or less identified persons behind the machines that are linked up through the Internet. While many of these identify themselves and take active part as social persons, others are anonymous game or chat partners whereby the computer, more than the person on the "other side," is the actual opponent in the game or the chat. Thus, the Internet café is a space where the clientele interact not just with each other, but also with the machines. The technical artefacts take part as actants in the production of space inside the café as well as linked outwards through the Internet. In addition to being a node in a local technosocial space, the Internet café thus provides a road to the "information superhighway," connecting to translocal communities in a "virtual" world. However, the technology is used to transgress spatial barriers in different ways.

In Valentine and Holloway's (2001) study of young people's use of the Internet in the countryside, parents were concerned that what they perceived as positive aspects of growing up in the countryside may actually encourage the kids to be too inward looking when they grow up. The Internet, they perceived, could compensate for this by providing access to a new world that could increase the kids' cultural competence and make them more prepared for the world outside the village. I did not make formal interviews with parents, but talked to several who expressed similar views. However, there was also a concern about what this may lead to in terms of the future of the rural, as this father expressed:

When I look at how my daughter uses the Internet, she seems to become more global and urban.

And if this continues, then this region will be no alternative for her.

However, Valentine and Holloway (ibid.) found that there was a gap between the parent's ambitions and the actual practices of Internet use. Rather than useful activities linked to future prospects, they were looking up Web pages of pop and film stars, and having rather casual chats with peers online. In my findings, with slightly older youth, I found that the Internet was used both for "useful" and more entertaining purposes. Linking this to spatial aspects, however, the question of usefulness or entertainment is not really interesting. Studying the practices in the Internet cafés, it was clear that the Internet expands the radius of activity and the range of experiences. Those who used the Internet experienced it as a medium without borders, where it was possible to get impulses as well as contacts and friends from all over the world. The gamers in the City café, for instance, expressed that the sociality with people around the world were maybe as attractive as the games themselves. Several of the informants had made close friends, even boyfriends and girlfriends with people in other countries, and a former member of the Ever Quest community had found love in Australia through the game and moved there. She still kept in touch with the EQ community in the café though, through her character in the game as well as in real person through the chat room.

I also found that the youth were keen on expanding their space locally through the net. The Internet café, as well as the Internet, was important in maintaining links between peers and friends, but it was also used to get new friends locally. Like this girl from Fjelldal says:

Girl, 17: Yes – this friend of mine, she had met this guy on the net – he is from the neighbour village. And they became friends, and she gave me his mobile number so I just texted him – and now we text several times a day. And I sometimes talk to him on the net.

Interviewer: *Have you met him in real life?*

Girl, 17: *No – not yet. But I know who he is. I have seen him in town and all that.*

These boys show a similar example in a discussion about the excitement of a local chatroom,just for the village Fjelldal:

Boy, 19: *We may meet just occasionally, so it is fun to meet on the IRC too.*

Boy, 17: *And you do sometimes talk to people there, who you may not talk to generally.*

Boy 19: *Yeah, I actually talk to a lot of people on the IRC-channel Fjelldal who I do not talk to at all. We know about them, but there are like groupings and so even at this small place. So you do not talk to them in reality.*

Interviewer: *So what about when you meet after you have met on the Net?*

Boy, 19: *I have experienced that a couple of times. But the feeling was not so mutual from my side. (…) You have another identity on the IRC. It is not really like the real world. (…) You are hidden. So you can be anyone. It is easier to say things. (…) But I never cheat; say I am somebody who I am not.*

Interviewer: *So you are just yourself, but still different?*

Boy, 19: *I won't say different. Just that I dare to say things I won't normally say. And take contact with people who I won't have talked to elsewhere.*

These are examples of how the community increases in local rural areas where the number of youth in the same age may be limited. As we see, part of the excitement is that it is a non-face-to-face contact, even though they know who the other person is. In this way, technology provides a new form for sociality, where the technology actually plays an important part not only in mediating contact, but in defining the character of the practice and sociality in itself.

The importance of the Internet and the café as arena for expanded sociality was particularly important for people with what may be seen as special interests within the community. One of the regulars at the café in Landby identified herself as a "gother." With the black hair, white skin, heavy makeup, and jewelry, she was definitely "different" in the community, and it was hard sometimes, she said. By going to the Internet café and being on the net, however, she met a lot of people from the same subculture with which to identify. Having that contact increased confidence that made it easier to be confident enough to be different in the rural community as well.

Technology connects people and places through the Internet café, and we see the production of space extends beyond the walls of the café and the borders of the village. It also has the potential to transgress less tangible borders that are to do with cultural and social aspects of being youth, including the constructions of self and other in communities, as people who would most likely not meet face-to-face can do so through technology.

CONCLUSION

Castells (1996) argues that while media have become globally interconnected, "we are not living in a global village, but in customised cottages that are globally produced and locally distributed" (p341). Following this thought, Internet cafés would be a good example of global cottages distributed locally. However, as we have seen in this chapter, the Internet café, as any other place, is not global, nor is it local. The Internet café is a place produced in the intersection of the activities within the four walls, the village or city where it is located, national and transnational discourses and structures, as well as through the way the Internet connection links it with the "other side" of the computer screens.

The understanding of Internet cafés as hybrids emphasises the entwined coconstruction of users and technologies, as well as space, where gender, as well as other identity markers, are central in the way the technology, as well as the cafés, develop and are understood. The next level focused on the production of Internet cafés as technosocial spaces, where materiality, including technological artefacts as well as images, are used in the local configuration of the Internet café as space. Finally, we saw how Internet cafés can be understood as places of connections, where technologies are actants in the production of space as well as new technosocialities, linking the local to the global, as well as expanding the range and radius of activities within the local.

By using the Internet café as an example, I hope to have shown how the Internet, in particular, but also other technologies and materialities, are integrated in technosocial practices producing spaces in the local, as well as reaching into the translocal. While the Internet may be seen merely as a mediator connecting people, it is important to stress that the presence of the technology taking part in the practice makes a difference. The Internet café, however, is just used as an example. When it comes to connecting people, the mobile phone is probably the most significant technology, a technology that has changed technosocial practices and the way people interact in many different ways in recent years. In order to understand this phenomenon, it is important to look at technology, as well as the social, as integrated in the production of technosocial spaces.

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ENDNOTES

1. Twenty years ago, Bijker, Hughes, and Pinch (1987) presented several approaches highlighting the seamless web of the social and technical, coining the term sociotechnical. These approaches had a starting point in studying large (socio)technological systems (*ibid*.). In this study, the starting point is not technological systems, but social practice, where findings show how integrated technology is in the actual practice. Hence, technosocial seems like a more precise concept. It also highlights the transformation of socialities that new technologies may imbue, which is indicated by the fact that the previous use of the term technosocial has been linked to new technologies like ICTs (Bingham, 1999; Escobar, 1996) and biotechnology (Oudshoorn, 2003).
2. Dagbladet (1999): ”Mer cappuccino til bygda” and ”-En internetkafé hadde vært fint.” Feature written by Mari K. Bye Rise. 20th July.
3. Dan Andersen, departmental manager Gallup Intertrack (personal communication April 2001).
4. This, as well as the other place names, are fictionalised, in order to secure anonymity.
5. Indicating the thickness of the glasses of a stereotypical nerd. A statement meant more symbolically than actual, at least I did not see a “coke bottom” during my hours at the café.

This work was previously published in Exploration of Space, Technology, and Spatiality: Interdisciplinary Perspectives, edited by P. Turner, S. Turner, and E. Davenport, pp. 54-69, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 4.11
Social/Human Dimensions of Web Services:
Communication Errors and Cultural Aspects. The Case of VRL-KCiP NoE

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ABSTRACT

This chapter presents some recent studies of the social and human dimension of Semantic Web services in the era of virtual organizations, focusing on the challenges, effects, and implications. The issues and results presented refer to the virtual organization known as the Virtual Research Laboratory for a Knowledge Community in Production (VRL-KCiP), Network of Excellence (NoE). In this chapter the authors analyze the risks arising from the modern communication process in this new form of organization, focusing in particular on the knowledge sharing process. Furthermore, they discuss the cultural aspects of managing a virtual organization that determine the efficiency of the knowledge management processes. The aim is to consider the challenges and the associated effect on developing Web services from the social/human perspective and to examine the impact on an organization's cultural dimensions.

DOI: 10.4018/978-1-60566-650-1.ch018

INTRODUCTION

Semantic technologies are "meaning-centered." They include tools for auto-recognition of topics and concepts, information and meaning extraction, and categorization. Semantic technology software encodes meanings separately from data and content files, and separately from application code. The objective is to enable machines and people to share understanding and reason while programs are being executed. Semantic technologies then provide an abstraction layer above existing information technologies in order to bridge and interconnect data, content, and processes. Using semantic technologies, the process of adding, changing and implementing new relationships or interconnecting programs is relatively straightforward. From the portal perspective, semantic technologies can be thought of as a new level of depth that provides an improved, intelligent, relevant, and responsive interaction compared to that available with “classical” information technologies alone.

Hence, these technologies seem to hold the promise for improving communication and collaboration among dispersed organizations worldwide. This chapter discusses how such technologies functioned in a virtual organization involving numerous partners.

After describing the operations of the VRL-KCiP Network of Excellence (NoE) over the past three years, we briefly review the promising challenges of Web services. We then describe the Web services implemented and provided to VRL members. We show that even if these services are necessary for common and distributed work among the various partners, they alone cannot solve communication problems arising from misunderstandings. Based on the results of a previous study, we describe these misunderstandings and then examine cultural aspects of communication within the NoE which were determined to be critical factors in misunderstandings. These cultural dimensions cannot be handled technically but must be taken into account for Web services to be efficient.

THE CASE OF VRL-KCIP NOE

The Virtual Research Laboratory for a Knowledge Community in Production (VRL-KCiP) is a Network of Excellence (NoE) established in 2004 as part of the EC Sixth Framework Programme (Contract no. FP6-507487). The 27 member teams from 16 different countries (see Table 1) sought to create a new delocalized research structure at the European level, in which they would share research strategies, knowledge and resources, responsibilities, rights, and duties, as well as industrial contacts and contracts.

The idea behind the network (virtual organization) was to overcome fragmentation by applying the network principle to research. The NoE applied a multicultural approach both to the integration of modeling and simulation of knowledge-based production processes and to the relations among the joint partners. The objective of the VRL-KCiP was to support dynamic organizations, inter-enterprise operability, and necessary standardization. The network was driven by advances in virtual production, supply chain and life-cycle management, interactive decision-aid systems, development and rapid manufacturing. Incorporating these factors necessitated bi-directional relationships with industry. The virtual organization also aimed to benefit from the different approaches of the multicultural teams in treating common manufacturing problems and in promoting successful technology transfer. This would be achieved by incorporating emerging technologies driving new production paradigms in all phases of the complete/extended value-chain (design, production, distribution, use and end-of-life phases, including recycling) to allow development of new knowledge-based, added value and quality products and services in traditional sectors (Tichkiewitch, 2005).

The network attained industrial involvement and commitment by incorporating selected European industries to play a key role in providing industrial viewpoints on research relevance, research directions and awareness of integration activities and research topics related to production. Moreover, the joint research outcomes were publicized to attract and recruit new members.

Obviously, such a network is not primarily hierarchical in nature, and co-operation cannot be dictated from above. The research topics are

Table 1. The list of the partners in the VRL-KCiP NoE

Role*	Partic. No	Participant name	Participant short name	Country
CO	1	Caisse des dépôts et Consignations	CDC	F
CR	2	Institut National Polytechnique de Grenoble	INPG	F
CR	3	University of Twente	UT CIPV	NL
CR	4	University of Berlin	FhG/IPK	G
CR	5	ITIA CNR	ITIA	I
CR	6	University of Bath	Bath	UK
CR	7	Fundation TEKNIKER	TEKNIKER	E
CR	8	University of Patras	UPATRAS	GR
CR	9	Kungliga Tekniska Högskolan	KTH	S
CR	10	Hungarian Academy of Sciences	MTA SZTAKI	HU
CR	11	University of Ljubljana	UNI LJ	SL
CR	12	Universitaet Stuttgart	USTUTT	G
CR	13	Israel Institute of Technology	TECHNION	IL
CR	14	Ecole Centrale de Nantes	ECN	F
CR	15	Université Technologique de Troyes	UTT	F
CR	16	Politechnica University of Timisoara	UPT	RO
CR	17	Ecole Polytechnique Fédérale de Lausanne	EPFL	CH
CR	18	University of Durham	UoD	UK
CR	19	Delft University of Technology	TU Delft	NL
CR	20	Eindhoven University of Technology	TUE	NL
CR	21	Politechnica Poznanska	PUT	PL
CR	25	Pôle Productique Rhône Alpes	PPRA	F
CR	26	University of Stellenbosch	US	SA
CR	27	Politecnico di Milano	Poli-Milano	I
***CO = Coordinator; CR = Contractor**				

extremely diverse and evolve significantly, which may appear to some extent uncontrolled. Thus we can assume that networks of excellence are adaptive and flexible but hard to manage and co-ordinate (Shpitalni, Guttman, Bossin, 2005).

The main activities of research in the VRL-KCiP NoE were as follows:

1. **Integrating activities:** The goal of these activities was to create the integrated infrastructure (processes, tools, and procedures) required to establish a sustainable, integrated, European level virtual research laboratory.
2. **Joint research activities:** These research activities were designed to evaluate the joint research capability of the network, improving constantly as the infrastructure developed as part of the *"integrating activities"* evolved. These research topics were determined both by the ongoing research in the different labs and by the research directions determined together with large EU industrial members. The research teams were determined by taking into account actual member competencies, in order to reduce research fragmentation in Europe and

to create the best complementary activities between the actors.

3. **Spreading excellence activities:** These activities were directed at extending the scientific benefits of the network to academia and industry and, disseminating new knowledge by means of training sessions, scientific journals, web sites, and conferences.

The large number of network participants together with the network's multicultural, multidisciplinary, multilingual inherent characteristics require advanced knowledge and information sharing services, which may be facilitated by implementing Semantic Web services. The following overview discusses the promising challenges of available Web services, and describes those implemented in the VRL.

THE PROMISING CHALLENGES OF WEB SERVICES

A Web service is a set of related application functions that can be invoked over the Internet as an integrated part of any program code. Businesses can dynamically mix and match Web services to perform complex transactions with minimal programming. Web services allow buyers and sellers worldwide to discover each other, connect dynamically, execute transactions, and share information (data, knowledge) in real time with minimal human interaction.

Web services are self-contained, self-describing modular applications that can be published, located, and invoked across the Web:

- **Web services are self-contained:** On the client side, no additional software is required. A programming language with XML and HTTP client support is sufficient to get started. On the server side, a Web server and servlet engine are required. The client and server can be implemented in different environments. It is possible to turn an existing application into a Web service without writing a single line of code.
- **Web services are self-descriptive:** The client and server need to recognize only the format and content of request and response messages. The definition of the message format travels with the message; no external metadata repositories or code generation tools are required.
- **Web services are modular:** Simple Web services can be aggregated to form more complex Web services either by using workflow techniques or by calling lower layer Web services from a Web service implementation.
- **Web services are platform independent:** Web services are based on a concise set of open, XML-based standards designed to promote interoperability between a Web service and clients across a variety of computing platforms and programming languages.

Examples of Web services may include applications used for theatre reviews, weather reports, credit checks, stock quotations, travel advisories, or airline travel reservation processes. Each of these self-contained business services is an application that can easily integrate with other services, from the same or different companies, to create a complete business process. This interoperability allows human activities, interactions and/or collaboration to dynamically publish, discover, and bind a range of Web services through the Internet. Table 2 presents the main categories of Web services.

Web services make up a connection technology, providing ways to connect services together into a service-oriented architecture. A network component in Web services architecture can play one or more fundamental roles: service provider, service broker, and service client.

Table 2. Categories of Web services (Source: www.service-architecture.com/web-services/index.html)

No.	Category	Description
1	**Business information**	A business shares information with consumers or other businesses. In this case, the business is using Web services to expand its scope. Examples of business informational Web services are news streams, weather reports, or stock quotations
2	**Business integration**	A business provides transactional, "for fee" services to its customers. In this case, the business becomes part of a global network of value-added suppliers that can be used to conduct commerce. Examples of business integration Web services include bid and auction e-marketplaces, reservation systems, and credit checking
3	**Business process externalization**	A business differentiates itself from its competition through the creation of a global value chain. In this case, the business uses Web services to dynamically integrate its processes. An example of business process externalization Web services is the associations between different companies to combine manufacturing, assembly, wholesale distribution, and retail sales of a particular product.

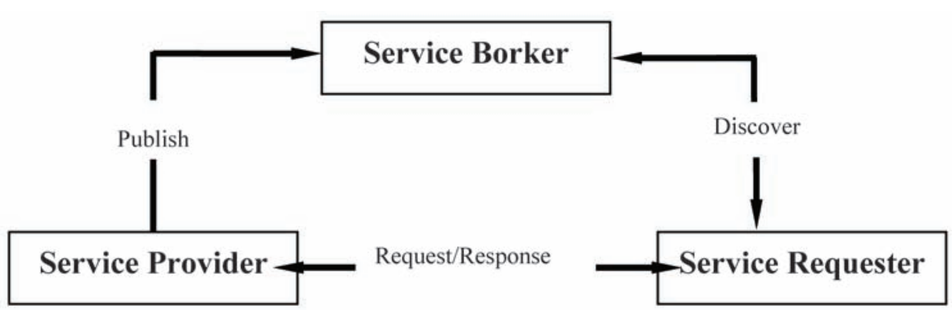
Services providers create and deploy their Web services and can publish the availability of their WSDL-described services (Web Services Definition Language) through a service registry, such as a Universal Description, Discovery, and Integration (UDDI) Business Registry.

Services brokers register and categorize published services and provide search services. For example, UDDI acts as a service broker for WSDL-described Web services.

Services clients use broker services such as the UDDI Business Registry to discover a needed WSDL-described service and then to bind to and call the service provider. Binding involves establishing all environmental prerequisites necessary to successfully complete the services. Examples of environmental prerequisites include security, transaction monitoring, and HTTP availability. The relationships between these roles are described in Figure 1.

In this chapter, the term Web services refers to technologies that allow connections via the web. A service is the endpoint of a connection. Moreover, a service has some type of underlying computer system that supports the connection offered. The combination of services—internal and external to an organization—makes up a Service-Oriented Architecture (SOA), which is essentially a collection of services that communicate with each other. This communication can involve either simple data transfer or two or more services coordinating some activity. Some means of connecting services to each other are needed (www.service-architecture.com).

Figure 1. Service roles and interactions



WEB SERVICES FACILITIES IN THE VRL-KCIP NOE

The following Web service facilities were used for internal and external communication between the partners of the Virtual Research Laboratory for a Knowledge Community in Production (VRL-KCiP) Network of Excellence (NoE). The main achievements to support internal communication included:

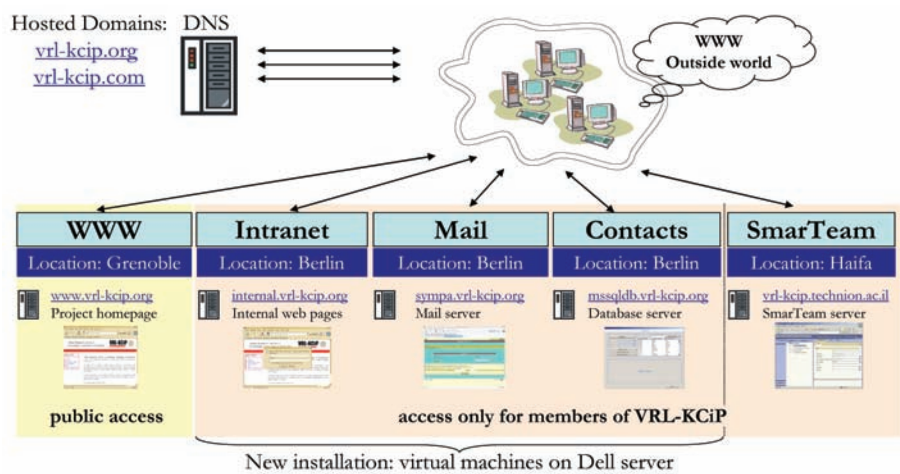
1. Registration and administration of the VRL-KCiP Internet domain, and installation of a DNS server for the domains vrl-kcip.org and vrl-kcip.com;
2. Implementation of an internal website for NoE members with access control;
3. Provision of the project partners' contact data, CV, areas of research, collaborations, and publications;
4. Specification and development of a tool for central administration of contact data and task allocation (the VRL Shepherd);
5. Installation and maintenance of a central contacts database;
6. Development of a communication handbook (*The Hitchhiker´s Guide to VRL-KCiP*);
7. Installation and administration of a mail server for mailing lists (Sympa);
8. Issuance of document templates for all kinds of documents needed within the project (e. g. for presentations, poster, reports) to ensure a unified appearance and facilitate management and assignment of documents to different operations;
9. Implementation of knowledge management capabilities and file sharing among members of the NoE using the SmarTeam tool.
10. Implementation of a common calendar for publishing important events.
11. Implementation of a common topic based forum capability.
12. Implementation of an expertise mapping capability

After communication and groupware services were initially installed on numerous PCs at the beginning of the project, it became evident that a more stable server platform was needed to deliver stable and reliable services to network members. To this end, in early 2005 Fraunhofer IPK began planning an adequate IT infrastructure. After analysis, it was decided to implement the new infrastructure using only two servers and a client PC for administration, made possible by utilizing virtual machine technology with multiple virtual PCs / servers running on a single computer (Figure 2). The implemented environment is described below in further detail.

Experience from past project coordination showed delivering reliable Web services requires that the corresponding server applications run on separate server machines. Moreover, some of the utilized services require different operating systems. An analysis of the required services for the IT infrastructure of VRL-KCiP internal and external communication indicated that a reliable implementation would need a total of eight machines. During a test phase these services were installed on eight physical test machines. This infrastructure had suitable performance but maintenance of the hardware turned out to be rather difficult. Also, running eight physical machines seemed to be unreliable since the malfunction of one machine could paralyze all services. Therefore, after an analysis of how to improve the infrastructure, a server was specified to run virtual machines, each hosting a separate PC, and a backup server was specified as well.

The IT infrastructure for VRL-KCiP internal communication is now based on two Dell servers and a virtual environment containing eight virtual machines, replacing eight physical PCs (Figure 3). This virtualization technology has enabled the organization management to reduce cost and optimize redundancy for the whole

Figure 2. Web service facilities: Intranet services



infrastructure. A Dell workstation is used in addition for administration and development tasks. The hardware specifications are presented in Table 3.

The virtualization of the information technology infrastructure for VRL-KCiP internal communication is based on VMware Server Software. VMware provides a virtual layer residing on a Windows 2000 Server local host system. The virtual server farm is divided into two virtual segments:

- A live segment hosting all live virtual servers with their services;

Figure 3. VRL-KCiP virtual segments

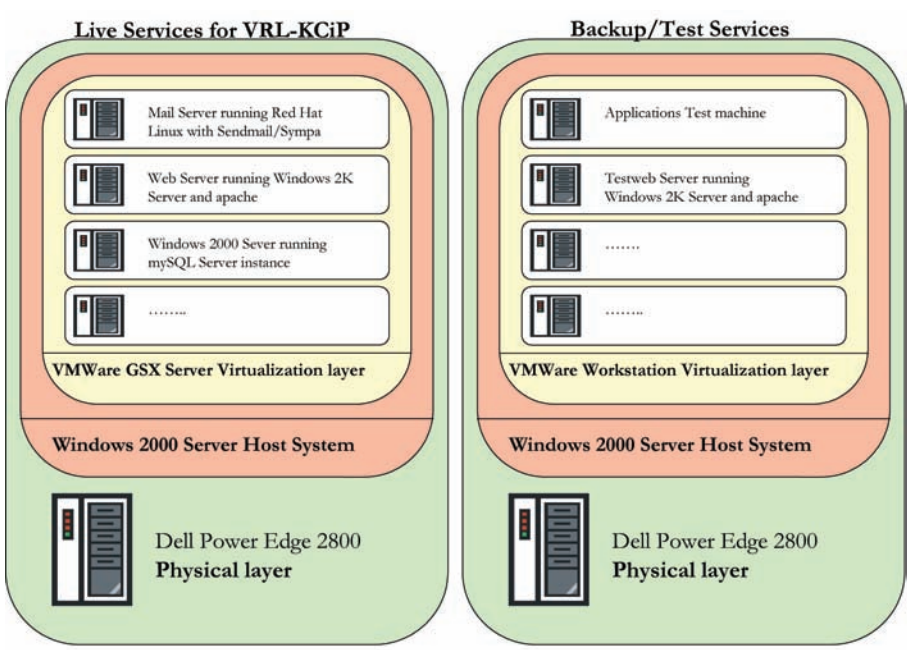


Table 3. Hardware specifications

Hardware	Parameters / Specifications
Server 1	Dell Server Power Edge 2800: Dual P4 Xeon 3,0 GHZ; 3 GB Ram; Hard drives: 450 GB Raid 5, 73 GB Raid 1
Server 2	Dell Server Power Edge 2800: single P4 Xeon 3,0 GHZ; 1 GB Ram; Hard drives: 73 GB Raid 1
Workstation	Single P4 3,0 GHZ; 1 GB Ram; Hard drives: 80 GB Raid 1

- A backup/test segment hosting all tests, daily backups for the live-Segment.

Based on the described virtual platform, servers have been set up to provide all VRL-KCiP partner services, as follows:

- **Mail Server:** running Red Hat Linux with sendmail and Sympa;
- **Web Server:** running MS Windows 2000 server with Apache as web server software;
- **Database Server:** running Windows 2000 server and a mySQL server instance holding all the data for the VRL-Shepherd client;
- **Database Server:** running Windows 2000 server and a mySQL server instance. This server will provide a centralized login data for web and forum services;
- **Backup Server:** running Windows 2000 for disc-to-disc backup of all live virtual servers from segment 1 to segment 2;
- **Web Server:** a mirror of the web server mentioned above acting as a test platform for all releases before going live;
- **Application Server:** a standard client machine for testing purposes of the VRL Shepherd client;
- **Forum Server:** running windows 2000 server with apache and forum software.

For effective communication and project management a number of groupware services needed to be implemented and deployed. These "VRL-KCiP member services" include Web-based Intranet as a hub for information distribution, management of contact data information, document management and e-mail exchange. All of these VRL-KCiP member services have been set up and are widely used by network members. Access to the services is available via the network's public web site (www.vrl-kcip.org) or via a direct URL at http://internal.vrl-kcip.org/. Access to member services requires a login with username and password on the VRL-KCiP Intranet section of the virtual organization's Web page (Table 4).

The Web service facilities define the "**VRL world**". These facilities supported the development of human relations among the laboratories and universities involved in the partnership. They served as the foundation of building the knowledge community in the field of manufacturing, the project's main objective. Despite communication problems and cultural differences, the members met the challenges of working together. They succeeded in creating a unified integrated world that can be easily navigated and that presents the network's members, research areas, publications and collaborations all in context over the web.

SOCIAL / HUMAN CHALLENGES AND IMPACT ASSOCIATED WITH WEB SERVICES IN THE VRL-KCIP NETWORK OF EXCELLENCE

The Web service facilities in the VRL-KCiP have some unique features:

- The service providers and service clients are members of the same knowledge

Table 4. The VRL-KCiP Intranet: Web services for the virtual organization members

Network organization	
Hitchhiker's Guide	Hitchhiker's Guide is the project management handbook for VRL-KCiP. It provides information about who's who in the network and about the different internal communication facilities
Who's who	Who´s Who in VRL-KCiP: 1. Organigram; 2. Contact data of all members of the network; 3. Registration process.
Mailing	All mailing lists are displayed and can be downloaded as .xls file.
Templates	Templates for all documents which are needed within the network, e. g. posters, presentations, deliverables.
Deliverables	All Deliverables for VRL-KCiP can be downloaded from the Intranet.
Registration process	New members of the project have to be registered by the main representative of the laboratory they belong. This will ensure consistency and avoid non-project partners attaining project internal information. The new member has to give information about personal data and membership to organizational units (categories) within the NoE to the main contact.
Logos	The logos of all organizations within the VRL-KCiP network and the VRL-KCiP logo can be downloaded in different files formats.
VRL shepherd reader	VRLshepherd. It can be used to view partner and organization data.
VRL Web shepherd reader	Test version of the new web based VRL Web Shepherd.
Member Services	
SmarTeam	The SmarTeam Knowledge Management System is used for asynchronous data exchange
CDC tool	Tool for financial management of the NoE is located at CDC, Paris
Discussion Forum	Forum for discussion of relevant network themes
Calendar	All project internal dates, meetings, deadlines etc.
Video conferencing support	Instructions for use of VRL-KCiP video conferencing system
News section	Actual news concerning VRL-KCiP are presented for members only
Software Demonstration and Exchange Platform	The platform gives an overview on software tools developed by NoE partners
Key Performance Indicators	Input platform for indicators to evaluate VRL-KCiP performance

community. They work together to enrich the knowledge base system;

- The management team (which acts as broker) supports both the service providers and the clients, piloting the virtual organization's activities with respect to European Commission "rules" and performance indicators for the 6th Framework Program.

The VRL Web service facilities must support the *virtual knowledge work* of different researchers working in distributed laboratories in different countries (see Table 2). The heterogeneous backgrounds of the participating professionals, the diverse professional interactions (among the team members and with industries), and the challenges to be met can generate various kinds of misunderstandings, leading to errors and conflicts. Our experience with the VRL NoE showed that despite innovative Web services, the problem of misunderstandings still remains. These misunderstandings can interrupt activities and lead to decisions that are later regretted. In other words, the NoE, assumed to provide a creative forum in which researchers and companies can interact and share knowledge, often must face major complexities due to accumulated misunderstandings. Experience has shown that to manage the risks linked to such misunderstandings, we must focus on communication errors. In this context, we propose general guidelines for cross-cultural communications and discuss the potential role of IT-based tools in solving misunderstandings in virtual engineering teams.

Misunderstandings in the VRL-KCiP Communication Process

According to the Free Dictionary (http://www.thefreedictionary.com/misunderstandings), the term "misunderstanding" can be explained in two ways:

1. Putting the wrong interpretation on;
2. An understanding of something that is not correct;

Another related word in this context of explanations is misconception, which is an incorrect conception.

These definitions underline the causes and effects of misunderstanding. The consequences of misunderstandings must be avoided.

According to international standard ISO/IEC 11179-4, misunderstanding in information technology must be avoided: "Precise and unambiguous data element definitions are one of the most critical aspects of ensuring data shareability. When two or more parties exchange data, it is essential that all are in explicit agreement on the meaning of that data. One of the primary vehicles for carrying the data's meaning is the data element definition. Therefore, it is mandatory that every data element have a well-formed definition; one that is clearly understood by every user. Poorly formulated data element definitions foster *misunderstandings and ambiguities* and often inhibit successful communication".

All these definitions and contextual explanations of misunderstandings are linked with communication and human perception of concrete terms, concepts, information or knowledge.

Communication is not only a necessary process for solving technical problems. It is also a very important tool to manage a team, both to motivate people and also facilitate knowledge transfer between team members. Misunderstandings and errors can occur during the communication process, as outlined below (Paek & Horvitz, 2000):

- Channel failure, overhearing (Paek & Horvitz, 2000);
- "Non-understanding" (Hirst et. al., 1994); "Problematic reference" (Schegloff, 1987); "Communication breakdown" by cochlear-implant user (Tye-Murray & Witt, 1996); Jargon (Ahlsen, 1993);
- Misunderstanding by abduction (McRoy & Hirst, 1995), by coherence (Ardissono et. al., 1998); "Negotiated misunderstanding" (Blum-Kulka & Weizman, 1998); Conventional breakdown in cross-cultural interaction (Ulichny, 1997); Input failure (Ringle & Bruce, 1981); Underspecification (Deemter & Peters, 1996);
- Misconception (McCoy, 1989); Breakdown by unshared conventions (Gumperz, 1995); Co-membership differences (Schegloff, 1987); Problematic sequential implicativeness (Schegloff, 1987); Pracmatic infelicities (Marcu & Hirst, 1996); Model failure (Rigle & Bruce, 1981);
- Contribution (Clark, 1996).

This interdisciplinary taxonomy of communication errors is not meant to be a complete or exhaustive review of the research literature. Rather, it serves as a preliminary attempt to correlate different types of communication errors. All the definitions of misunderstandings, groundings, and mentioned causes can be integrated in the six semiotic layers mentioned by Stamper (1973 & 1996).

The most relevant sources of communication errors in the VRL-KCiP virtual organization are explained below (Lewkowicz, Wijnhoven & Draghici, 2008):

- **Video conference:** Video conferences are marked by a time lag between when a question is asked and when the other party perceives the question. For example, three seconds can elapse between the time you ask a question and the time your question is perceived at the other end. That's a long silence to tolerate. Many conferences fell apart because someone repeated a question while the person on the other end was trying to answer, resulting in a waste of time. Functional errors of the video conference system that can induce misunderstandings are as follows:
  - Delays between a speaker's explanations and presentation image reconstruction;
  - Echoes causing voice distortions and missing information;
  - People who do not take system delays into consideration and therefore speak too quickly. Misunderstanding is generated because slow voice refreshing can affect the duration of the meeting.
- **Language:** Misunderstandings are often generated because English words and phrases are mispronounced and/or used incorrectly by people whose native language is not English (i.e., Romanian, Hebrew, French, Greek, Hungarian, Spanish, Swedish etc.). While people seem to have accepted each other's pronunciation styles, sometimes English-speaking partners speak too quickly and are misunderstood. Such misunderstandings can be avoided by e-mail communication.
- **Cultural gap (communication gap):** Due to differing perceptions (or prejudice) about the work process and possible work solutions (cultural influences, education in national systems, experiences in national companies), misunderstanding in cooperation can occur. Most of the researchers, task and work package leaders believed in the importance of the following:
  - Face-to-face meetings and early involvement of all key players;
  - Common objectives, commitment, clear roles and responsibilities, rules and practices Team research and goal setting theory has demonstrated the importance of establishing a common purpose among team members and then working towards this purpose to increase team effectiveness (Hacker & Lang, 2000).;
  - Ongoing follow-up video conference meetings and
  - Well established standard tools and good systems that are compatible in terms of software, hardware, electronic communication / data transfer.
- **Cultural differences, cross-culture communication:** Cultural issues and poor leadership lead to misunderstandings and conflict that are not easily resolved. Cultural differences must be acknowledged and carefully handled. Communication feedback (even in the case of e-mail communication) is necessary to avoid misunderstandings.
- **Knowledge Management Systems:** The main drivers for implementing KM initiatives are as follows: dissemination of best practice to a key set of employees; retention of the tacit knowledge of key employees; promoting continuous improvement; responding to customers more quickly; and reducing rework. The VRL-KCiP Knowledge Management System (KMS) was developed using the SmarTeam application. The most frequent misunderstandings with the KMS were generated by difficulties connecting with the server, which did not allow data saving and forced people to input the information again. Moreover, access to specific items in the KMS was very difficult for most people in the

beginning because of problems using the SmarTeam interface. These problems have been partially solved by enabling external data input possibilities, and by publishing the knowledge from within the SmarTeam system on regular web pages.

- **Annual evaluation / motivation / recognition:** The VRL management team agreed that these practices definitely helped motivate the network members. However, it was mentioned by some that this could be further amplified by developing a complementary incentive program celebrating the achievement of key project goals. Such measures quantify network achievements and the contribution of each separate team in achieving network goals. The idea was to develop common goals and agreed upon measurements that were known to all teams in order to reduce misunderstandings of the aims and the means required to achieve them.
- **Experience:** As project managers gain experience in global virtual team projects, they learn how to overcome the challenges and drastically improve project performance metrics, among them engineering cost, construction cost, engineering time, overall project delivery time, engineering quality, and construction quality. Figure 4 shows the semiotic layers of misunderstanding together with human guidelines for improving cross-cultural communication skills. Improving knowledge sharing and communication in virtual engineering teams could be an important management tool (Lewkowicz, Wijnhoven & Draghici, 2008). This improvement can, for example, help detect and diagnose non-functioning design teams, advance understanding of how design teams acquire and maintain their collective identity, and help serve as a means for understanding the evolution of information needs in design teams.

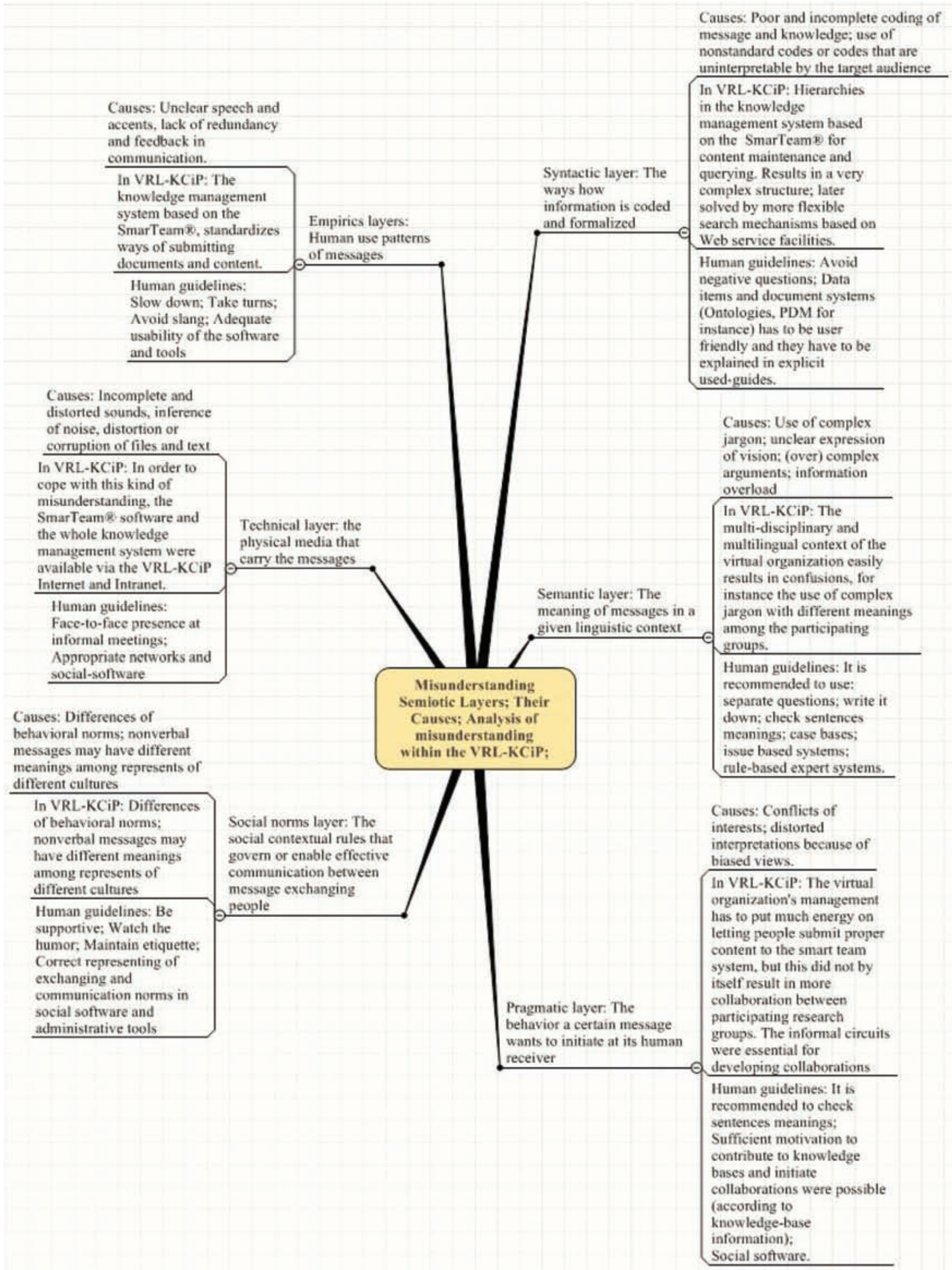
Currently, no well developed tool exists for identifying level of understanding, and especially for detecting potential misunderstandings in a global virtual engineering team. As indicated above, such a tool is urgently needed. It can be built by means of further literature research, survey studies (to learn the business magnitude of this problem more precisely), possible tests of such tools, and making these tools part of common project management practices for virtual teams. Some initial attempts at such research have already been made in the field of off-shore information technology development (Kernkamp, 2007), and the field of manufacturing and product engineering must soon follow.

The above review of the literature combined with our experience in the VRL-KCiP NoE has led to the synthesized presentation in Figure 4. The figure shows the misunderstanding semiotic layers together with their causes, an analysis of the communication errors in the VRL-KCiP organization and some human guidelines (Lewkowicz, Wijnhoven & Draghici, 2008). Even though the word *virtual* is found in global virtual engineering teams, some element of face-to-face interaction is critical and cannot be avoided. One of the most crucial failure factors was a lack of understanding of local work practices, cultural differences, and language issues.

Organizational Culture Assessment and Study

Another aspect of social/human impact associated with Web service creation and use in the VRL-KCiP is multi-cultural synergy. This synergy had an impact upon organization management, approaches to knowledge management and, in particular, knowledge sharing. The debate started from the potential advantages of virtual communities, which can create culturally synergistic solutions, enhance creativity and cohesiveness among team members, promote greater acceptance of new ideas and provide a competitive advan-

Figure 4. Synthetic presentation of the misunderstanding semiotic layers



tage for the whole organization. Yet, culture is not a sure or stand-alone remedy for improving organizational performance, which is complex, multileveled and deeply rooted. Culture must be observed and analyzed at every level before it can be fully understood or successfully changed and managed.

In this context, a study of organizational culture research was carried out within the VRL-KCiP NoE. The questionnaire was inspired by the survey presented by Anawati and Craig (2006). The main ideas in building the questionnaire were:

1. **General overview** of the virtual team: awareness of cultural differences; accepting cultural differences; allowing team socializing/informal chat; rewarding good behavior in culturally appropriate manner.
2. **Spoken and written** characteristics for communication and inter-relation development. The general overview takes the following into consideration: avoid slang, colloquialisms, jargon, acronyms; use simple language; avoid metaphors; avoid humor; keep to the point; confirm understanding by asking open-ended questions; reiterate key points; use follow-up emails for feedback; formulate criticism/ praise carefully. In addition, **spoken language** is linked with verbal dialogue, so the following aspects are relevant: speak slowly/clearly; acknowledge/invite each individual to speak; allow for "think time" between responses; alter tone of voice (do not be too abrupt); supplement discussions with written text or visual. Some important aspects regarding **written** communication are: write from the receiver's point of view; be more descriptive; use lists/points; vary between formal and informal writing.
3. **Religious belief** is important for scheduling meetings and deadlines (religious holidays or celebrations must be considered).
4. **Time zone** is linked with time organization: allow extra time for time zone differences; attempt to schedule meetings during work hours; rotate meeting times to share the burden of after-hours work.
5. **Face-to-face** meetings are the most relevant way to build trust in the organization and should be encouraged: initiate team face-to-face meeting if possible; initiate team video conferences; put team member photographs on a website; rotate face-to-face meetings in different locations.

This research underlines that cultural aspects have had an important influence on the VRL-KCiP network. The organizational culture emphasizes the individual teams'/partners' culture, and this culture is in a state of transition. In the following, the research results are examined by analyzing the answers given by each thematic group to each question (122 respondents). The nationalities of the participants involved in the research were: Spanish, Hungarian, German, Colombian, Japanese, Slovene, South Korean, British, Romanian, Dutch, Greek, Israeli, Italian, French and Swedish. For analysis purposes, the participants were divided into four groups: Northern Europe (British, Dutch and Swedish), Central Europe (Hungarian, German, Slovene and Romanian), Southern Europe (Spanish, Greek, Israeli, Italian and French) and East Asia (Japanese and South Korean). The participants' average age was 37.07 years. This low average isan advantage for the VRL-KCiP organization, as the population of Europe, and particularly the research community, tends to be older. The youngest participant was 24 years old, while the oldest was 62; 24% of the participants were female, and 76% were male. Table 5 presents the most relevant research results.

In our study, we focused on discovering and describing the impact of multi-culturally in virtual teams, and in particular in the VRL-KCiP Network of Excellence. The potential advantages of global virtual teams are that they can create culturally synergistic solutions, enhance creativity and cohesiveness among team members, promote

Table 5. Relevant research results

Question	Comments
1. Inter-relationship development inside the organization	
How do you rate the importance of socializing (e.g. informal chat, subjects out of work, jokes)?	The participants mainly rated the importance of socializing as very high or high; no one rated it as rather or completely unimportant.
Do you tolerate the religious beliefs of others (e.g. prayer time, religious holidays)?	The results do not show a significant tendency. While most of the participants pay attention to this topic, others consider it less important. Possible causes for this could be either that religion is not of great importance for them, or they think that religion is a private matter that should be kept out of work.
Should the other team members be aware of your culture?	According to Anawati and Craig (2006) this should be the case. For 31% of the participants it is very important that others are aware of their culture, and for 45% this is sometimes the case; 24% of the participants think that culture should not be of importance.
2. General differences	
Have other team members sometimes behaved in a way that bothered you?	To obtain the answers to this question, comparable answers were assigned with a value (3/often, 1/sometimes, 0/never) and then scaled relative to the number of each group's participants. The following hypotheses were assumed, based on culture (discussed in the answers to the next question): **Hypothesis 1:** *The environment of Northern Europe is informal;* **Hypothesis 2:** *The environment of Central Europe is hierarchical;* **Hypothesis 3:** *The environment of Southern Europe is informal;* **Hypothesis 4:** *The environment of East Asia is hierarchical.*
Is your environment rather hierarchical or informal? Is this due to your culture, workplace, religion or others (please specify)?	In general, the participants consider their environment as rather informal. The research results validated hypothesis 1 and 3; hypothesis 2 could not be validated because of the distribution of the answers, and hypothesis 4 was not admissible. For 76% of the participants, workplace relations were the decisive factor in this estimation; 31% mentioned culture, while religion did not play a decisive role in human relations. In this context, it must be considered that workplace relations will, in most cases, be influenced by the culture of the surrounding environment.

a greater acceptance of new ideas and, hence, provide a competitive advantage for multinational corporations.

We were interested in describing and characterizing the human/social aspects and relational dynamics generated by modern information and communication technology methods and tools implemented in a virtual organization (and/or the impact of creating Web service facilities), in particular for the VRL-KCiP NoE.

We have presented the results of the research conducted within the setting of VRL-KCiP and based on the topics presented by Anawati and Craig (2006). The results show that it is very difficult to formalize cultural issues, as every individual ultimately acts differently. But when the virtual team members behave in a tolerant and endeavoring way they can overcome culture-related difficulties. If the commitment to the common task is granted to the required extent, the task will be accomplished successfully.

Desktop conferencing/collaboration tools can provide very good support for intercultural collaboration as they offer many possibilities to express and explain even complex matters and can be therefore recommended as useful investments. Finally, even if today's technology provides possibilities for cross-cultural virtual teams, the classic face-to-face meeting remains indispensable as a decisive part of effective team building.

The research, statements and observations regarding the VRL-KCiP organizational culture point out two largely shared perspectives: (1) the culture emphasizes the individual teams' (partners) culture, and (2) the culture is in a state of transition. It seems that organizational culture and Web service facilities are connected in their evolution.

FUTURE RESEARCH AND TRENDS

Our research approach will be repeated in the future because the VRL-KCiP has been extended to become EMIRAcle – European Manufacturing and Innovation Research Association, a cluster leading experience, whose aim is to valorize the results of VRL-KCiP as a legal entity in the form of an international non-profit association according to Belgium Law (AISBL). Until the end of June 2008, the NoE and the association co-existed in order to guarantee a seamless transition between the two organizations. EMIRAcle is an important element of the common marketing and dissemination strategy created by VRL-KCiP members.

The present and future trends of real organizations are focused on encouraging the development and implementation of virtual teamwork. As organizations worry about their bottom lines and reduce travel, they will begin to more strongly support virtual teams. They will also begin to focus on increasing the productivity of those teams. In the new millennium, the competence of most organizations will depend on innovative deployment of new technologies for effectively managing knowledge networks for organizational performance (Tapscott & Williams, 2006). Many such "virtual" organizations using information and knowledge as their fundamental bases are redefining the "reality" of their traditional environment. In the process, they are also posing challenges and opportunities by redefining traditional thinking about industries, organizations, competition, products, services, technologies, people and economy (Draghici & Draghici, 2006).

CONCLUSION

This chapter has presented some of the human dimensions of a virtual organization (in particular the VRL-KCiP NoE). In our approach, the Web services term/concept refers to the technologies that allow connections, and a service is the end-point of a connection. For effective communication and project management, a number of groupware services were implemented and deployed in the "virtual space" of the NoE. These "VRL-KCiP member services" include: Web-based Intranet as a hub for information distribution; management of contact data information; document management; e-mail exchange. All of these VRL-KCiP member services have been set-up and are widely used by network members. Access to the services is available on the network's public web site (www.vrl-kcip.org) or via a direct URL at http://internal.vrl-kcip.org/. Despite all of these services, misunderstandings still remain. We then focused on discussing the challenges and impact associated with web services development, from the social/human perspective and its impact on the organizational culture dimensions of VRL-KCiP NoE.

The potential advantages of virtual teams are that they can create culturally synergistic solutions, enhance creativity and cohesiveness among team members, promote greater acceptance of new ideas and provide a competitive advantage for the whole organization. Yet, culture is not a sure or stand-alone remedy for improved organizational performance. Culture is complex, multileveled and deeply rooted, and must be observed and analyzed at every level before it can be fully understood or successfully changed and managed.

The theoretical aspects are verified through the results of organizational culture research within the VRL-KCiP. The questionnaire used in the research was inspired by the survey presented by Anawati and Craig (2006). These researchers proposed a framework of behavioral adaptations in order to give an orientation for cross-cultural virtual team members by considering the following items: general overview of the virtual team; spoken and written characteristics for communication; religious belief importance for scheduling meetings and deadlines; time zone linked with the time organization; face-to-face meetings, which are the most relevant ways for building trust in the organization. The research underlines that cultural aspects have had an important impact on the VRL-KCiP network. The organization's culture emphasizes the individual teams'/partners culture, and this culture is in a state of transition.

Future studies will be developed in the context of VRL dynamics and its transformation into the EMIRAcle association.

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KEY WORDS AND DEFINITIONS

Ad-Hoc or Virtual Team: Is a recombinant structure for work that pulls people and resources together quickly to solve a particular problem or client issue (Koulopoulos & Frappaolo, 1999).

Core Competency: Represents the overriding value statement of an organization. Core competency need not be narrow (Kotler, 2000). Hindle (2000) identifies three essential elements of a core competency: (1) provide potential access to a wide variety of markets; (2) make a significant contribution to the perceived customer benefits of the end product; and (3) be difficult for competitors to imitate.

Expertise: Is the property of a person (that is, expert) or of a system that delivers a desired result, such as pertinent information or skills.

Expertise generally implies providing useful and large amounts of knowledge and action quickly (fluency). In general, expertise has several synonyms, among them know-how, skill, knowledge, competence, or excellence.

Knowledge Community: Is a community of people, groups or teams that share competencies, information and knowledge (in a specific field of activity) based on a specific knowledge management system defined in the context of a knowledge sharing culture with a proper ICT system. Web services support knowledge communities.

Misunderstanding: Can be explained in two ways: putting the wrong interpretation on; b. an understanding of something that is not correct. Another related word in this context of explanations is misconception, which is an incorrect conception (according to the Free Dictionary http://www.thefreedictionary.com/misunderstandings). In information technology must be avoided: "Precise and unambiguous data element definitions are one of the most critical aspects of ensuring data shareability. When two or more parties exchange data, it is essential that all are in explicit agreement on the meaning of that data. One of the primary vehicles for carrying the data's meaning is the data element definition. Therefore, it is mandatory that every data element have a well-formed definition; one that is clearly understood by every user. Poorly formulated data element definitions foster *misunderstandings and ambiguities* and often inhibit successful communication" (according to international standard ISO/IEC 11179-4)

Organizational Culture: Is a concept in the field of Organizational studies and management which describes the attitudes, experiences, beliefs and values of an organization. It has been defined as "the specific collection of values and norms that are shared by people and groups in an organization and that control the way they interact with each other and with stakeholders outside the organization." (Charles & Gareth, 2001).

Semantic Technologies: provide an abstraction layer above existing information technologies in order to bridge and interconnect data, content, and processes. Using semantic technologies, the process of adding, changing and implementing new relationships or interconnecting programs is relatively straightforward. From the portal perspective, semantic technologies can be thought of as a new level of depth that provides an improved, intelligent, relevant, and responsive interaction compared to that available with "classical" information technologies alone.

Virtual Research Laboratory for a Knowledge Community in Production: (acronym VRL-KCiP) Is a virtual Network of Excellence (NoE) established in June 2004, consisting of 27 partners (more than 200 researchers) from 16 different countries that decided to work together and build a knowledge community in the field of design and manufacturing research (www.vrl-kcip.org). VRL-KCiP is financed by the European Commission in the 6th Framework Programme.

Web Service: Is a set of related application functions that can be invoked over the Internet as an integrated part of any program code. Businesses can dynamically mix and match Web services to perform complex transactions with minimal programming. Web services allow buyers and sellers worldwide to discover each other, connect dynamically, execute transactions, and share information (data, knowledge) in real time with minimal human interaction.

This work was previously published in Handbook of Research on Social Dimensions of Semantic Technologies and Web Services, edited by M. M. Cruz-Cunha; E. F. Oliveira; A. J. Tavares & L. G. Ferreira, pp. 357-378, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 4.12
Social Software Use in Public Libraries

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ABSTRACT

With the emergence of Web 2.0, libraries have started employing social software applications (such as blogs, tagging, social networking, and wikis) to engage readers, encourage user-contributed content, and connect with user populations in novel ways. However, little research has been conducted on the applications of Web 2.0 technologies within public libraries. This chapter focuses on the applicability of social software in a library setting and examines the use of such innovative techniques as live tagging, social cataloging, and social bookmarking. The chapter evaluates the potential of social software tools for facilitating collaboration between librarians and library patrons; it addresses the concerns expressed by the library and information science community related to the issues of trust, authority, accuracy, responsibility, and ethics in the context of the Library 2.0.

DOI: 10.4018/978-1-60566-368-5.ch040

INTRODUCTION AND BACKGROUND

User-centered philosophies are at the heart of libraries' service and have been in practice long before the emergence of Web 2.0. However, with the advent of the social-interaction technologies, such as blogs, wikis, and social bookmarking, libraries have seen a radical shift as they are now faced with web-users' expectations. These expectations may not be met with less interactive computer technologies, such as library online public access catalogs (OPACs). Libraries have recognized the value that technologies of Web 2.0 can provide to their users and are implementing social software in innovative ways. This chapter provides an overview of social software use in public libraries and evaluates its potential for facilitating collaboration between librarians and library patrons. The author focuses on the applicability of Web 2.0-type technologies in a library setting and presents an overview of social software use in public libraries. Additionally, the chapter addresses concerns expressed by library and information science professionals related to the issues of trust, authority, accuracy, responsibility, reliability, and ethics in the context of Web 2.0, as well as outlines the directions for future research.

Web 2.0

At the base of all social software use is the concept of Web 2.0. The term itself was coined in 2004 by Tim O'Reilly and John Battelle, at a conference on web technologies (O'Reilly, 2005; Anderson, 2007). O'Reilly (2005) defines *Web 2.0* as:

"the network as platform, spanning all connected devices; Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that gets better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an architecture of participation".

Abram (2005) expands the philosophy further to include more human aspects of interactivity, such as conversations, interpersonal networking, personalization, and individualism. He explains *Web 2.0* as:

"fundamentally about a transition of the Web site and email-centric world from one that is mostly about information to one where the content is combined with functionality and targeted applications….It's primarily about a much higher level of interactivity and deeper user experiences….characterized by open communication, decentralization of authority, freedom to share and reuse, and the market as a conversation." (emphasis added)

Stephens and Collins (2007) view *Web 2.0* as "the next incarnation of the World Wide Web, where digital tools allow users to create, change, and publish dynamic content of all kinds… to make connections, carry on conversations, and collaborate" (p. 253). They distill Web 2.0 principles to:

- **Conversations:** User participation, discussion and feedback are welcomed and encouraged
- **Community:** Open conversations can lead to a sense of community and belonging
- **Participation:** New information is created via collaboration between users
- **Experience:** Engagement with other users and the community is rewarding and provides some type of fulfillment
- **Sharing:** Users can contribute as much or as little as they like (p. 253)

O'Reilly (2005), Anderson (2007), and McDermott (2007) develop a conceptual framework for the examination of Web 2.0 philosophies and technologies in the context of libraries. For instance, Anderson (2007) emphasizes a need for more serious discussion on Web 2.0 and expands on O'Reilly's "Six Big Ideas" of individual production and user-generated content, harnessing the power of the crowd, data on an epic scale, architecture of participation, network effects, and openness (2005). Anderson suggests a) focusing on both mature social software applications, e.g., blogs and wikis, and new applications, e.g., data mash-ups, which build on earlier applications; and b) investigating web technologies and standards that enable the software applications of Web 2.0, including XML and AJAX (p. 196). McDermott (2007) presents a breakdown of the specific functions of each application as a means to evaluate Web 2.0's potential and uses.

The most commonly used technologies in libraries include:

- Blogs (for example, "What's New" pages; blogs designed for specific user audiences or community outreach programs)
- Wikis (mainly used *within* libraries by library staff)
- Social bookmarking sites such as Del.icio.us, LibraryThing, and photo sharing sites where users can describe books or photos (used to provide book reviews, reader's advisory lists, user contributed subject terms or "tags")
- Open source software (used to develop or enhance library OPACs to allow user comments, reviews, and tagging)
- Social networking tools such as Facebook or MySpace (to notify specific user groups about programs or new resources in the library)
- Podcasting or videocasting (to teach library/information literacy skills; to let users know about new programs and resources; or for guest lectures)

Library 2.0 Timeline

Applications of Web 2.0 philosophies within the library context have been conceptualized as *Library 2.0,* or *L2* for short. The term *Library 2.0* is attributed to a post by Michael Casey in 2005 on his blog "LibraryCrunch." Casey and Savastinuk (2006) emphasize the need for user-centered change, encouraging participation by users in the creation of both physical and virtual library services, and the breaking down of barriers between libraries and users. However, in libraries, as in any other organizational or cultural context, radical trust is required to embrace change. According to Fichter (2006), "radical trust" implies trust within the community, allowing and encouraging users to participate in developing library services. In libraries, one area where the issues surrounding radical trust are seen most is through libraries' use of social software by allowing users to contribute to library OPACs. Librarians are concerned with the loss of authority and accuracy when users contribute content, such as tags, reviews, or comments to library catalog records. However, Abbas and Graham (2006) see this user participation as a means to bridge the chasm between users and library resources. Learning more about user-generated, collaborative content can also inform library and information professionals of new ways to augment past practices and develop new systems and services (Abbas, 2007; Graham & Abbas, 2007; Spiteri, 2007).

Below is a brief timeline demonstrating milestones of social software adoption in libraries. This timeline, however, is not inclusive of all forms of social software, as little documentation is available about the initial use of blogs, wikis, or podcasts in libraries.

Prior to 2003 – 2004: One of the first websites that allowed users to contribute links and sites to newstories was Slashdot, which was developed in 1997. Further sites such as Del.icio.us (developed by Joshua Schachter in 2003-2004), Furl (in 2004), and a host of others (Simpy, Spurl, Raw Sugar) were developed during 2003-2004. The year 2004 also saw the first use of the term *Web 2.0* by O'Reilly and Battele.

2005: *Library 2.0* was coined by Michael Casey and LibraryThing, Flickr, and other social sharing sites were made available on the web in 2005. Users were encouraged to organize and tag their own collections of books, photos, and bookmarks, and to tag and comment on other user's collections as well. The Steve.museum.org tagging project began to explore user-generated tags in museum's online collections. This project illustrates one of the first large scale research efforts to learn more about the feasibility of employing user-contributed tags to index images on the museums' websites.

2006: The PennTags project at the University of Pennsylvania began. The University of Pennsylvania community is invited to tag or comment on library resources within the library's OPAC using a homegrown system developed by the University of Pennsylvania. Library integrated system vendors also begin to integrate tagging, faceted and visual search and classification into library OPACs.

2007: Libraries begin implementing user-contribution features into their library OPACs. For example, in Jan. 2007 SOPAC was developed by the Ann Arbor District Library, which incorporated tagging, commenting, and reviews into the library's OPAC. In May 2007 LibraryThing for Libraries was launched. Libraries could connect their OPACs to LibraryThing using specialized software, that allowed users to provide tags for library resources. Danbury Library, in Connecticut, was the first library to have gone live with LibraryThing for Libraries. As of February 2008, the LibraryThing for Libraries site notes 40 member libraries.[1]

USE OF SOCIAL SOFTWARE IN LIBRARIES

To date, little research has been conducted into the extent, uses, and implications of social interactive technologies in libraries. Abbas, Chen, and Lomax (2007) and Bejune (2007) focused on the use of social software in public libraries. A landmark study conducted by the OCLC Online Computer Library Center (2007), a nonprofit service and research library consortium, presented attitudinal responses from the general public and library directors about the role that libraries should play within social networking. The study also measured the general public and library directors' use of social networking and social media sites, as well as other online habits (e.g., use of commercial sites, search engines, etc.). The results related to the use of social software in libraries are presented below.

Contemporary research on Web 2.0 technologies in libraries appears to be concentrated on the phenomena of "tagging" within social bookmarking and photo sharing sites like Del.icio.us, Furl, LibraryThing, and Flickr. One such study that is tangentially related to libraries' use of social software was conducted by Spiteri (2007), who explored how tags in Furl, Del.icio.us, and Technorati reflect current standards for developing controlled vocabularies (thesauri and subject heading lists).

It is important to note that research on the use of "user-generated content" in libraries began much earlier than the emergence of the concept of Library 2.0. Image retrieval researchers concerned with achieving better access to rich collections of images in contexts such as libraries, archives, art history departments, and newspapers have been exploring the use of user-generated descriptors (user-contributed content) since the mid 1990's to present. Examples include:

- Hastings (1995) had users apply their own descriptions to a collection of Caribbean paintings, and O'Connor, O'Connor, and Abbas (1999) explored the gathering and application of user-defined/supplied descriptors for personal photographs;
- Ornager (1997) and Neal (2006) examined how newspaper journalists requested and searched for images by using captions in newspaper databases;
- Greenberg (2001) examined user-supplied descriptors for business and medical applications;
- Abbas (2001, 2005) explored the vocabulary problem in digital libraries and systems designed for youth, and proposed utilizing most frequently used search terms as user-defined descriptors to build controlled vocabularies;
- Reuter and Druin (2004) used descriptors provided by children for digital picture books in the International Children's Digital Library.

Most of the related literature focuses on defining Library 2.0, as well as presenting the best practices and ideas for using the different technologies in one's own library. The literature demonstrates how libraries can implement proprietary applications that augment existing systems, use open source software, develop their own in-house applications, and integrate currently available social interaction technologies.

Additionally, the literature conveys a number of concerns that members of the profession hold, including acting too abruptly to embrace new technologies before they are fully matured; or, as is the case in many libraries, before their basic web presence has developed. Breeding (2007) sees the current implementation of Web 2.0 technologies as creating "silos of information" or "small containers of isolated information" on a library website (pp. 24-25). As a result, patrons may experience difficulty navigating through library websites to locate the silos that may be present on blogs and wikis pages. Breeding is concerned with the issues of interoperability between systems, as well as the need for the development of common information architecture for library systems. Interoperability issues still remain in the current library automation environment, and Web 2.0 tools have done little to resolve them.

Bejune (2007) presents the first study on the use of wikis in libraries. The study uses the framework of CSCW (Computer Supported Cooperative Work) to examine how libraries and librarians are using wikis to collaborate with each other and with users. Bethune used a sample of 33 wikis identified from a review of library and information science literature, the Library Success wiki,[2] and messages from three professional listservs (LIBREF-L, Web4lib, and DIG_REF). Bethune developed four categories of collaborations using CSCW as a framework. Results of his study (p. 32) demonstrated that the majority of library wikis (77.1%) were used for collaboration among libraries and among library staff within a library (categories I and II). Collaborations between library staff and patrons or between patrons themselves (categories III and IV) were less frequent (22.9%). The results are summarized below.

- Collaboration among libraries (extra-organizational) 45.7 percent
- Collaboration among library staff (intra-organizational) 31.4 percent
- Collaboration among library staff and patrons 14.3 percent
- Collaboration among patrons 8.6 percent

Further examination of library wikis reveals that the majority of the wiki sites analyzed by Bejune were hosted by academic libraries (19 out of 33), including 1 public library, 1 school library media center, 3 professional library associations, 2 wikis related to professional conferences, and 3 associated with either national or state-wide digital library projects. While Bejune's study is by no means exhaustive, it does provide a useful framework to study the application of wiki technologies within the library community. Bejune also presents some ideas on why wikis are used more in categories I and II rather than in III and IV. For example, librarians are accustomed to collaborating with each other within their organization or between libraries. Reasons for low use in categories III and IV include: (1) libraries are perceived by users as repositories of resources, not places for collaborative work; (2) there may be concerns within the library community about authority, responsibility, and liability; (3) wikis may be better suited for activities in categories I and II; and (4) wikis are still new technologies. Librarians may be experimenting within "safer contexts" before trying more public projects (p. 32-34).[3]

OCLC Study of Attitudes toward Social Software Use in Libraries

To learn more about online habits, social software, and social media site use by the general public and library directors, OCLC (Online Computer Library Center) conducted an online survey of 6,163 members from the general public of Canada, France, Germany, Japan, the U.K., and the U.S.

Researchers also surveyed 382 U.S. library directors. The findings illustrated the use of social interactive technologies in libraries worldwide. The survey also uncovered many telling features related to the attitudinal views of the general public and library directors related to social software use in libraries. The study did not measure the actual use or implementation of social software within libraries, since few libraries were actually using social software at the time. The key attitudinal points were identified as follows:

- The general public does not currently see a role for libraries in the social networked world
- 6% of the general public answered that they were very likely/extremely likely to describe their collection on a library social site
- 5% of the general public would share videos/photos on a library social site
- 13% of the general public would like notifications when new items were added to the library
- 8% of the general public would share ideas with library staff about services
- 6% of the general public would participate in online discussion groups or use library social sites to meet others with similar interests
- 14% of U.S. library directors considered building social networking sites for their communities (OCLC, 2007, pp. 5-1 – 5-5).

In an effort to ascertain the implementations and use of social software within libraries and museums, Abbas and colleagues have been conducting a census of social software use and tagging in libraries and museums. Preliminary findings of this research were presented at the 2007 annual meeting of the American Society for Information Science & Technology (ASIST) during a panel session on tagging activities in libraries, newspapers, and education (Abbas, Chen, & Lomax, 2007). The sampling frame, method, and preliminary findings of this ongoing study are presented below. The study is currently examining the extent of use of all types of social software within libraries.

Sampling Frame and Research Method

To gather a sample of libraries (public, academic, school, and special), a directory of library web sites and catalogs (lib-web-cats) was utilized. [4] The lib-web-cats directory is a searchable database of over 32,000 libraries worldwide developed by Marshall Breeding, the Jean and Alexander Heard Library's director for innovative technologies and research at Vanderbilt University in Nashville, Tennessee. The directory contains links to each library's website and online catalog, information about the library type, geographic location, address, current and previous library automation systems used, size of the collection, and also presents the most exhaustive source of information on libraries. At the time of the study, the site included information on 16,887 public libraries in the U.S. In addition, research literature on libraries and tagging was reviewed and all websites listed there were visited.

Libraries were selected by state from within the U.S from the lib-web-cats database. To provide a random sample, every tenth library site was accessed. Data was gathered on types of social software being used by the library, whether or not the library allowed users to tag or create content on their website, any specific uses noted, audiences/users targeted by the technology, type of library, location, as well as issues with accessing or locating the social software within the library's website. The data were gathered in a Microsoft Access database and notes about access issues and other relevant information about each site were recorded in a spreadsheet.

Preliminary Findings

As mentioned above, since this is an ongoing study, the findings presented reflect the study as reported in 2007 and only focus on use of social software and tagging within libraries.

A total of 70 sites were reviewed for this analysis. Of that sample, it was found:

- 70% of the total sample of libraries and museums (49 out of the total sample reviewed) included some mechanism for tagging on their website
- 81% of the public library sites reviewed (30 out of 37 total public library sites) included some mechanism that allowed users to contribute tags to their library
- 76% of the academic library sites reviewed (13 out of 17 total academic library sites) provided user tagging, and
- 37.5% of the museum sites reviewed (6 out of 16 total museum sites) included user tagging.

Tagging in libraries was found to employ different methods of social cataloging, live tagging, and social bookmarking, described in detail below.

Live Tagging and Social Cataloging

Some libraries allowed users to contribute their own subject terms or tags directly to online public access catalogs (OPAC):

- Tags appear on records in the library's OPAC catalogs
- Users can choose from a tag cloud, e.g., "500 Most Popular Tags," "Top 10 Tags" or "10 Most Recent Tags"
- Users have access to customer reviews
- Users are offered cooperative bookmarks such as "Customers who checked out this item also checked out…"

Only the Ann Arbor District Library, SOPAC, and two academic libraries, the University of Pennsylvania, and Midlands Technical College in South Carolina were employing live tagging at the time of the study.

Libraries can utilize LibraryThing services as follows: (a) they can link directly to their LibraryThing account where users can view a tag cloud of tags used by the library; (b) with LibraryThing for Libraries, the library's OPAC is integrated with LibraryThing.

- Users can search by tags through a special "Tag Browser"
- Tags are imported from LibraryThing
- Users of the OPAC catalog cannot directly add their own tags.

At the time of the study, the Danbury Public Library, in Connecticut, was the only public library employing LibraryThing for Libraries, and no academic libraries were using LibraryThing.[5]

Social Bookmarking

Libraries use social bookmarking sites to organize online resources for their patrons. Typically, there is a link to the Del.icio.us page from the library's website, though few libraries in the sample linked back to the library's website from their Delic.io.us site. Delic.io.us was also used by libraries to set up online reading lists for their users. This social bookmarking site was the most popular technology in use–80% of all public libraries in the sample that provided mechanisms for tagging used Delic.io.us. Academic libraries also used Del.icio.us, but preferred more academic-centric social bookmarking sites, e.g., Connotea and CiteULike.

FUTURE TRENDS

As mentioned above, there is little research focused on the adoption and applications of Web 2.0 technologies within public libraries. The research by Bejune and Abbas provides a useful framework to study this issue in greater depth. The OCLC study offers valuable insights into the attitudinal views of both the general public and library administrators on the role of libraries in the social networked world. For now, these views do not overly support the adoption of social interactive technologies, although the findings encourage libraries to do so. More research into the extent of use, motivations for use, and feasibility of using each novel technology is needed.

The social and organizational aspects of implementing and utilizing Web 2.0 technologies in libraries should also be addressed. The literature illustrates the concern that library and information professionals express about issues of trust, authority, accuracy, responsibility, reliability, and ethics related to employing Web 2.0 tools. These discussions also raise the question of whether or not library and information professionals believe the critical tenants of librarianship are being challenged when libraries encourage collaboration and contribution by their users in this novel, ever-changing environment. Overall, several areas of interest within the library and information science (LIS) community relating to future research of social software have been identified (Graham & Abbas, 2007): (a) the long-term success of social software and tagging in practical and scholarly use, (b) specific use in scholarly environments, (c) effect on LIS practices of annotation, cataloging, and indexing and abstracting, (d) effect on LIS education, (e) scalability within systems, and (f) continued support and participation by users.

CONCLUSION

Social software deployment in libraries is an important phenomenon that requires further study. As more libraries begin to use social interaction technologies, more research into practical, social, organizational, and professional issues encountered by the library and information science community is needed so that libraries can make informed decisions about whether or not to use social software. While it is beneficial to hear success stories to garner ideas for augmenting library services, there are still technological and ethical issues needing exploration. Web 2.0-based applications can offer much to libraries, and while the philosophies of Web 2.0 and Library 2.0 may refresh and advance the thinking of the profession, their adoption should be looked at with an eye for outcomes and usefulness, and not on the threat of being outmoded.

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ONLINE RESOURCES

Del.icio.us http://del.icio.us

Flickr http://www.flickr.com

Furl http://www.furl.net

Library Success wiki http://www.libsuccess.org

Library Technology Guides. lib-web-cats http://www.librarytechnology.org/libwebcats

LibraryCrunch http://www.librarycrunch.com

LibraryThing for Libraries http://www.librarything.com/forlibraries

LibraryWikis http://librarywikis.pbwiki.com

PennTags http://tags.library.upenn.edu

Raw Sugar http://www.rawsugar.com

Simpy http://www.simpy.com

Slashdot http://slashdot.org

Spurl http://www.spurl.net

KEY TERMS AND DEFINITIONS

Blog: Short form of the word *weblog*. Blogs are online interactive journals or newsletters. Readers are encouraged to post comments and to engage with the author and other readers. Blogs can include other Web 2.0 technologies, such as RSS feeds, podcasts, videos, and tagging.

Library 2.0: The application of the Web 2.0 technologies and philosophies within the library context to improve or provide new services to user communities.

OPAC: A library's online public access catalog that provides access to the services and collections of a library.

Social Bookmarking: Web environments that provide users with the means to organize, describe, and share their resources (web bookmarks, books, and photographs) with others. Sites such as Del.icio.us, LibraryThing, and Flickr are examples.

Social Networking: A Web 2.0 service that provides users with a platform to set up personal spaces online to share information, music, software applications, etc.

Social Software: Web 2.0 technologies used to communicate, share, organize, collaborate, and extend functionality of other web applications. Blogs, wikis, social bookmarking, and social networking technologies are examples.

Tagging: Providing terms to describe resources in a social bookmarking environment. Tags can be used to sort, retrieve, and find the resources by the tagger or others that use the site. Tagging is also referred to as *user-generated descriptors* or *user-contributed content*.

Web 2.0: Using the World Wide Web as a service-oriented platform to connect devices, protocols, standards, and applications. The Web 2.0 philosophies include: rethinking how software is developed and distributed, and enabling more human connections through conversations, collaboration, participation, and exchange of ideas and technologies.

Wiki: A collaborative website that provides a platform for users to contribute, edit, or remove content.

ENDNOTES

1. http://www.librarything.com/forlibraries/
2. http://www.libsuccess.org
3. See also Bejune's companion wiki available at http://librarywikis.pbwiki.com
4. Lib-web-cats directory is available at http://www.librarytechnology.org/libwebcats
5. LibraryThing for Libraries launched in May 2007.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova & R. Fiordo, pp. 451-461, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 4.13
Social Computing:
Implications for E-Government

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ABSTRACT

This article examines the area of social computing and its implications for electronic government (e-government). Social computing is a broad term that refers to different products and services that supports human interaction in a computer mediated environment. Terms such as online communities, peer networking, and social software have overlapping meanings with social computing (Parameswaran and Whinston, 2007). E-government refers to the delivery of government services via information and communications technology to citizens, businesses, employees, government agencies and special interest groups. In this article we present a theoretical model for the application of social computing in the area of e-government and we use an analysis of state websites to assess the extent of social computing development in the e-government domain. Our findings indicate that social computing is in its infancy in e-government applications. We make recommendations and analyze the potential value and challenges of social computing in e-government.

IINTRODUCTION

Social computing refers to a variety of web-based products that allow individuals to interact with each other in both synchronous and asynchronous environments. Social computing is demonstrated through means such as online communities, virtual games, newsgroups, and online chats. In May 2006, approximately 74% of United Stated internet users visited a social networking site (comScore, 2006).

The prominence and popularity of government websites is minuscule when compared to social computing environments. In the global arena, many countries have undertaken ambitious e-government projects to interact with their constituents. The four main constituents interacting with governments are citizens, employees, businesses, and other governments. Globally, e-government has advanced at different rates and varies depending on the level – local, country, or region. The global e-government leaders, identified by the United Nations (UN) e-government readiness index are ranked as 1.Sweden, 2.Denmark, 3.Norway, 4.United States, and 5. Netherlands (UN E-government survey, 2008). The e-government readiness index is a composite value that includes components for the country's telecommunications infrastructure, the stage of e-government development, and the human capital index (adult literacy and gross enrollment ration) (UN E-government survey, 2008).

Social computing provides an avenue to take e-government to the next level of development. In this article we explore the value of incorporating social computing capabilities into e-government initiatives. As e-government advances, interactive components can enhance user involvement. This study presents a theoretical framework for inclusion of social computing in e-government projects. We then use state websites to examine the current level of adoption of social computing in e-government, and present recommendations for future research projects. The aim of this study is to fill the gap in the existing literature with respect to the application of social computing in the domain of e-government.

SOCIAL COMPUTING

Social computing is a broad term that refers to different products that support human interaction in a computer mediated environment. Terms such as online communities, peer networking, and social software have overlapping meanings with social computing (Parameswaran and Whinston, 2007). Social computing incorporates tools such as threaded messages, blogs, and wikis for individuals to share information (Neumann, Hogan, and MacDonaill, 2005). Additionally, virtual worlds, social networks, multi-player games, and newsgroups are also examples of social computing. Social computing is different from traditional face-face social environments because it is: "mostly decentralized, highly dynamic, highly transient, fluid boundaries, rich content, highly mobile, very highly scalable (Parameswaran and Whinston, 2007 pp.338)." Globally, six of the ten most popular websites are social computing environments (Alexa, 2008), for the list of top ten most visited websites see Table 1.

The term "blog" derived from the term weblog, is typically a website where an individual makes periodic entries. A blog is defined as a website with dated entries – or "posts" – in reverse chronological order, written by a single author or a group of authors, often accompanied by links to other blogs that the site's editor visits on a regular basis, in order to allow for further exploration of the sources. In many cases, those frequently visited pages are grouped in a list of favorites or "blogroll". Each post usually allows for comments, and can also provide an instrument to "track back" or back link posts in other blogs that refer to the original one. With these instruments, visitors can not only follow a specific blog, but also expand their sources to other blogs that link to or are linked from the first one, forming a web of related blogs.

Early blogs were started by web enthusiasts who would post links to "cool stuff" that they found on the Internet. They added commentary and began posting daily. They read and linked to each other's blogs. In this sense, Kumar et al. (2004) affirm that blogs tend to be quirky, highly personal, typically read by repeat visitors, and provide an inside into a very active community. Vogelstein (2005) identifies blogging technology as among the top "10 tech trends to watch in 2005" by Fortune magazine. Ashley (2002) mentions

Table 1. Global top 10 websites

Website	Description
1. Yahoo (www.yahoo.com)	Personalized content and search options. Chatrooms, free e-mail, clubs, and pager.
2. YouTube (www.youtube.com)	YouTube is a way to share videos.
3. WindowsLive (www.live.com)	Search engine from Microsoft.
4. Google (www.google.com)	Search engine.
5. MySpace (www.myspace.com)	Social networking site.
6. Facebook (www.facebook.com)	Social networking site.
7. Microsoft Network (www.msn.com)	Content provider
8. Hi5 (www.hi5.com)	Social networking site.
9. Wikipedia (www.wikipedia.org)	An online collaborative encyclopedia.
10. Orkut (www.orkut.com)	Social networking and discussion site operated by Google.

that blogs and their model of content production and platform interoperability are proving to be increasingly useful and powerful, inspiring innovative developments and uses for the web. The power of blogs is their ability to immediately put form to thought, and in seconds, share it with the world.

From a historical perspective the earliest social computing initiatives were USENET newsgroups of the late 1970s (Reid and Gray, 2007). Online newsgroups provide an asynchronous environment for users to share information via posted messages. Online newsgroups allow users to create threads for new messages, and also respond to comments posted by other users. Recently, the increase of synchronous methods for online interaction such as chat, has resulted in a steady decrease in the use of online newsgroups (Zaphiris and Sarwar, 2006).

Wikis are open content material that are editable by all members of the community (Neumann et al., 2005). Wikipedia is the best know wiki with over six million articles in over two hundred and fifty different languages (Orr, 2007). Due to the open nature of Wikipedia the accuracy of its content is sometimes questioned, however a recent study by *Nature* journal indicated that for any article, Wikipedia's content had approximately four errors while Encyclopedia Britannica had three errors (Giles, 2005). A controversy naturally ensued as Britannica vehemently disputed the study's results (EncyclopaediaBritannica, 2006). In a business context wikis provide an opportunity for collaborations, but they also increases vulnerability to web site vandalism and destruction of intellectual property (Wagner and Majchrzak, 2006-2007).

Virtual worlds such as Second Life represent another dimension of social computing. Second Life users create a digital persona and engage in activities akin to those of the real world. Second Life members engage in activities ranging from financial transactions to networking with other members. Businesses and institutions such as IBM, Dell, Cisco, Nissan, National Public Radio, Harvard Law School, and Emory University all have created a virtual presence in Second Life (Bray and Konsynski, 2007). Virtual worlds represent a "resort economy" where people use real money to consume virtual products and everyone is "having a good time" (Noam, 2007). Unfortunately, social, legal, ethical, and political ills of the real-world can also encroach into virtual worlds.

A social network is broadly defined as a group of individuals connected by a set of relations

(Downes, 2005).Online social networks, such as Myspace, Facebook, Friendster, and HiFive provide a platform for users with common interests to share information with each other. In 2005 there were over 300 known social networking sites online (Reid and Gray, 2007). The popularity of social networking sites has ignited research interest in the current academic literature (Charnigo and Barnett-Ellis, 2007; Neumann et al., 2005; Reid and Gray, 2007). Online social networks serve as a complement or extension of the user's real-world life since many users in online social networks interact in an off-line environment (Charnigo and Barnett-Ellis, 2007).

Massive Multiplayer Online Role Playing Games (MMORPGs) such as Everquest (www.everquest.com) and World of Warcraft (www.worldofwarcraft.com) represent another dimension of social computing. The main difference between MMORPGs and other social computing environments is that there is usually an explicit plot for users in the former, while the later does not (Bray and Konsynski, 2007). MMORPGs are designed for entertainment purposes, but they also represent a world where users can become immersed into the life of their virtual persona. It is estimated that Korea has over half a million online game addicts, and the government is trying to combat the problem by conducting annual surveys and providing counseling services (Ihlwan and Jacobs, 2006).

Web 2.0

Web 2.0 services, facilitate interactivity and fluid boundaries between users and developers (O'Reilly, 2005). O'Reilly, the originator of web 2.0 also identifies companies such as Flickr and Napster and items such as blogs, wikis, cost per click, and search engine optimization, as examples of what characterizes web 2.0 and differentiates it from web 1.0. Open source applications are also driving the development of web 2.0 applications (Gupta, 2007).

Web 2.0 encompasses a wide range of products, services, and applications and is not constrained by a single static definition. Businesses recognize the value of web 2.0 applications and are harnessing available opportunities. RSS (real simple syndication) is another web feature associated with web 2.0. RSS allows users to subscribe to their favorite sites and receive information every time the site is updated. The international investment bank Dresdner KLeinwort Wasserstein has successful implemented wikis which replaced intranet pages, and are used for project development and information sharing by approximately 2,500 employees (Orr, 2007). Web 2.0 applications can also have negative social implications for the business world. Recently, companies like Delta, Google, and Microsoft have terminated employees that published disparaging comments about the company on blogs (De Piante, 2007).

E-GOVERNMENT

E-government refers to the use of information and communications technologies (ICTs) by governments to interact with citizens, employees, businesses, and other government agencies. E-government is generally classified into different groups based on the primary stakeholder (citizens, employees, businesses, governments) that is interacting with government. The main e-government categories are government-to-citizen (G2C), government-to-employee (G2E), government-to-business (G2B), and government-to-government (G2G); with G2C as the most dominant area of interest to both developers and researchers.

The goals of e-government projects range from providing increased services to citizens to reengineering internal business processes. The e-government platform introduces an alternative medium for citizens to interact with government. Successful e-government projects can improve strategic planning, reduce costs, and also improve relationships between management and employees (Ruël, Bondarouk, and Looise, 2004). E-government projects can be implemented at different levels including country level, federal level, state level, and local level.

Several different researchers (Andersen and Henriksen, 2006; Layne and Lee, 2001; Murphy and Shleifer, 2004; Siau and Long, 2005) have defined models to explain the growth of e-government. Layne and Lee's 2001 model describe four stages of e-government development: cataloguing, transaction, vertical integration, and horizontal integration. A second model (Ke and Wei, 2004), identifies three sequential phases for the development of e-government projects: initiation, infusion, and customization. Andersen and Henriksen (2006) identify four stages: cultivation, extension, maturity, and revolution. Siau and Long (2005) used a meta-synthesis of other e-government models to create a newly synthesized model with four stages: web presence, interactions, transaction, and transformation. The common theme across the e-government development models show e-government as an evolutionary process, typically with early stages of static web-pages that leads to more advanced stages with interactivity and political participation.

E-Participation

As governments move online, a major objective is for citizens to access the services that are available. E-participation serves as an umbrella term for user involvement in online activities. In terms of e-government, e-participation can involve activities such as using government services, online polling, online voting, and attending online meetings. *E-political participation* addresses online participation in political activities ranging from information searches to political activism. Further, users that participate in online social and economic activities have an increased likelihood of participating in e-political activities (Shelley, Thrane, and Shulman, 2006). Demographic factors such as higher education and youth (Shelley et al., 2006) are also positively correlated with e-political participation. Although teenagers and senior citizens select divergent topics in online social groups, politics is the one theme that is captured across both demographic groups (Zaphiris and Sarwar, 2006). Interestingly, e-political participation does not necessarily translate into actual off-line political participation in activities such as voting.

In 1999 over 100,000 supporters used blogs and the social networking site Meetup as part of the presidential campaign for Howard Dean (Reid and Gray, 2007). In 2008 presidential candidates Hillary Clinton, John McCain, Barack Obama, and Ron Paul (listed alphabetically) all used social networking sites to generate support for their campaigns. The number of Facebook supporters listed for each candidate was: Clinton-143,529; McCain-106,410; Obama-341,270; Paul-84,365 (Facebook, 2008).

THEORETICAL FRAMEWORK

Social computing provides a new area for development and expansion of e-government initiatives. Each area of e-government: G2C, G2E, G2B and G2G, can be impacted by social computing. Social computing can be used instead of paper forms to manage feedback from citizens to government agencies (Bevarly and Ulma, 2007/2008). Online communities have traditionally been anonymous (Parameswaran and Whinston, 2007), but today many users see anonymity as optional. Whether anonymous or not, social computing provides a platform for stakeholder involvement with e-government. We propose that social computing will impact e-government in two main areas: communication type and interaction level. Communication type refers to whether social computing is occurring in a synchronous or asynchronous mode. Interaction level refers to whether e-government facilitates interaction with stakeholders through their participation or through the implementation of government regulation. Participation refers to actions initiated by the user, such as chatting or posting a message. Regulation refers to actions initiated by government such as tickets, and fines. Figure 1 represents the theoretical framework for this study.

An e-government project can provide the platform for virtual meetings with citizens, employees, and businesses. The town of Cary, North Carolina has used the web to post detailed staff reports and also interactive components such as online surveys and discussion boards (Bevarly and Ulma, 2007/2008). As e-government services expand, fully operational virtual meetings can add another dimension of interactivity to involve different stakeholders in democratic processes. Employees at different levels can also benefit from the introduction of virtual meetings. As an e-government project matures, horizontal integration - linking different functional agencies, and vertical integration – linking different levels of government (Layne and Lee, 2001) can utilize virtual meetings to support a geographically dispersed workforce.

From an e-government context, virtual communities can also be used to foster community spirit and encourage participation in community activities. The focus of virtual communities has shifted from technology developments to usage, with individuality vs. community membership as an emerging theme (Jakala and Pekkola, 2007). At the local government level, virtual communities can provide an additional environment for individuals that already know each other to foster stronger community ties. However, one concern is that negative real-world influences can also be incorporated into virtual communities.

Online virtual worlds present a unique opportunity for government interaction through e-government. Virtual communities such as Second Life use real money for virtual transactions (Noam, 2007). The implications of such transactions indicate that there are real taxes that can be generated from virtual communities and the possibility of entities using virtual worlds as tax shelters (Bray and Konsynski, 2007). As the e-government platform matures federal, state and local governments can integrate functions into virtual worlds to collect taxes. Government regulation in the real-world involves financial penalties for traffic violations, property violations, misdemeanors, felonies, and other illegal activities. Since many real-world businesses have already assimilated into virtual environments, government involvement can be the next frontier.

Figure 1. Theoretical framework – social computing in e-government

INTERACTION LEVEL / COMMUNICATION TYPE	***Participatory***	***Regulatory***
Synchronous	-Chat -Virtual Community Eg: community meeting	-Chat -Eg: Issue citation
Asynchronous	- Message Board - Blogs Eg: community forum	-Forum Eg: post codes of conduct

METHODOLOGY

This study examines the websites of the fifty states in the United States (U.S.) for evidence of social computing. This is an exploratory study and we use only the state governments' website to examine for the social computing constructs. We used a bimodal variable where yes=1 and no=0 for the presence of each item found. Each website was examined until it led to an external site. An external site is considered to be any site outside of the main e-government page. Examples of external sites include universities, businesses, non-profit organizations, and any other entities that are accessed from the government page. The primary page that was accessed was the United States government page (www.usa.gov/Agencies/State_and_Territories.shtml) that then provided links to the official state web pages. Each state website was examined for the following eight components: chat, message boards, virtual communities, forums, blogs, wikis, RSS, and other (representing any *other* or novel approach to social computing)

To conduct a search for the above listed items we accessed the states' websites. While on the page we traversed each section for evidence of the above listed items. We also used the pages' internal search engine and submitted each of the above options as part of a key word search. The list of the fifty sites visited is available in Table 2. All data was collected over a two-week period in the spring of 2008.

RESULTS AND IMPLICATIONS

The websites of all fifty states in the United States (U.S.) were examined for the presence of social computing components. This section presents the results of the data analysis and discusses its implications. Of the fifty sites examined 34% contained a chat feature. In all instances the chat feature was used to provide live help to visitors of the website. Interestingly, the live help chat feature was usually provided as a service on the website, but affiliated with the public library system. Only one site provided a feature that looked like a message board. The site allowed people that lived in the state to comment on personal experiences while living there. A note on the site indicated that all comments will be reviewed by an administrator before being posted on the site.

Only two sites provided the opportunity to participate in a virtual community. The two sites allowed users to link to external sites and participate in a virtual community. One state allowed its residence access to a Facebook group where they can communicate about the state. The second site allowed users to participate in a social group to quit smoking. Neither of the two virtual communities identified were sponsored by the official government site. They however, are relevant to this study since they were both accessed from the state's primary e-government page.

Blogs were identified on 18% of the state pages examined. The contents of the blogs identified were associated with the following: 1.activities of the state's governor, 2.travel and tourism experiences, and 3.small business initiatives of the state council. The blogs were accessible for all visitors of the website. Lastly, the most common component identified on these sites was RSS. Of the 50 websites, 56% allowed visitors to subscribe for an RSS feed. RSS is a proxy for web 2.0 services that are available on the website.

As outlined in the earlier sections of this article, there are many potential benefits of incorporating social computing into e-government projects. However, as with any emerging technology there are opportunities for abuse. There can be unintended adverse effects associated with the use of social computing in e-government. Anonymous leaks can be used to disseminate confidential information and make unauthorized disclosures of government information (Swartz, 2007). However, in the sites examined, there was very limited use of social computing components. The few sites that

Table 2. E-government site of fifty U.S. states

State	E-government Website
Alabama	http://www.alabama.gov
Alaska	http://www.state.ak.us/
Arizona	http://az.gov/webapp/portal/
Arkansas	http://www.state.ar.us/
California	http://www.ca.gov/
Colorado	http://www.colorado.gov/
Connecticut	http://www.ct.gov/
Delaware	http://www.delaware.gov/
Florida	http://www.myflorida.com/
Georgia	http://www.georgia.gov/00/home/0,2061,4802,00.html
Hawaii	http://www.ehawaii.gov/dakine/index.html
Idaho	http://www.accessidaho.org/
Illinois	http://www.illinois.gov/
Indiana	http://www.in.gov/
Iowa	http://www.iowa.gov/state/main/index.html
Kansas	http://www.kansas.gov/index.php
Kentucky	http://kentucky.gov/
Louisiana	http://louisiana.gov/wps/wcm/connect/Louisiana.gov/Home/
Maine	http://www.maine.gov/
Maryland	http://www.maryland.gov/portal/server.pt?
Massachusetts	http://www.mass.gov/?pageID=mg2homepage&L=1&L0=Home&sid=massgov2
Michigan	http://www.michigan.gov/
Minnesota	http://www.state.mn.us/portal/mn/jsp/home.do?agency=NorthStar
Mississippi	http://www.mississippi.gov/
Missouri	http://www.missouri.gov/
Montana	http://mt.gov/default.asp
Nebraska	http://www.nebraska.gov/index.phtml?section=nol
Nevada	http://www.nv.gov/
New Hampshire	http://www.nh.gov/
New Jersey	http://www.state.nj.us/
New Mexico	http://www.newmexico.gov/index.php
New York	http://www.state.ny.us/
North Carolina	http://www.ncgov.com/
North Dakota	http://www.nd.gov/
Ohio	http://ohio.gov/index.stm

continued on following page

Table 2. Continued

Oklahoma	http://www.ok.gov/
Oregon	http://www.oregon.gov/
Pennsylvania	http://www.pa.gov/portal/server.pt?
Rhode Island	http://www.ri.gov/
South Carolina	http://www.sc.gov/
South Dakota	http://www.sd.gov/
Tennessee	http://www.tennesseeanytime.org/
Texas	http://www.state.tx.us/
Utah	http://www.utah.gov/
Vermont	http://www.virginia.gov/cmsportal2/
Virginia	http://www.virginia.gov/cmsportal2/
Washington	http://access.wa.gov/home.aspx
West Virginia	http://www.wv.gov/Default.aspx
Wisconsin	http://www.wisconsin.gov/
Wyoming	http://wyoming.gov/

have adopted social computing initiatives as part of their e-government platform seem to be very cautious and conservative in their approach.

LIMITATIONS AND FUTURE DIRECTIONS

This study is exploratory in nature and provides a template for the examination of social computing in the emerging area of e-government. The study provides a theoretical framework for the inclusion of social computing into the e-government landscape, and uses state e-government websites for analysis. However, the main limitation of this study is the small sample size. Examining only fifty websites makes it challenging to generalize the findings to a generic e-government environment. A further study will require analysis of a much broader sample including local e-government sites such as cities, counties, and municipalities.

E-government website administrators and developers can also be interviewed to determine if social computing is part of the future agenda on the e-government site. As part of a future study, we can further examine how sites intent to use social computing, and what factors are supporting or hindering the use of such initiatives. One concern however, is that once social computing is incorporated into e-government, politicians can exploit the existing networks by influencing the community through establishing ties with the network's leadership (Murphy and Shleifer, 2004). This type of behavior is already prevalent in real-world settings so transference to social computing will not be entirely shocking. An empirical investigation of political influence through social computing is another area for further examination.

CONCLUSION

This study contributes to the growing literature examining social computing. The specific context examined is the emerging area of e-government. We use the fifty U.S. state e-government websites to examine the presence of social computing. The results of this study indicate that social computing is very new in the area of e-government. As e-government develops, social computing can be incorporated to support participation of citizens in government activities.

Globally, e-government is an emerging phenomenon and is in different developmental stages. The primary manifestation of e-government projects is through an official government website typically represented with a ".gov" extension. Social computing tools can be a valuable addition to e-government sites to increase both usage and visibility. However, some inherent challenges associated with site management and accountability can occur. Important questions pertaining to who will monitor and edit the content on e-government social computing sites also need to be addressed as developments occur. As with any emerging technology, initial capital expenditure by the government entity may also prove to be a limiting factor.

Social computing combined with e-government represents an exciting new frontier for exploration by both developers and researchers. E-government administrators can use the social computing platform to attract users to their sites. From the research perspectives, this area represents fertile soil for research projects ranging from usability studies, adoption facilitators and inhibitors, firm level impact, and individual behavioral components.

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This work was previously published in International Journal of Virtual Communities and Social Networking, Vol. 1, Issue 1, edited by S. Dasgupta, pp. 23-33, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 4.14
Designing for Disaster:
Social Software Use in Times of Crisis

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ABSTRACT

Using the London Bombings of 7 July 2005 as a case study, this paper illustrates the need for sociotechnical interventions in systems design. By employing Actor Network Theory the author makes visible the active participants and technologies within the ecosystems of social software. Such visiblity provides insight to the designer seeking to optimize communication systems in the wake of disaster. Guidelines for improving systems and user interfaces based on disaster scenarios are described.

BRIDGING THE SOCIAL AND TECHNICAL WITH ACTOR NETWORK THEORY

The rapid development of people-powered communication tools—cell phones, digital cameras, blackberries, laptops and their accompanying software, wikis, Facebook, My Space, and blogs have created a dynamic, constantly evolving space where ordinary people can communicate almost instantly. Moreover, the ability to easily place links and send data means that these dynamic sites weave themselves into an endlessly shifting web of interconnected references and allusions.

These Information and Communication Technology (ICT) systems have evolved amidst a tumultuous period of crises and disasters affecting millions. The urgency of upheavals—be they natural disasters or terrorist events—has spurred on the rapid creation and transformation of communication tools. Online social software, in particular, has a participatory culture that has responded to events in ways that add to and even circumvent traditional media channels. Our methods as designers of ICTs have not kept pace with the rapidly evolving technologies and the communities they support. In this paper, I propose a sociotechnical approach that can optimize these systems based partially on a previously published conference proceeding (Potts, 2008b) and my unpublished dissertation (Potts, 2007).

The acid test of sociotechnological design might just be the minutes, hours, and days after a natural or manmade disaster. Researching how people find and exchange information, share links, and offer support during these events can yield a more complete, detailed, and accurate understanding of how individuals communicate in response to terrorism, hurricanes, tsunamis and other crisis situations. Extending the sociotechnical discipline further by encouraging designers to become active participants within the activities they are trying to design for will lead to more robust systems that can mediate communication between participants. However, you cannot optimize that which you cannot recognize, and that is why finding a means to map situations and players is the essential starting point for improving design.

Actor Network Theory (ANT) offers an excellent method by which designers can begin to make visible and respond to social software ecosystems. ANT's creator, Bruno Latour, noted that his method should be used when "boundaries are . . . terribly fuzzy," since other social theories do not work so well when "things are changing fast," and this certainly describes the post-bombing activity on the internet (Latour, 2005). The major tenet of ANT is that all participants, whether they are human or non-human, have equal agency to affect any given situation. These participants are referred to as "actors," and they can be people or technologies. Actors come together to form a network, creating assemblages of relations, which are often temporary and specific to an individual action or a broader event.

Understanding this concept allows designers to see a landscape of participants—human or technological—who cooperate to create, validate, and share information. Illustrating these scenarios as well as finding the pathways taken by the participants of these social software systems will help designers rethink their current strategies for design and contextual use. Researchers have used ANT to reconsider the design of Common Information Spaces (CIS) with regard to Computer Supported Collaborative Work (CSCW) (Rolland, Hepsø, & Monteiro, 2006) to bring to light social issues within technology design (Berg, 1998), to understand emergence and diffusion of technology (Bruun & Hukkinen, 2003), to explore sociopolitical frameworks for user-centered design (Spinuzzi), and to support application development (Mackay, Carne, Beynon-Davies, & Tudhope, 2000; Tatnall & Gilding, 1999).

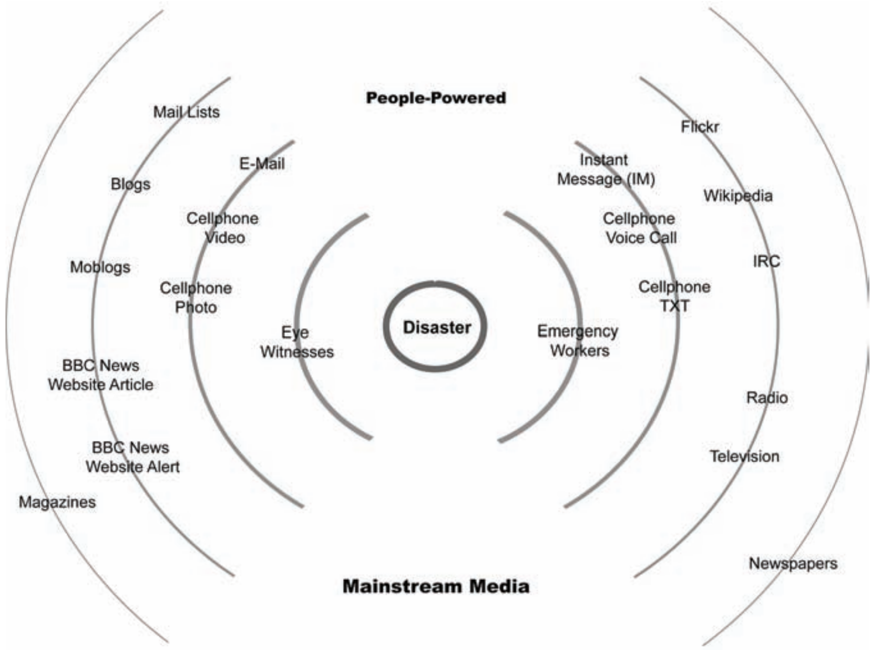
While I am not suggesting ANT as an "answer" or an end point for better social software design, I am claiming that it will provide designers with a methodology for leveraging their own participation, to gain insight into technology and its cultural use. In other words, it enables designers to see the social and the technical elements of systems including ephemeral, shifting, and expanding systems for which they are designing.

EMERGENT SOCIAL SOFTWARE ECOLOGIES

Over the last few years, social software such as blogs, wikis, and media-sharing sites have provided an outlet for people to share and distribute information. Some of these tools are already deployed, others are modified as disasters unfold, and a few are created as a result of the disaster.

The diagram in Figure 1 captures the sociotechnical context of an event. While this diagram

Figure 1. Sociotechnical ecosystem that must be made visible to design optimized systems



approximates disaster response generally, it draws on the specific ecosystem around the London Bombings of 7 July 2005. I cannot capture all of the ecosystems' participants, let alone represent Michael Callon's "mass of silent others," (Callon, 1987) the lurkers; nonetheless, this diagram offers a fairly comprehensive representation of the post-bombing communication activities (Law & Mol, 2003). This diagram illustrates emerging social software and traditional media systems as they extend outward from the center of a disaster. This figure deploys three principles Callon identified as crucial for regarding humans and technologies equally: agnosticism, symmetry, and free association (Callon, 1986). Agnosticism refers to examining human and non-human actors equally, with priority given to neither the technology nor the social issues surrounding them. Thus, technology and people are regarded as equal agents of action, and symmetry enforces the use of the same language to describe the actions of either humans or technology. Free association requires that such distinctions between humans and technology cease. This concept confronts both technological determinism and social constructionism. Two researchers who examined ANT as a methodology for examining information systems states that "we think in binaries which often leads us to designate an entity as either technological or social, and then we attribute specific properties to that entity in order to explain its behavior, thereby, adopting an essentialist position" (Tatnall & Gilding, 1999, p. 957). ANT seeks to avoid those binaries by equally granting agency and using similar language to describe the actions of these actors.

Adhering to these principles helps ensure that we use the same language to discuss how these actors are employed during an event and that we consider them on equal footing such that we can create a sociotechnical system optimized for exchanging information during a disaster. Closest to the center are humans who are direct participants in the event. Reverberating outward are the multitude of person-to-person (P2P) technologies typically used by those affected in the immediate area of the event or by those who have a stake in the outcome of the disaster. Farther out, the next layer includes social software and traditional media channels that distribute information to different community members. The outer layer includes the least effective tools for immediate communication, such as traditional newspapers and magazines with longer to-market schedules. The nearer to the center an actor is, the more effective and immediate communication to and from this actor will be during and immediately following a disaster.

The remainder of this paper will uncover and trace through the lens of ANT how those active participants are able to coordinate information (Callon, 1986). This can be quite complex. For example, take the case of an actor posting an image to Flickr in the wake of a disaster. Another actor sees the image, recognizes it as her son, and posts her recognition on Flickr. According to ANT, this single communication act contains at the minimum six actors: Flickr, the poster of the image, the mother who posts a comment, the son in the image, the camera that took the image, and the terrorists who caused the disaster in the first place. Once these communication exchanges are made visible, completely new associations can be seen and traced further. ANT reveals these traces, allowing the actors to instruct the designer on what these connections might mean. Such involvement makes the designer aware of and socially engaged in how everyday people are employing these communication tools. These insights will aid designers in creating future communication tools based on real-world participant activities.

CASE STUDY: LONDON BOMBINGS OF 7 JULY 2005

Designers can neither create new systems nor optimize current tools if they do not recognize how people are currently using these systems. When we understand the sociotechnical context and visualize it, we can begin to optimize these systems and design for flexibility to support cultural change and technological improvements.

On 7 July 2005, London's public transport system was attacked by a series of suicide bombings that killed 52 and injured over 770 people. The attack occurred during the morning rush hour, and many of the victims were commuters toting communication devices, such as cell phones, blackberries, and laptops—the newly indispensable tools of their trade. As the crisis unfolded, these victims and bystanders were poised and ready to exchange information with unprecedented detail and speed. Directly after the bombings, participation on social software websites spiked as commuters snapped photos with cell phones, posted to their mobile blogs ("moblogs"), and swapped questions, news items and links to more relevant information.

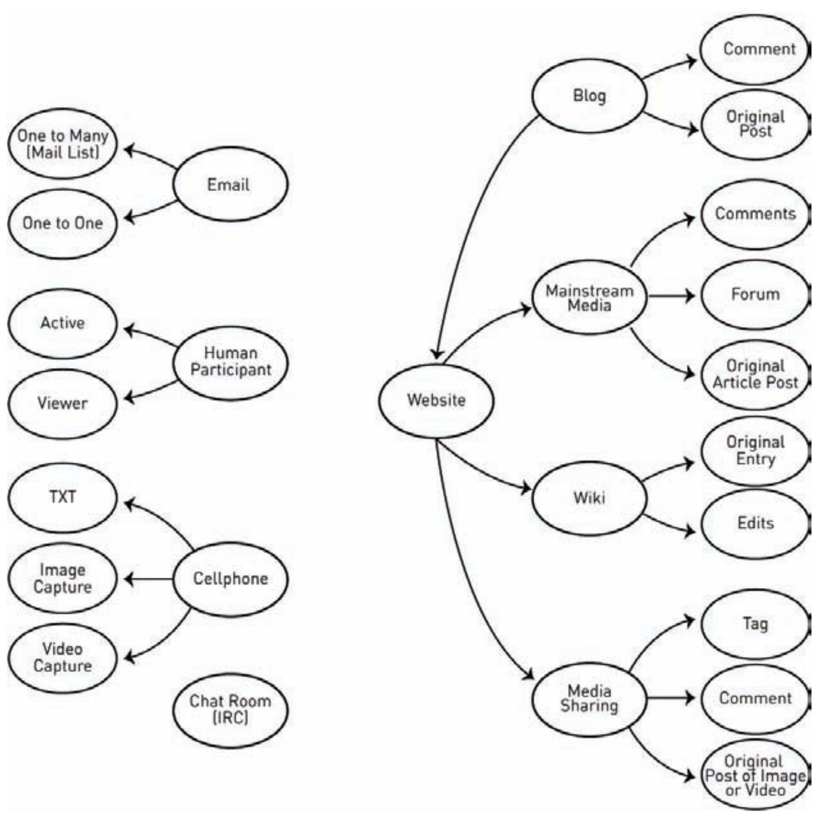
Unlike earlier, static websites, social software is a participatory medium; people are able to create and shape experiences using available tools such as "tagging" and distributing images on Flickr, a photo sharing site; or linking content from one site such as the BBC home page, to another, such as a Facebook page. These instances of swapping or linking across different software systems and sites are the use cases that are in need of a sociotechnical-inspired response. The online situations I observed after the London bombings were in constant flux, and multiple participants usually originated them across multiple sites rather than by a single author on a single site. By making these moments of sharing and linking visible, the designer can understand these use cases as holistic experiences that are no longer limited to one activity on one website. They are revealed instead as part of a greater ecosystem of social software tools and participants. I purposely use the word ecosystem, because I want to describe these tools as living, organic sites of active knowledge sharing, information gathering, and data validation.

Amidst the chaos of exchanging information and discussing the 7 July bombings, victims and bystanders posted to blogs, added text to wiki pages, chatted on IRC channels, posted images, and exchanged text messages using their cellphones. The use of hyperlinks proved an effective means of guiding people to information points. Links allowed information to travel throughout these networks, providing a sense of consistency and validation when multiple actors would refer to the same links to exchange information.

In terms of ANT then, actors in this amalgam of post-disaster scenarios include cellphones, human eyewitnesses, digital cameras, mainstream media websites, social software websites, friends or relatives of participants, friend-of-a-friend (FOAF) participants, and outlier participants who may not be local to the area but nonetheless are active in locating and sharing information. In this and similar situations, a key component of maintaining and encouraging this communication is the presence of a moderator and other human aggregators to help with data collection, with linking of information and with posting original content, as well as having technological infrastructures in place such as websites and text messaging systems.

Figure 2 illustrates the ecosystems in which participants of the London Bombings of 7 July 2005 communicated. This is an abbreviated look at the numerous actors involved, listing sites of major interest because of their comparatively widespread use during times of crisis when information coordination is taking place. The

Figure 2. Social software actors employed in the wake of the London bombing disaster



scenario reveals how being able to trace these actors allows us to find tangible evidence of these networks. These details can inform the designers about these communities so they make visible the often-unknown ecosystems that surround users of social software. These ecosystems are unknown to those who are not active participants within these communities. Making these ecosystems visible by diagramming them provides designers a tangible representation of the multitudes of available social software systems employed by a particular community. Such visibility can prompt designers to move beyond creating systems that are walled gardens—social software systems that constrain activities to a single system such as Flickr, Blogger, and MySpace. By opening these walled gardens and creating open systems, designers can enable participants to share content across multiple social software systems. Participants are already climbing these walled gardens because their social context is not bound to a single system or community, as evidenced by their posting of links and creating workarounds to share information from one walled garden to another. We, as designers, need to recognize these activities and create systems that can facilitate such participation and knowledge sharing.

It is by embedding themselves within these scenarios that designers can understand what it is to be participants, negotiating often broken systems and manipulating tools in order to communicate as effectively as possible. By embedding, I mean for designers to become a part of these communities, observing how people use these systems by participating rather than silently observing. By adding tags to images, tracking down the missing online, commenting on blogs, and witnessing how participants stretch social software tools in ways that the authors of these systems never intended, designers can gain an understanding that simple observation would never provide them because participation demands that designers use these systems. Such insights lead to designing the kinds of solutions that will allow for quicker adoption of these tools when they are needed most – the moments after a disaster occur.

The mapping I suggest reveals how data is aggregated and exchanged and locates the numerous minor actors who provide meaningful information to help in the creation of these assemblages. The context and communication of this text is a tangible, material expression of these actor networks. They are not constrained to any localized spatiality (Law & Mol, 2003), so much as they are a series of transactions that can be traced when these communicative functions surface on various social software systems.

Many initial reports about the London Bombings surfaced on blogs, especially on group blogs. Communicating information between blogs and their participants occurred regardless of international boundaries; Americans, Britons, and other nationals were able to exchange information, regardless of time zone and location. They listed links, posted chat histories, and coordinated information.

An example of this phenomenon of how effective comments can be for allowing people to share information and build assemblages within their visible networks is Alfie's Moblog. This blog was used extensively on the day of the bombing because of blog owner Alfie Dennen's posting of Adam Stacey's photograph (Dennen, 2005) of people evacuating a damaged carriage in the London Underground (Figure 3).

This image would be broadcast later across the world and posted to numerous social software sites including Flickr (Applegate, 2005), as seen in Figure 4. The flow of the image of Stacey throughout the social software ecosystem speaks to how information can remain a stable assemblage as it moves throughout a communication system. The information is made fluid by these movements and encourages communication from other actors as the data propels through the network, creating an assemblage of information (Law & Mol, 2003) as seen in Figure 5.

Figure 3. Image of Adam Stacey evacuating the London Underground (Dennen, 2005)

Figure 4. Adam Stacey's image as posted to Flickr (Applegate, 2005)

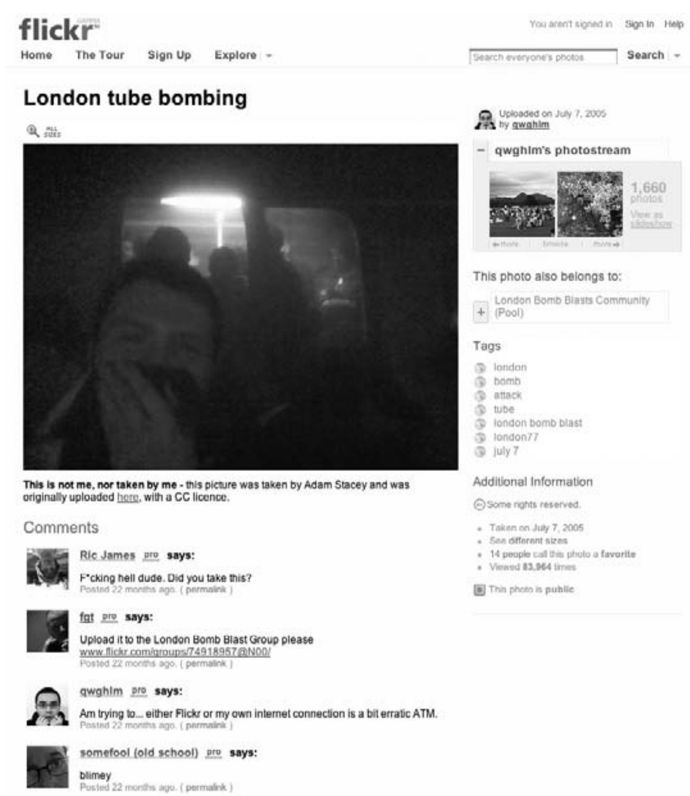
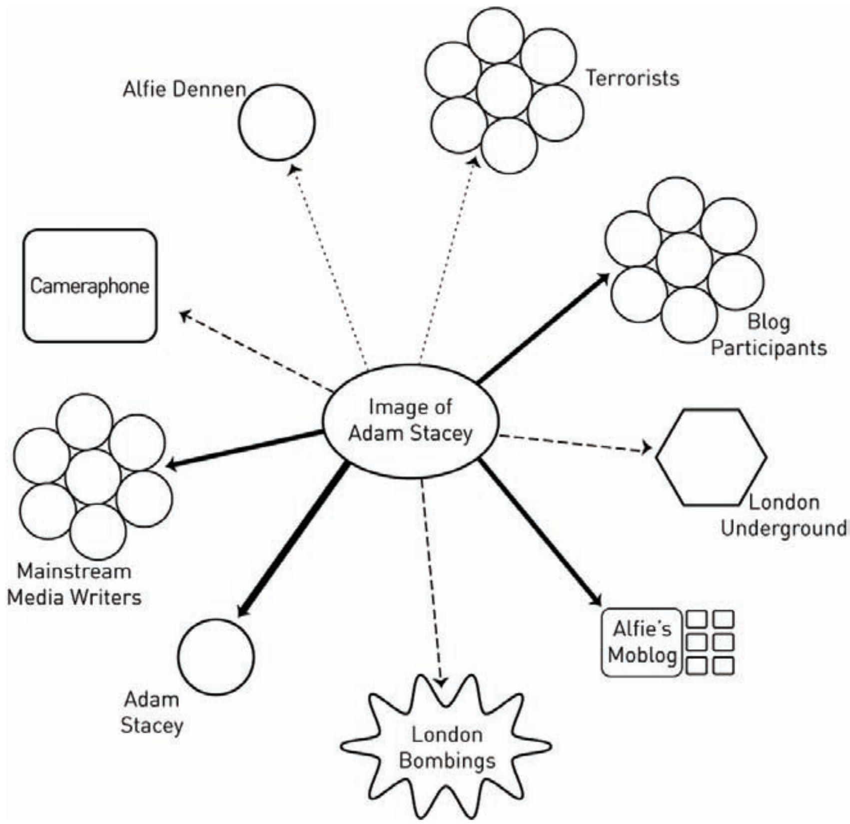


Figure 5. Actor network created by the reverberations of Alfie Dennen's post featuring the image taken by Adam Stacey during Stacey's escape from the London Underground (Potts, 2008a)



An overview of the actor network invoked by this post is shown in the actor network diagram I created in Figure 5 (Potts, 2008a). There were multiple actors participating in this information coordination: cellphones, computers, news outlets, Adam Stacey, Alfie Dennen, Flickr, the BBC News website, and the numerous participants who helped distribute the photo and inquire as to Stacey's well being. Participants who posted comments were able to relay information about the safety of the photographer of this image as well as discuss other victims of the attacks. Participants from Wikinews asked where and when the photo was taken, trying to add information to the event's entry on the cooperative news site. Through linking to other sites and allowing audience participation, these blogs were able to create an assemblage both of the bombing event and for tracking down the author of the photograph within this ecosystem. By making visible these connections through such diagramming, designers can begin to understand the pathways and traces of these images and communities as they flow across multiple ecosystems. Understanding how this information flows is indispensable for creating social software systems that allow for such communication. Such systems must be flexible enough to provide tools to participants that can be modified on-the-fly, aggregate information that the community deems important, and allow for validation of this information by other community members, moderators, and technologies.

By using ANT, we can see what users need and want within these current sociotechnical settings.

It behooves us as designers to design with them and for them, rather than over and around them. The issue is not what went right or wrong with the communication systems on 7 July. Rather, the issue is how we can best use our expertise as both systems designers and participants to make confronting the next disaster less painful.

DESIGNING FOR DISASTER

In this section, I will briefly discuss several proposed design guidelines as well as solutions based on my research of the use of social software during times of disaster. When disaster occurs, people attempt to reunite the missing, share eyewitness accounts, and coordinate information. As a participant, an observer, and a designer, I have witnessed these use cases first hand. Unfortunately, none of these sites are actually talking to each other, which means that the participant is burdened with 1) finding all of these disparate sites, 2) leaving their information on these sites, 3) remembering where they left the information, and then 4) scouring the sites to see if any replies to their inquires were made. Individuals use these different systems to learn, share, and build content without any central repository or authoritative confirmation of data. A solution must be found to unite content to confirm, validate, and redistribute this information back to these various web sites and web services. Such a solution would need to address the issue of openness across systems as well as the more specific example issues below.

In considering the design of sociotechnical systems, it is critical that special attention be paid to language and culture. For example, in labeling information, tags can be incredibly helpful as they provide data points on which other users can pivot to find similar content. However, quite often Flickr participants do not tag their photos, or they do so inconsistently. For example, across Goodman's pool of ten photos mentioned earlier, sometimes he tags photos with "train" and sometimes with "trains." On different photos, he uses the tag "bomb," "bombs," and "bombing" to describe the event. Morville explains how tags "serve as threads that weave a disparate collection of objects together" (2005, p. 138). If one participant cannot consistently tag his content from a single event posted all on the same day, how can we hope to have any consistency of labeling across an entire community during any given disaster. And yet, such consistency is necessary in order to have any hope of locating this sort of first person information in time to coordinate information, locate the missing, and create a sense of community during disaster. Looking across the Flickr community, there were easily 25 different tags used to describe the event, including "terrorism," "bomb," "killings," "blasts," and "londonattack."

An immediate solution for this issue on Flickr would be to create an autocomplete feature much like the one currently employed on social bookmarking tool del.icio.us (2007). When bookmarking a page using the del.icio.us tool, users can label the bookmark. As seen in Figure 6.1, the del.icio.us tool suggests relevant tags from three sources: recent tags used by the participant, tags used by the participants' community, and tags used across del.icio.us community. Such tagging suggestions allow for articulations to take place, uniting content and normalizing language for a community to support information coordination. This is a participant-centric solution, empowering the human participant while allowing actor tags to support knowledge management and information distribution through the network, all of which pushes the "thinking" to the side, so participants can interact with the tools that they build — whether these are folksonomies or more elaborate systems such as searching for content on Flickr and uniting that content with other participatory systems. While people clearly make do with cumbersome implementations, creating frameworks to support information coordination would help propel black boxes of information through the network, allowing participants to find the information they need when they need it.

By looking across multiple systems, designers can implement affordances that work well, such as the del.icio.us implementation for consistent tagging. This relatively simple design adjustment can help support communication as frantic and frenetic as disaster communication. When typing in a new tag, del.icio.us also provides users with an autocomplete function that provides visual cues to the user about prior tags they have used. For example, for adding a new bookmark, when the user types "f," del.icio.us would suggest "food" and any other word that begins with the word "f" in that participant's list of tags. This is where metadata emerges for the user, allowing the participant to connect the tags with each other to produce relevancy about the item they are tagging. This metadata allows for ease of searching by other participants who share an understanding of the folksonomy created with this tag. Such functionality could be added to Flickr as a quick fix solution for gaining consistency across an individual participant's tags. Another solution that would take a step further would be to pull up all tags posted that day across any community to which the participant belongs or across the entire Flickr community. A further solution would be to look at the tags the participant created for a given image, and then make suggestions to add further tags to these images. For example, all photos tagged "bomb" on 7 July 2005, could also be tagged with these keywords: bombing, blast, london. This solution would also help with creating more advanced aggregators, a further design innovation that I consider a next logical step in this sociotechnical design solution. All of these solutions take into consideration the social needs of the participants, treating each item within the network as an empowered actor. Such a framework aids in building a design that allows exposing the kinds of information people need to locate, validate, and push through the network.

An effective development of the tagging feature will have to include a way to identify and reroute inappropriate and mislabeled entries that can waste time or needlessly muddy the exchange of information. On the day of the bombings, a false alarm occurred in Brighton. One user tagged his images of this police response to this incident with "brighton" and also "londonbombing," even though the images posted clearly were not images of the London Bombing. These are not eyewitness images of the London Bombings, although they meet the requirements of being in the same country and during the same time span. The same occurred with images of the Swindon Railway station evacuation that occurred on the same day. They are much too far away from the actual bomb sites, and Flickr participants were quick to post their annoyance at these images being added to the London Bomb Blasts Community photo pool. One user, known as Drift Words, commented "Swindon!! That's hours away!" Clearly, some intervention on the part of the moderator was necessary in order for such restrictions of temporal space and location to be met to keep a sense of relevancy within the London Bomb Blasts Community. Being made aware of these actor networks is essential for a machine aggregator to be able to assist in the parsing of this information.

If moderators could help make these networks visible by describing the type of event and data they need to locate and collect, we could work towards developing systems that could aggregate this information for us using artificial intelligence (AI) based on people-powered constraints for each individual event. This will help us move past generalist search engines and towards finding relevant content as specific needs arise. By embedding ourselves in these communities of practice, we will also know what sort of cues to look for – examining the temporary connections between participants, the keywords created during times of disaster, and the networks that propagate outwards from the postings of information. Designing by collecting and examining the whole picture of actors and connections can help lay out the entire mediascape, allowing a holistic picture to form of interactions, communications, and aggregations.

The deeper technical implications of leveraging sites such as Flickr and determining what can be extracted through these systems could be crippling for designers and participants. Most web sites are closed systems that do not allow for the exchange of content outside their system. This creates daunting conditions in which to try verifying and exchanging information during a disaster or when attempting to research these events from a historical perspective. There are multiple owners of disaster content, from the news corporation to bloggers; there are also multiple maintainers of this content, including BBC News producers, chat participants, and Flickr pool moderators. Sources of this content can be wide in scope, from the Wikinews site to the Have Your Say section of the BBC News, to more obscure web sites or the moblogs that were used during the London Bombings. Locating these web sites, verifying data points, and exchanging information between them is a formidable crisis for online communication.

Today, many systems provide RSS feeds for participants to access content. Flickr also allows for RSS feeds to be published by user participants. Unfortunately, Flickr does not expose enough information through their web service and does not retain enough information in their database about images, participants, postings, and interactions for this social software site to be as effective a tool as it could be during times of disaster. The available Application Programming Interfaces (APIs) that can access information provided by the Flickr web services are maintained and created by community members. Written in different versions relating to various programming languages such as Java and PHP, each has its own limitations. This versioning could very well force a researcher to need to use multiple APIs to try to extract the most data. We must encourage unifying these APIs with a set of best practices. The APIs, however, while a huge problem for developers and researchers, represent a relatively minor obstacle compared to the limits Flickr imposes upon the amount and kind of data it is currently logging.

Flickr is currently incapable of cataloging many important details about the data it contains. I shall now briefly highlight a number of issues regarding how Flickr catalogs information, in preparation for the discussion below about areas for improvement in social software more generally. In fact, many of the problems found in Flickr are problems with social software in general. Put simply, Flickr does not catalogue detailed information about the data it is holding, and by doing so, it does not enable the level of participation necessary to support the complex communication needs of people affected by disaster.

When a tag is added to an image on Flickr, there is no corresponding date information associated with it — it is simply saved into Flickr's system. Therefore, determining when a tag was added to an image is not possible, given the standard Flickr API and web service. To illustrate this shortcoming, I have the following example. A developer conducts a search using the Flickr web service for the tag "bomb" posted to any Flickr image between 6 July 2005 and 8 July 2005. When this search was conducted on 1 January 2007, 2489 images were found. When this search was conducted a month later on 25 February 2007, there were 2492 images found. During that intervening time, an indeterminate number of photos that fell within that criteria were deleted, modified, and/or added, resulting in a positive gain of three extra results in the later search. Of course, hundreds of photos could have been added or removed, but the current state of Flickr's data holdings does not allow us to ever know the exact number or find any important data we may have lost forever. Missing data is a huge problem for those studying these events after the fact.

There are at least two possible solutions to this issue. The best method would be to convince Flickr to record and expose the tag creation date. The other way would be to monitor and record changes on the Flickr system and record the information along with enhanced data into a separate repository that can handle the additional information. This way is not optimal because it requires an extremely reliable system on both ends of the web services and requires the creation and long-term maintenance of both hardware and software to gather this data. Regardless, this still hides information from everyday participants. Exposure of these networks is necessary to further the creation of more articulations that will allow for the free flow of information through these fire spaces.

A similar problem occurs with Flickr groups. An image can belong to one pool, many pools, or no pool at all (aside from the user's personal photostream). Quite often, a picture will be added to a group at a much later date and sometimes at the request of another user. However, using the currently exposed web service, one cannot pinpoint when this addition was made. We might know that a person asked the owner to add a photo to a particular group, but it is impossible to find out when, if ever, that image owner complied. Knowing if and when a poster responded to a query would not only leave us a more complete history of the posting, but also help us understand moderator influence. Without this data, I needed to walk through each photo to find moderator comments and see if the response was positive. This is not an effective solution for long-term tracking of a moderator's sphere of influence and ability to affect community during times of disaster, for those who are studying these efforts and for those trying to design improved communication systems, and for those victims and volunteers trying to find validated information.

The same issue occurs for the comments posted to these images. When they are first posted, comments list the time and date that they were posted. Over time, the comments lose these date and timestamps, reverting to more general descriptions of "Posted 7 months ago." This is too vague to enable community members to trace usage, and it is utterly useless for those tracking historical data. Timestamp data must be kept, for Flickr or any other social software system, to be an effective and reliable communication tool. To omit this vital data when it could so easily remain present and intact is a great disservice to the community and to those attempting to document historical usage to create more effective systems. Timing — both literal and figurative — is of the essence for coordinating disaster information.

All of the issues and solutions discussed in this section were made visible by the use of Actor Network Theory. This theory provides ways of understanding each participant – whether it is a technology or a human being – as an integral part of any communicative act. By examining these situations through such a lens, designers can be active participants at the center of these interactions rather than developing interfaces and systems from the sidelines.

CONCLUSION

The various actors—images, systems, participants, cellphones, websites, etc.—have the potential to provide relevant data that could be better coordinated if a system were in place to gather this information and distribute it to those in need, either of emergency services, or connecting the missing with the found. By leveraging the actors and ecosystems that already exist, designers can foster the free flow of information through these systems, and this could reduce the anxiety and chaos that inevitably follow a disaster.

As geopolitical instability and climate change promise to make crises even more frequent, a method for aggregating visual and textual narratives so that they are easier to locate in times of emergency is becoming increasingly critical. Arranging this information so that it is readily available and locatable will ensure that it is also easier to coordinate and leverage to answer the many questions that indeed go unanswered or simply arrive too late to be effective.

In order to create such systems, we need tools such as ANT so that we can recognize the systems we must optimize. A major strength of ANT is that this theory allows designers to document all of the relevant actors—people, tools, and resources—that allow information to flow through these networks. ANT encourages designers to overlook nothing and, rather than imposing hierarchies and taxonomies on these communities, allows actors to suggest connections between people and technologies. By extending this theory to allow for the prioritization of these human needs, we can use ANT to improve the design of these mediated systems. Finally, by understanding these experiences through participating within these systems, designers will be empowered to create systems that are far more inclusive, operate across numerous networks, and enable everyday people to communicate during times of disaster.

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This work was previously published in International Journal of Sociotechnology and Knowledge Development, Vol. 1, Issue 2, edited by E. Coakes, pp. 33-46, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 4.15
Student Use of Social Media:
University Policy and Response

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ABSTRACT

This chapter presents information on the usages and intent of social media by college students and administrators. Primary and secondary quantitative data is provided, as well as qualitative information obtained from interviews of multiple constituents. Researchers and postsecondary employees can more effectively examine technological trends in regard to online social networking for non-academic purposes after considering this data. Theories of self-esteem, interpersonal communication, decision making, and innovation diffusion are integrated throughout the chapter.

INTRODUCTION

Millions of American high school and college students have one thing in common: they log in daily to Web sites to view recently uploaded photographs, check out opinions on blogs, and see if friends have made any changes to their onscreen profiles. Individuals born between 1981 and 2000, coined *Millenials*, are growing up in a world in which participation in online social networking is considered conventional behavior. Timothy Hawkes, the headmaster of The King's School in Sydney, Australia, perhaps summarized it best. As quoted in *The Sydney Morning Herald* (Goodman, 2007), Hawkes said, "…technology isn't part of students' lives these days. It is their lives."

Social networks refer to a collection of individuals linked together by a set of relations (Downes, 2005). Associated research tends to focus on social network analysis, a framework intended to enhance the sharing and interaction among groups and communities (Cho, Stefanone, & Gay, 2002). Online social networks possess a parallel purpose, with Web sites intended to assist users in meeting new people or staying connected with friends or associates. The Web sites allow for searches based on a multitude of factors including affiliations such as a college or high school. Some sites like Shelfari are designed around a common interest, in this case targeting book aficionados. Other online social networks are centered on a professional component, a quasi modern-day version of the now more traditional

DOI: 10.4018/978-1-60566-104-9.ch010

networking after-hours event. Two such examples include LinkedIn and MyRagan, designed for all professionals and professional communicators, respectively.

Online social networks are also termed virtual communities or profile sites, and the relationship-building capacity of these sites present more than simplistic social consequences. Network participants are exposed to groups centered on the advantages and/or disadvantages of specific colleges, clubs and professors. Higher education institutions are beginning to recognize that reputation, campus culture and even enrollment figures may be impacted by online social networking.

The objective of this chapter is to present the response of university administrators and students to the use of online social networking for non-academic purposes. Qualitative data from student and administrator interviews helps shape the chapter and allows for candid and relevant anecdotes surrounding the topic. The use of primary and secondary quantitative data offers insight and perspective to a compelling, complex and constantly evolving topic. Theories of self-esteem, interpersonal communication, decision making, and innovation diffusion are integrated throughout the chapter.

OSN REIGNING GIANT FOR COLLEGE STUDENTS

The interests of college students are as diverse as the myriad of online social networking (OSN) sites available to them. From Bebo to Classmates.com to Friends Reunied to Friendster, university students have numerous OSN options as they put their technologically savvy skills to use in finding their niche. One network in particular dominates the college scene with over 85% market share of four-year universities in the United States: Facebook.

Originally called *thefacebook,* and targeting college students, Facebook is now the second most trafficked online social networking site following MySpace. In hipper context, Facebook is "…the online hangout of just about every college student in the nation" (Levy, 2007). Mark Zuckerberg, the man credited with Facebook, dropped out of Harvard University to focus full-time on his creation. Like MySpace co-founders Tom Anderson and Chris DeWolfe, Zuckerberg had become frustrated at his own experience and felt he could develop something better than what existed. The story goes that he believed Harvard University was too slow in creating an online student directory, so he made sure his own version was both expedient and impressive. After 6,000 students at Harvard registered with thefacebook, within the first three weeks, Zuckerberg piloted the program at Stanford and Yale (Naposki, 2006). The online social networking site quickly became a sought-after commodity and officially became known as *Facebook* in August 2005.

Facebook initially required a college or university .edu domain extension, but the site has since expanded. High schools and companies now have access to the online social network within certain regions. The official site at www.facebook.com has a section detailing "How this expansion affects you," the Facebook member. It starts by explaining:

Now you can get all your friends on Facebook—people who couldn't get on before because their schools didn't offer e-mail addresses, because they went to work instead of colleges, because they graduated before Facebook even existed, or for any other reason.

Evidently people heeded the call. The site had 24 million members by June 2007 (Kirkpatrick, 2007) and more than 60 million active users as of January 2008, representing an average 3% weekly growth since January 2007. It is no wonder Facebook's originator understands the Millenial generation—Zuckerberg is 23 years old.

SOCIAL MEDIA AND CONNECTIVITY

Facebook has more than three million users aged 25 to 34, and even more users younger than that (Ronn, 2007). With so many online social networking users falling in what is considered the traditional college-age category, there is a need to understand the link between the communication taking place via social networks and how it fits into the larger picture of relationships and overall well-being. Wood's research on personal relationships (1995) determined investment, commitment, trust and comfort with relational dialectics as the four defining characteristics of a successful relationship. Westerners' emphasis on verbal disclosure as an important trust-building mechanism was further noted. This need for verbal acknowledgement and response has important implications for administrators in postsecondary institutions, particularly because many college students feel overwhelmed and lonely as they embark on their first real venture away from home for an extended time. As quoted in *Everyday Encounters* (Woods, 1996), a student stated:

The worst time in my whole life was my first semester here. I felt so lonely being away from my family and friends at home. Back there we were really close, and there was always somebody to be with and talk to, but I didn't know anybody on this campus. I felt all alone and like nobody cared about me. I became depressed and almost left school, but then I started seeing a guy and I made a couple of friends. Everything got better once I had some people to talk to and be with.

The mission statements of postsecondary institutions often center on themes of academic integrity, attaining in-depth knowledge of a particular discipline, well-roundedness and civic-mindedness. But educators and administrators recognize that if students are not content, if they are lonely and depressed and not focusing on their studies, then their self-esteem, sense of responsibility and ultimately their educational experience may be lost or at least substantially weakened.

Theories of self-esteem have established that human beings possess a universal desire to protect and enhance their self-esteem (Rosenberg, Schooler, & Schoenback, 1989). At no point in life are peer acceptance and feedback on one's self more important than in adolescence, and these are two distinct features of online social networking sites (Valkenburg, Peter, & Schouten, 2006). From the college recruitment stage to retaining students through graduation, a recurring theme is connectivity. Students should feel welcome, at ease and comfortable in their home away from home.

Academic Decision-Makers Response to Student Expectations

Academic decision makers must consider new ways of reaching students for recruiting purposes as well as connecting with students as part of retention efforts, and some of these efforts involve technological innovations. The use and need of technology by higher education administrators is altered as the expectations and usage of technology changes by students. In fact, computers, the Internet and social media may be changing so fast that it is impossible to predict the impact. But what is recognized, according to Baase (2003), is that these technological changes in work processing methods have resulted in a loss of community. E-mail, Skype and other mediums are replacing traditional face-to-face conversations. So while technology is often lauded for bringing the global world together, it is simultaneously faulted for creating an unnatural barrier in community.

Many higher education administrators are in the unenviable situation of not having appropriate technology required to act as expert decision makers when it comes to increasingly evolving technology. This is closely aligned to the decision making theory called *incrementalism*, in which individuals may not be able to perform their job responsibilities at the highest level because they do not possess all the facts, information and technology required. In this case, decision makers enact former solutions to current problems and work within a bounded rationality in which they choose an "incremental alternative rather than a fundamentally newly designed approach" for solving problems (Hoy & Tarter, 1995).

But when it comes to constantly changing technology, is an incremental alternative enough to reach students who possess an entirely different set of communication and connection ideals? Typically, the initial decision to have a certain technology available for student use is made at the institutional level (Robinson, Jr., 2006), but in the case of OSN, it may be more an issue of student expectations and current usage driving technology decisions by administrators. Student demand is forcing administrators to play catch-up and create novel ways and approaches for "informative provision and instruction" (Sellers, 2005). Administrators need to not only manage their own collegial community but find ways to encourage community for students.

Communicating with Prospective and Current College Students

Knowing of the growing popularity of Millenials to utilize online social networking sites, it is not surprising that higher education administrators are beginning to view these networks as valid mechanisms to reach student audiences, including prospective students. The broader communicative strategy in this case is referred to as e-recruitment, and the tactics focus on communication with prospects via instant messaging, e-mail and online social network profiles.

It appears prospective college students do not mind this encroachment on their virtual lives, especially if they can control initiating the communication. An E-Expectations Class of 2007 report by Noel-Levitz (2006) discussed the propensity for prospective college students to utilize technology or, in some cases, express a desire to utilize various Web-based applications. Excerpts from the published survey data show student responses to completing certain activities on college Web sites:

- 72% have or would like to exchange instant messages with an admissions counselor or student worker
- 72% have or would like to complete a form to RSVP for a campus event
- 70% have or would like to inquire online
- 64% have or would like to read profiles of faculty
- 64% have or would like to e-mail a faculty member
- 64% have or would like to read a blog written by a member of the faculty
- 63% have or would like to read a blog written by a current student
- 63% have or would like to view a virtual tour
- 62% have or would like to personalize a Web site (meaning they received a unique experience based on information supplied)
- 61% have or would like to e-mail current students from the site (Noel-Levitz, 2006)

These statistics indicate a majority of survey respondents desire activities in Web-based form. A chief benefit to higher education institutions using OSN and other Web-based activities is the relative ease in maintaining connectivity through the posting of information or by e-mailing others, and Millenials have come to expect instantaneous communication. According to Lenhart and Madden (2007), e-mail is the highest ranking Internet activity by teens, with 57% going online to retrieve information about colleges and universities. This underscores a need for colleges and universities to utilize Web-based applications in their recruiting plans. In today's competitive market where each prospective student is crucial to a college or university's full-time equivalent figures, Web sites must be interactive. The more opportunity a Web site has for personalization based on a user's interest, the more likely a Millenial will stay interested.

Once students are enrolled in a postsecondary institution, that interaction must continue. Tinto's predictive model of student integration (1982; 1993) discusses how interactions in both the academic and social realms play a significant role in the attrition process. Factors including peer-to-peer interaction and peer-to-faculty interaction are positively related to degree completion.

Online social networking may prove to be an invaluable tool in assisting students who are easing into college life. Roommates are often introduced to each other through Facebook or MySpace, learning about each other's interests, study habits or partying tendencies through online profiles. Students learn about residence hall life and which clubs might be of interest to them. Once enrolled in college, online social networks prove to be a constant source of information for students. Profiles and groups encourage attendance at campus events, promote specific clubs, fraternities or sororities, and allow college students to view last-minute changes to an academic calendar through bulletin board announcements.

College student Donald Moore thinks it is smart business for organizations to participate in online social networking. "Almost everyone is on some type of social network, so why not communicate an upcoming event this way since so many people check them out constantly? If you send an invitation to 100 people and only one responds, it is still a success because that is one more response than you had before you started. Why not take advantage of free publicity?"

Connectivity in Times of Bereavement

Online social networking remains undeniably constructive as a means of connecting individuals regardless of geographic constraints. The aftermath of the April 16, 2007 massacre occurring on the campus of Virginia Tech University provides insight into a unique value that online social networking provides to college students. Students throughout the U.S. united after the Virginia Tech tragedy by creating online groups and posting comments expressing their concern and grief. The language was often candid, emotional and sentimental. One of the many group descriptors read, "In memory of those lost and those grieving at Virginia Tech. This is a group to honor those who have lost someone just know that you are not alone the world is watching and we are all praying. Today we are all hokies!!"

It was clear that many of the postings originated from those not directly impacted. College students blessed not to have been straightforwardly affected by the incident were nonetheless trying to make sense of the tragedy and working to find a way to reach out and show compassion. One student from Ontario, Canada is a member of a 1,625-member Facebook group titled *A Canadian Tribute To All Those Involved In The Virginia Tech Shooting*. An excerpt from her posting reads, "I don't know any of the people who died in that horrible act, but my heart goes out to each student and all the families involved. You don't need to know anyone to be sad for them." For this individual and others, the Facebook group was a virtual memory wall offering a chance to emotionally embrace.

Until May 2007, Facebook's policy was to delete profiles of the deceased. That policy was altered after online protests and a letter campaign were initiated in response to friends and family of Virginia Tech victims learning that profiles of victims were to be removed (Hortobagyi, 2007). "…these pages are what's left of their voices, and the rest of their voices have been stolen from us," said Virginia Tech student John Woods (Hortobagyi, 2007).

As is the case with the Virginia Tech mourners, it is not just friends or family that are posting comments on online social network sites. Some students who have never interacted with the deceased reach out to find a shared connection in the confusion and despair that comes from the loss of life and the struggle to move on and find meaning from a tragic situation. In a posting for a Facebook group dedicated to remembering a young Midwestern college student who died of heart failure, an individual posted a comment, "He sounds like a great guy. I'm sorry I didn't know him." Others that did know him use everyday vernacular indicative of young people, "he had a heart attack, 26 and dying of a heart attack, that's soooo HORRIBLE! stephen and i worked together like 3 or 4 yrs ago. we would always butt heads but you never want to see this happen to anyone regardless of the relationship you have with them, he's way too young [sic]."

Bereaved college students are an extremely vulnerable cohort to issues of self-confidence and self-efficacy, often feeling a loss of control to external events and factors. These students find their identity formation challenged, and this formation is an important developmental milestone for those in their late teens and early 20s (Balk, 2001). Identity formation challenges mean bereaved students question their own competence and self-worth. Depression, generalized anger, and behaviors categorized as self-destructive are reported outcomes of bereaved students who do not progress through the grieving process in a healthy manner (Silverman, 1987; Tyson-Rawson, 1996).

This issue is critical to colleges and universities as it can influence a student's ability to successfully experience college life. "If for no other reason than a university's interest to increase student retention, graduation, and long-term alumni support, it makes sense for a university to engage systematically in efforts to assist bereaved students" (Balk, 2001).

It is not a mere handful of students impacted by bereavement. Studies indicate that 22-30% of college undergraduates are in the first 12 months of grieving the death of a family member or a friend, and 35-48% of college students are in the first 24 months of grieving the death of a family member or a friend (Balk, 1997; Wrenn, 1999). Colleges and universities have reason to pay attention to bereavement influences and processes as many students are touched by loss during their college years.

One bereavement framework in particular, attachment theory, appears applicable to online social networks. Attachment theory describes bereavement as the outcome of bonds, mainly emotional bonds, sundered by death (Bowlby, 1980). The theory depicts a bereaved's simultaneous process of letting go of emotional attachments to the deceased while striving to invest in other social sources. Peers are often a vital source of social support, yet often are unaware of the critical assistance they can provide. As Barnett (1982; 1987) describes, most college students are incapable of transforming their empathic understanding in a helping fashion because they lack the skills or understanding of what to do. College students untouched by bereavement typically demonstrate both ignorance and fear when in the presence of a grieving peer.

It is in this area that attachment theory and online social networking may prove to find an important association. Talking about grief provides a means to maintain interpersonal relationships and also to invest in attachments with others (Balk, 1997). Many college students are uncomfortable talking about grief or other emotive topics through face-to-face communication. However, over the Internet, they find it soothing and comforting to display sensitivities. For years, funeral homes have offered condolence opportunities via the Internet. Perhaps the posting of comments via online social networking sites is a natural progression.

As online social networking becomes a better researched and highly prevalent mechanism for peer support, higher education administrators will need to determine how to utilize online social networking sites as part of best-practice intervention programs to reach out to or assist bereaved students.

Table 1.Exhibit A (Wandel, 2007)

Exhibit A	
University Use of OSN sites	**Column N%**
Publicizing student organizations	83.3
Planning campus programs	56.5
Announcing upcoming events & deadlines/university calendar	51.6
Publicizing non-university events	19.0
Providing information to current students regarding academics	12.4
Recruitment of new students	9.9
Alumni relations	7.1
Retention efforts	6.3
Distributing information to faculty, administrators and staff	1.3
Fundraising	0.8

HIGHER EDUCATION ADMINISTRATOR USE OF OSN

From serious issues such as bereavement, to simply usesocial media as a means for promotion of campus events, administrators are trying to make sense of how best to utilize technological innovations. To confound the issue, much of the verbiage used by Millenials makes it clear that parents or other adults are the outsiders treading at times on unwelcome ground. Acronyms like PBM, PIR, P911 and POS may seem as innocuous as CUL (see you later), but they can have far more serious implications (PBM = Parent Behind Me; PIR = Parent In Room; P911 = Parent Alert; and POS = Parent Over Shoulder). (Table 1)

It is not surprising given this "keep out" emphasis that, while the larger sphere of online social networking use by higher education administrators is growing, many other administrators are still unsure of how best to approach or utilize social media. A survey of over 1,000 higher education administrators found that fewer than 40% of college or university administrators worked at institutions that had created groups on an online social network site (Wandel, 2007). Groups in this case refer to an element of online social networks, particularly Facebook, in which members can create and join a faction similar to a group or organization in the physical world. Administrators recognized Facebook as the dominant forum used by college students, and 97% of postsecondary officials also chose to access Facebook, while only 23% used MySpace.

For those college administrators participating in OSN, the majority use it as a vehicle to communicate with students about organizational or programming issues. Over 83% said they use Facebook and other sites as a way to publicize student organizations, and over 56%t said they use the forums as a way to help plan campus programs. In addition, over half of the respondents indicated they use online social network sites to announce upcoming events and deadlines as part of a university calendar system. Exhibit A offers a ranking of why university and college administrators stated they use online social network sites.

Rollins College serves as a successful example of using OSN as a tool to promote its orientation/welcome back session. "There wasn't a seat open, because the word went out on Facebook and people actually replied, 'Yeah, I'll be there.' By knowing that other people were going to be participating it started to build steam and build community,"

Table 2. Exhibit B (Wandel, 2007)

Exhibit B	
Perceived Concerns of OSN sites	**Column N%**
Privacy issues	84.6
Student safety	78.1
Liability issues concerning alcohol or drug use	69.5
Legal responsibility	54.4
Freedom of speech issues	43.0
Difficulty regulating the posting of information	41.1
Postings may create social disruptions on campus	35.2
Student access (or lack of) to computers	8.9

said director of Rollins Explorations Doug Little (Santovec, 2006).

Online social networking sites can even be utilized when college or university administrators do not form official groups. Over half of surveyed college administrators report they casually or unofficially monitor student activities, trends and interests (Currie, 2007). Survey respondents reported 36.2% accessed an online social network site on a daily basis, and another 32% accessed a site at least once a week (Wandel, 2007). Higher education administrators are increasingly using online social networks as related to their work. For example, postsecondary institutions such as Utica College, SUNY New Paltz and Colorado State have Facebook groups dedicated to career matters.

CONCERNS AND CONSIDERATIONS GERMANE TO HIGHER EDUCATION

From a higher education perspective, a plethora of considerations exist when students, administrators and educators are involved with online social networks. At the top of the list are concerns of privacy and student safety. Katy Lowe Schneider (personal communication, May 31, 2007), associate dean of students at Hanover College, said she and her staff try to emphasize not only the professional implications of having information posted online, but also the threat to safety that can ensue if students list private and personal information in a public forum. "One thing our director of security often says is if Ted Bundy had been alive today, his murder spree would have included hundreds because stalking would have been much easier. 'I'm blond, early 20s, 5'5" and live at 517 Chi Alpha in Room 3' listed in a student's profile can make her an easy target for crime." (Table 2)

While safety and issues related to cyberstalking have garnered much attention in scholarly journals as well as mainstream media, other concerns exist. Legal, ethical and social implications abound regarding OSN practices. Exhibit B illustrates a ranking of concern as reported by higher education administrators.

Legal Issues

Jessica Binkerd may have been an online social networking participant to achieve a hedonic experience, but the photographs on her MySpace profile ultimately proved anything but pleasurable for her. The photographs were used against her as she was sentenced to more than five years in prison for driving under the influence and vehicular manslaughter. Photographs of the University of

California, Santa Barbara student drinking alcoholic beverages with friends were posted after the date of the fatal accident (Wagstaff, 2007).

Photographs have proved as evidence in numerous other cases. Lowe Schneider describes an example of when a fraternity hosted a philanthropic event in which one participant became so intoxicated that he had to be rushed to the hospital for alcohol poisoning. The fraternity members claimed no alcohol was consumed at the event. "We searched Facebook with the title of the auction and within seconds came up with 20 pictures of students consuming alcohol at the event in plain sight," said Lowe Schneider. "We used these photos in judicial action. We try to be careful not to search Facebook looking for violations, but if information is contradictory, we will use it to assist us."

Cameron Walker became embroiled in a public controversy when he became the first person expelled from a college for Facebook-related activities. Walker, at the time president of Fisher College's Student Government Association, was also an "officer" of a Facebook group that criticized a campus police sergeant and created a petition to get him fired (Stone, 2006). According to Walker, the sergeant had harassed students in order to encourage situations where arrests could be made. Walker claimed the Facebook group he and another student created was a prank. To support this, he pointed to his Facebook group's officer title, which he selected, as "Duke of Propaganda." The administrators at Fisher College in Boston did not see the humor, and they cited Walker as being in violation of the Student Code of Conduct against "verbal, written, graphic, or electronic abuse, harassment, coercion, or intimidation of an individual."

Many college students feel it is unfair to use online social networking profiles or postings against an individual. "I know some universities use Facebook as a tool to bust underage drinkers as well as catch people doing thing they should not be doing," said college student Kathryn Piepho. "I just feel like universities are over-stepping their boundaries by viewing students' Web pages."

Of course, it is not only students that can bring about litigious or public controversy. Vetted by attorneys, Roger Williams University formally adopted a proactive social networking and blogging policy in summer 2007 for faculty and staff when using a university e-mail address (Roger Williams University, 2007). An excerpt from the policy states:

Roger Williams University provides access to the World Wide Web for all of its employees as a privilege and in many cases a necessity to meet the responsibilities of their job. This includes the use of social networking sites, and access to an array of blogs—and even permission to write a blog of one's own—as part of one's professional activities. The University defines "professional activities" as those that advance the University's mission of education, research and public service.

In light of that definition, each employee is reminded when he or she blogs or accesses a social networking site with a Roger Williams University e-mail address, the employee is a representative of the University and must act accordingly. That means an employee can access such sites as Facebook or MySpace to communicate with students, faculty, staff or other professional colleagues in matters related to their teaching and/or professional responsibilities at Roger Williams.

Employees who use a Roger Williams e-mail account must consult their supervisor and/or Dean in advance of their intention to use social networking sites. In addition, staff or faculty using either an RWU address or a personal address to create or post comments to blogs should include this disclaimer: The postings on this site are my own and don't necessarily reflect Roger Williams University's opinion, strategies or policies.

Some activities that would NOT be considered acceptable uses of the Internet from a Roger Williams account include but are not limited to:

- Posting items anonymously or under a pseudonym;
- Conducting personal social relationships unrelated to University activities;
- Using and creating an account with dating and/or matchmaking sites;
- Engaging in partisan political fundraising activity;
- Engaging in online gambling;
- Posting comments or writing blogs that are obscene or untrue;
- Using social networking sites or blog postings to harass others;
- Selling goods or services for personal financial profit.

The policy further details the use of personal e-mail accounts when participating in online social networking sites. It will be interesting to analyze over time how this policy is accepted by faculty and staff. Will it decimate the confidence of faculty by restricting their speech? Will staff appreciate the guidelines to help ensure abuses are limited? It will also be interesting to learn how many other institutions choose to adopt similar policies.

Impact of OSN on the Student-Athlete

In addition to explicitly stating the expectations and responsibilities for employees, many college and university administrators view OSN policies as an opportunity to assist and even benefit another cohort, that of high profile student-athletes. This group is subject to increased scrutiny for participation in online social networking sites. In response to this, the University of Michigan at Ann Arbor is one of many postsecondary institutions electing to take a proactive stance. As of 2007-08, it became mandatory for students to sign a pledge regarding good conduct on social networking sites as part of the student-athlete code of conduct.

Judy Van Horn (personal communication, May 9, 2007), associate athletic director/senior woman administrator at the University of Michigan, said the intent is to use the pledge to educate students. "It's better for us to find inappropriate material on an athlete's profile than for a news reporter to do so," she said. A university representative checks each online account once a semester to make sure all language and photographs are appropriate. As Van Horn explained, it is what is considered appropriate that is often debated. "Using the f-word or having sexually explicit photographs may not be offensive to a student, but it is still shocking to others," she said. If anything inappropriate is found, Van Horn said a process is in place to have the offensive material taken down within 24 hours.

As social networking sites garner increased attention, Van Horn said students are getting smarter and taking advantage of closed groups. Closed groups define members and place restrictions on who can post and view comments within a group. In the past, the University of Michigan had student-athletes "clean up" their personal sites but they remained connected to other questionable groups. "You lose control any time you join a group," Van Horn explained. Identity theft is also a problem. Van Horn said six sites have misrepresented the University's star quarterback as his own, and two other sites misrepresented the head coach.

The University of Michigan's Department of Athletics created the Student-Athlete Conduct Policy as an educational tool, focusing on three areas: Internet Social Networking Community Sites, Athletic Department Policy, and Recommendations. The language from the policy includes:

Internet Social Networking Community Sites. *Internet sites such as Facebook.com, MySpace.com, Xanga.com, Friendster.com and others provides individuals with an opportunity to interact with an extraordinary expansive universe of new* *people and connect with current friends. Postings on personal profiles, groups and chat rooms are in the public domain and easily accessible by anyone including reporters, parents, coaches, groupies, predators, employers, and graduate school admissions officials. Once information is posted, it can be retrieved by computer savvy individuals even after it has been deleted.*

Athletic Department Policy. *Participation in intercollegiate athletics at the University of Michigan is a privilege, not a right. Athletic Department conduct policy currently states, "Student-athletes shall deport themselves with honesty and good sportsmanship. Their behavior shall AT ALL TIMES reflect the high standards of honor and dignity that characterize participation in competitive sports at the University of Michigan." While the Athletic Department does not prohibit student-athlete involvement with internet based social networking communities, this high standard of honor and dignity encompasses comments and postings made to internet sites. The Athletic Department reserves the right to take action against any currently enrolled student-athlete engaged in behavior that violates University, Department, or team rules, including such behavior that occurs in postings on the internet. This action may include education, counseling, team suspension, termination from the varsity team and reduction or non-renewal of any athletic scholarships.*

Recommendations. *Immediately review any internet websites you may have posted on the internet to ensure that the postings are consistent with University, Department, and team rules and that they present you in a way you want to be portrayed. For your safety and privacy, you should refrain from posting and should promptly remove any personally identifiable information such as telephone number, address, class schedule and places frequented as well as any photos you may have posted. Alert the Compliance Services Office of any sites that falsely appear to be yours as this constitutes identity theft, and the University will assist your efforts to have the offensive site removed. Be cautious about which chat groups you join to be sure you want to be publicly associated with that group. Once you become a member, you are linked to the discussion that takes place within that group. Only the group's administrator is able to delete your group membership or postings made to a group site.*

On a broader scale, the NCAA Student-Athlete Advisory committee has discussed the issue of athletes' profiles but, according to assistant director of member services Jess Rigler (personal communication, June 4, 2007), does not set forth policy on the topic. "We leave it up to the individual institutions to set policy on this," he said. While the NCAA Student-Athlete Advisory committee does not track the number of policies that exist, Rigler estimates that "…almost all of the Division I schools have some sort of policy regarding social networks and about half of the Division II schools have a policy in place." He explained the key, however, is in how well written and followed the policies are from one campus to another.

Coaches are striving to find ways to encourage dialogue of OSN usage with the aim that education and awareness of the topic will produce a kind of galvanization of student-athletes. If students are spurred to action and understand the importance of promoting positive images for themselves, their team and their universities, then monitoring sites becomes less of a burden for coaches and administrators. Courtney Felke, a senior playing NCAA Division I women's basketball, said, "Our head coach told us to modify the information that we had posted online because of how easily the information is accessible to other people and how information can be misconstrued. We haven't had any issues, but we're working to be proactive. More than once there have been discussions about this."

Other colleges are hosting guest speakers to introduce the topic of OSN, and still others choose to approach the issue through written correspondence. A letter from Bill Maher (Canisius, 2007), director of athletics at Canisius College, is sent to each student-athlete to educate them regarding online social networking and to remind them that unique responsibilities and expectations come with serving as a student-athlete.

Dear Canisius Student-Athlete:

Facebook.com and other similar websites have generated national concern about the safety and welfare of high school and college students. This concern has created intense discussions particularly on college campuses and more specifically, within athletic departments.

The focus of these discussions has been on the posting of student-athlete profiles and photographs on these websites. Many student-athletes have elected to post pictures of themselves and teammates engaging in inappropriate activity. Examples of this activity includes: underage drinking, hazing rituals, drug use, smoking, and even questionable sexual behavior. In some instances, these photos have led to disciplinary action against student-athletes and against teams including forfeitures of contests at institutions across the country.

The media has become aware of these sites and has gained access to some of this information posted. These outlets have been able to exploit student-athletes by simply copying what has been posted and allowing scrutiny of student-athlete behavior in a grander scheme. It also draws attention to the institution in a negative fashion. Opposing teams have even capitalized on the website by downloading pictures and using them as motivation for themselves or to taunt a specific student-athlete.

All of our athletic teams have policies on underage drinking, hazing and inappropriate behavior. Your decision to post items on facebook.com or similar websites is a personal one; however, the Athletic Department and your individual team policies should serve as a filter for what you decide to put on line. Any public pictures or comments determined to be contrary to these departmental policies and/or the Student-Athlete Code of Conduct will be treated as violations of said policies and handled accordingly.

Your coaching staff has explained the Department's expectations in this area, so please ensure that you take the appropriate steps to avoid additional consequences. If this behavior continues, your coach will be in a position to suspend you from competition and potentially recommend a dismissal from the program and a non-renewal of your athletic scholarship.

You must remember that you represent Canisius College at all times. Do not post pictures, comments or information on the websites that would/could embarrass you, your team, or Canisius College, or that are clearly contrary to the expectations for the student-athletes. It is a privilege to represent Canisius College in athletic competition, so your good personal judgment in this area is expected.

Our competitive goals are clear – to win Championships within the Metro Atlantic Athletic Conference. For us to reach these goals, it takes a level of personal commitment from each student-athlete in our program. The personal decisions you make on a daily basis will determine our overall success. Do your part to help us win MAAC Championships.

After controversial photographs of several student-athletes appeared publicly due to postings on online social networking sites, the athletic office determined it best to educate students and limit future problems. Some institutions, including Loyola University Chicago and Kent State, have moved in an even more aggressive manner, completely banning student-athlete membership in online social networks. These types of bans do have critics who question the First Amendment rights of students being violated by such blatant prohibition. To date, any violation appears to be dismissed as the expectations of student-athletes are significantly higher than that of other students. This is not only the case with online social networks, but also in other rights-restriction capacities such as drug testing. However, the issue of First Amendment concerns is far from clear-cut and precedent-setting cases are likely to emerge in the next few years.

Employer Ethics and Expectations

"Have you checked your Facebook page lately?
I have."

Imagine being 18 years old, seeking your first relevant work experience, and receiving that message. Through mock interviews with Hanover College's Center for Business Preparation, Lowe Schneider saw this very statement written by an employer on a student's evaluation.

Public access to what many feel is private information is causing concern and discussions on college campuses nationwide. Ethical questions abound as to whether it is fair for employers to look at online social networking sites to gain information about job candidates. To what degree students and prospective employees are protected under privacy laws and ethical boundaries when it comes to accessing these profiles is at the core of the debate. Is viewing an online profile considered the same as reading an article in a newspaper about a person and learning information about him or her? Is it a matter of being entitled to as much information about job candidates as possible, regardless of how the information is obtained?

"I hate the fact that universities are getting involved in online networks," said college student Lauren Deas. "I have so many great pictures that I can't even show in fear of losing a potential job or scholarship."

But despite such concerns, 40% of companies say that they would at least consider using Facebook profiles before making a hiring decision (Read, 2007). Thirty-two percent of students think it is unethical for companies to scan the Facebook profiles of job candidates, but only 17% of employers feel the same way. Chris Wiley and Mark Sisson, authors of the widely cited University of Dayton study, found that many students tend to draw sharp lines between their personal and professional lives and see Facebook as a tool to be used in a personal manner. One reason students may feel this way is that they often embellish on their online postings or profiles. Many college students acknowledge they purposefully misrepresent themselves. For example, 8% of students say they exaggerate their alcohol or drug use in Facebook postings. But should employers have to decipher reality from fantasy? Of businesses polled in the University of Dayton study, 326 said they were not convinced that students could make a clean break between their Facebook personas and their professional demeanor, so these employers see value in viewing online social networking sites to learn about job candidates.

Company officials do not appear apprehensive about Internet searches jeopardizing the law. Employment attorneys say it is not illegal for employers to search the Internet or publicly available Web sites created by applicants to see what information they can find. Moreover, the attorneys note the privacy issue is even ethically minimal if someone has put information about themselves on the Internet where millions of people have access to it (Pitfalls, 2006). Of course, employers could use Facebook to determine students' gender, race or sexual preference, but only 13% of the officials said they felt that scanning Facebook might violate equal opportunity employment laws.

The National Association of Colleges and Employers found that 27% of employers surveyed had reviewed job candidates' personal information on sites such as MySpace or Facebook or had conducted broader Internet searches on applicants (NACE, 2006). These non-comprehensive, unofficial background checks are easy to conduct. Most often, the reviews are conducted by interns or employees who are recent graduates since both groups have college e-mail addresses, enabling them to easily view online profiles (Finder, 2006).

As the senior associate director of the career center at Duke University, Kara Lombardi (personal communication, April 24, 2007) finds most human resource personnel "take an official stance that they do not formally use online social networks, but we do know that many are unofficially using it. Many of the employers that recruit on campus will bring young alums to campus to help interview. These alums, who do not work in HR, will look up candidates on Facebook. We have heard back from alums about deciding not to interview students based on what is posted in their profile."

Similar to the experiences of many college administrators, Lombardi was first introduced to the world of online social networking not by colleagues but by students. Peer educators in her office first acquainted her with Facebook, and she quickly garnered interest after learning the exorbitant amount of time students spend on OSN. Since then, Duke University's career center has embraced an appreciation for the benefits of online social networking, while working to ensure students understand the potential consequences associated with them. The career center posts on its Web site a statement developed in summer 2006:

Considerations for Blogs and Social Networks like MySpace and Facebook

Duke University takes free expression seriously and goes to great lengths to protect that right. Social networks such as Facebook and MySpace have expanded opportunities to express yourself, connect with friends and to build your network. Still, there are several responsibilities to consider when you create your persona and post messages online.

- **What you post is public information.** You have a much larger audience than you might be aware.
- **What you post is going to be around for a while.** Because caching and other forms of technology can capture your postings, information is accessible even after you've removed it.
- **What you post can harm others.** You are free to express yourself on social networks in ways that you feel are appropriate for you. However, it is important that you respect the privacy and rights of others. Posting things about others can place both you and your subject in a contentious situation.
- **What you post may affect your future.** There is a growing trend for employers to check Google and social networks to gather information about potential candidates. The online persona you create today may be available when you begin your internship or full-time job search or when you apply to professional or graduate school—even if you think you've deleted it. Carefully consider how you want people to perceive you before you give them the chance to misinterpret your profile and pictures.

As Lombardi describes, the career center's approach is "…to warn students that what they post is available for everyone to see so they should make sure they are presenting themselves in a way that won't damage their image. We found that most students are posting pictures and using language that they probably won't want a potential employer to see." She also said that while Duke University does not offer student workshops solely on the topic of online social networking, the topic is integrated into other workshops associated with recruiting, orientation, résumé and cover letters, and interviewing. Or, as she put it, it's discussed "…anytime we have a captive audience."

Lombardi's legal and ethical concern over online social networking centers on the issue of privacy. She cites a NACE Spotlight Online June 2006 article posted on the Duke University career center's Web site, an article showcasing the ethical issues surrounding the privacy of profile pages. The article describes a young man searching for an internship and, wanting to showcase himself in the most positive light; he recognized that many of the photographs and much of the language on his profile jeopardized this. He heeded advice to limit access to his profile. During an interview, he was surprised to be questioned about specific references to his Facebook account and the information posted on it. He did not think this information could be viewed to outsiders because he had limited his privacy settings. The interviewer explained that working for a state agency meant recruiters could access his Facebook account under the rules of the Patriot Act.

While some students vehemently oppose this seeming intrusion, others do not see their peers as victims in these circumstances. College student Lindsey Holder said, "People shouldn't be so naïve as to think that the Internet is private. I don't think people would see any problem with a job candidate not being hired because he has his own public access show that showcases his weekend binges, so why is it any different that he has devoted his own online profile to do the same? I understand that not everything that gets posted, photos in particular, can be controlled, but these businesses are putting their public faces on the line. I think they are entitled to feel confident that their new employees are representing them in the best light."

College student Sarah Powell agrees. "I think that it is a good idea to have employers look at student profiles. If I were an employer, I would not want to hire a student who parties and gets drunk all the time. That to me shows a lack of maturity. If a student does not want certain information seen or revealed to people, then it shouldn't be placed on the Web."

Rights and Responsibilities

Information gleaned from online profiles is not only used by off-campus employers, but extends to on-campus experiential education situations. Lowe Schneider of Hanover College said that she and her staff view Facebook pages when a student applies to be an orientation leader. "Particularly since these students are to be role models in our community, it's important to see what messages are out there," she said.

The ethical and legal issues associated with online social networking are a prevalent theme of discussion among the student life staff at Hanover College. There are First Amendment considerations to ensure students have the freedom to express themselves. But when that expression infringes on the rights and privacy of others, what are the results? Lowe Schneider offered a recent example of when a student posted pictures from a party on his Facebook page, and one of the pictures included a prominent female student leader violating the College's alcohol policy. The student asked her peer to take down the photograph and he refused. "So whose rights are more important here and how does the college judicial system intervene?" Lowe Schneider ponders.

Derek Morgan (personal communication, June 7, 2007) has served as a director of student activities for four years at the Colorado School of Mines. He works with all student organizations, Greek life, orientation programs, student government and campus programming. Several members of his student life staff have personal Facebook accounts and use the accounts to invite students to campus events. The accounts are also used as a vehicle to connect with students, view group pages, and share photographs from recent events. Morgan considers online social networking to be similar to cell phones and e-mail, all valuable mediums to communicate with others. “Online social networks are just another way to efficiently and effectively communicate with each other,” he said. “They are an instant way to communicate.”

Morgan said his school initially had a few Facebook groups such as the Intramural Sports office group and the Outdoor Recreation Center group that are no longer in existence. According to Morgan, a Facebook representative called the School to explain that offices and departments could not have accounts. To comply, the School now simply makes announcements about events through the personal pages of directors and other administrators. A Facebook group that remains active is the Mines Activity Council programming board group for the school. The group administrators update the account weekly, making announcements about upcoming events and submitting pictures from previous events to the group’s 162 members.

Morgan believes online social networking groups can be particularly helpful for first-year students, through the creation of orientation groups, residence hall groups, and other interest groups designed with the first-time student or transferring student in mind. He stated it would be hard to prove retention is positively impacted by online social networking, but noted, “Students that participate in the networks probably feel better about their experience and more involved with their campus community.”

Like Lombardi at Duke University, Morgan sees privacy issues as a concern. “There is the debate whether pictures on Facebook or MySpace can and should be used in disciplinary cases,” he said. “Student groups advertising illegal activities or things that violate school policy could be an issue, like fraternity pages showing pictures of hazing activities or underage drinking.”

Ethically, he sees even more challenges facing student affairs professionals. He raises two important questions: 1) As an advisor of student organizations, how far do I go to make sure all students’ Facebook pages are free of negative pictures and comments? 2) Does the school have an obligation to control content when a student has a page based on his or her enrollment in the school?

Linguistic Fantasy or Reality

Those higher education administrators interviewed for this chapter expressed concern over the issue of privacy and the type of personal information students are divulging on profile pages. After conducting interviews with students, an interesting commonality began to emerge. They too were concerned about privacy, but from a different vantage point. Students are concerned with privacy invasion, but mainly because they fear unseasoned online social networkers will not be able to distinguish between the real person behind the fantasy profile. With more than 100 million profiles on MySpace alone, students are working hard to be bold, unique and stand out in any way possible (Pospisil, 2006). Students see online social networking as their time for play, for fantasy. As college student Lauren Trisler said, “I’m not the same person on my profile as I am in real life.”

College student Danny Pfrank echoed this sentiment and added that he sees online social networking as a stage-specific endeavor. “Facebook and other online social networks always seemed to me as something you do throughout high school and college and then you get rid of as soon as you are in the ‘real world.’”

Perhaps his thinking stems from the fact that many elements of non-professional behavior can be found within the OSN realm. It is not only discussions of drunken debauchery or risqué photographs found within personal profiles. Facebook has a clipart gallery of "gifts" that can be purchased and sent to another member for $1 each. It is a clever concept, with many of the 160-plus gifts seemingly designed with sophomoric humor in mind. Imagine clipart gifts including jock straps, pacifiers, a screw, handcuffs, bikinis, a thong, and a roll of toilet paper.

There are also groups that could make a conservative college or university official cringe. An article in *The Boston Globe* in 2005 (Schweitzer) details students discussing on their Facebook sites their use of marijuana and a desire to have sex with certain university professors, with the group titled *my goal in College is to fuck a professor*. Group names are often created using edgy or offensive language. A ten-minute search of group sites around the nation in June 2007 brought up a unique sampling:

- I Hate When I Cheat off a smart person test and I still Flunk with 468 members
- Hey, President Brogan: WE WANT OUR $577,950 BACK! with 229 members
- B+?! F*ck you, Professor…Just give me the A- with 91 members
- Anti-America with 52 members
- Al Qaeda Terrorist and Anti Liberal Network with 44 members
- ANTI Hilary Clinton for president '08 with 59,873 members
- Actually Mr. Bush, you're an idiot with 3,456 members
- Petition against Professor Stephen Kaufman with 548 members

Whether these groups make a person squirm in discomfort, laugh, or simply be content knowing we live in a society of free expression, a challenge arises when a person is linked to an unintended group based on another affiliation or friend. It is common for students to realize all too late that they are associated with a group without having directly chosen to do so.

Tracy Mitrano, director of IT policy at Cornell University, has written several thoughtful pieces detailing how caution should be exercised when using online social networks. One of these, appropriately titled *Thoughts on* Facebook (Mitrano, 2006), discusses how what may seem appropriately funny as a teenager could be embarrassing or even disastrous as an individual gets older. Her example details a young man proud of his well-endowed anatomy, and how he boasted of this fact in an online chat room.

Years later, after being turned down from a job he really wanted, he found out the reason. The potential employer had found this information on the Internet, and the topic was deemed unprofessional enough to warrant a reason for not selecting the individual for the job. The young man requested the information be removed from the original site, but he was told that it was not possible since a commercial Internet Service Provider (ISP) was the domain of his posted information. It was an issue of caching, which in oversimplified terms is the storage of Web files for later use. Caching, as Mitrano explains, "…means that if you post something on Facebook, let's say for a day or two, just to be funny or to make a point, even if you take it down or change it, it remains accessible to the rest of the world on the Internet anyway (Mitrano, 2006)."

Implications for Administrators

How long all this information will be accessible is anyone's guess, but diffusion theory may help reveal the rate that OSN can be expected to continue its emergence as a critical influencer on students and administrators. This theory helps determine the rate of diffusion of a technological innovation, as well as assists in identifying the variables that may encourage or impede the acceptance or adoption of the technology by a community of people.

Diffusion theory is grounded in the idea that adopters make voluntary decisions to either accept or reject a technological innovation based on the expected benefits from independent use. In IT diffusion it should be noted that the adoption may be encouraged or required by management as opposed to being determined by independent use. This encouragement or mandate may influence whether adoption by a critical mass has been established (Katz & Shapiro, 1986). Achieving critical mass with a community of users is crucial. If critical mass is achieved, the innovation is likely to be universally adopted and, if not, the technology is typically abandoned (Markus, 1987).

Those higher education administrators surveyed for this chapter were in consensus that while they felt a critical mass of prospective students and current students use OSN, how the technology will ultimately be used for recruitment and retention purposes is still evolving. Online social networking may be considered an innovation that has progressed through the stages of diffusion in what is considered an extremely short timeframe as compared to the time most technological innovations move through the process. The stages of diffusion according to the innovation decision process theory (Rogers, 1995) are knowledge, persuasion, decision, implementation, and confirmation, and the stages of IT implementation include initiation, adoption, adaptation, acceptance, routinization, and infusion (Kwon & Zmud, 1987). Online social networking has moved through knowledge to confirmation, and from initiation to infusion, for a critical mass in only a few years. Facebook helped ensure IT diffusion to a critical mass by offering its site to more than just students. Through open enrollment, a domino effect is created so that the site becomes increasingly compelling as more people, and more connections, are made.

Not only are these connections compelling from a social standpoint, but online social networking sites could be one of the most effective ways to engage today's students and to strengthen their bonds to the university in a way that improves enrollment, increases retention, and establishes the foundation for strong and committed alumni relations. With such a new forum, at least in comparison to enrollment and communication strategies that have been utilized for decades, it is important for administrators to consider the issues and implications of using online social networks to communicate. Specifically, college and university administrators should consider:

- Creating strategic plans to communicate with prospective students as well as ongoing correspondence upon admittance. High school students make decisions about what college to attend based on a myriad of factors, including Web sites, campus visits, discipline offerings, cost, location, and friends and family. College and university administrators should not underestimate the power of online social networking sites that promote and highlight campus features. Even more, online social networks can help prospective students feel socially accepted even before participating in a campus visit. As part of a comprehensive e-recruiting campaign, online social networks are a relatively inexpensive and efficient way to communicate.
- Developing workshops on the topic of online social networking. While most everyone involved in academia is used to hearing and reading about safety issues related to OSN, many unexplored areas of this particular form of social media exist. Students can benefit from learning how best to utilize online social networking sites to gain a feel for campus culture. For example, a discussion could occur as to what OSN groups exist to promote weeknight or weekend happenings to help the student feel connected. Offering training or information-based workshops during orientation sessions may be useful, but incorporating them into discussions throughout

the year is ideal. Some students have reported feeling overwhelmed by the amount of time they spend on OSN sites (Currie, 2007), almost as an addiction, and discussions of how to healthily and effectively enjoy OSN may prove valuable.

- Extending these workshops to faculty and administrators. Many faculty and administrators are intimidated by online social networking sites and are unsure of how, if at all, to access and utilize groups and sites. Most online technology discussions revolve around how to impact learning. But the critical examination of "extended learning" outside the classroom should be a topic as well. A panel of faculty and staff can help colleagues brainstorm the social media and academic link, offering definition to an often gray area of what is appropriate. Workshops can also help faculty and administrators gain an appreciation of OSN as a way to reach students about departmental clubs, research or campus-related interests. OSN sites are not designed as educational tools, but they can be immensely effective in communicating to students about academic-related information.
- Writing an official policy. Official policies on online social networking practices are becoming more prevalent at colleges and universities. Cornell University offers an extensive policy, including information about *why* policies, safety measures, and self-responsibility are important. Roger Williams University has an online social networking and blogging policy dedicated to employees. The policy requires employees to consult with their dean for approval before accessing an online social network when using a university e-mail account (Roger Williams University, 2007). For those college and university administrators uncomfortable with an official policy or statement that may infringe or stifle First Amendment rights, it remains a helpful exercise to review other college or university policies. These discussions can be informative and useful as college administrators determine the level, if any, of involvement a campus has with social networks.
- Promoting organizational clubs, organizations, social gatherings or other events through online social networking sites. At Eastern Illinois University, peer educators are finding success in using Facebook to actively encourage the idea of a smoke-free campus (Currie, 2007). Groups at other colleges and universities show a strong online presence through Facebook groups touting minority tolerance and diversity acceptance, residence hall rules, science clubs, and pre-professional associations.
- Targeting special-interest groups such as student-athletes, transfer students or parents. Public relations efforts geared toward niche audiences can be effective but costly. Online social networks make it feasible to reach targeted segments or publics with personalized information, something enrollment experts say is critical in today's highly technological and competitive environment (Noel-Levitz, 2006).
- Coordinating meetings with high school teachers, principals, guidance counselors, students, and university administrators on the subject of OSN. The majority of college attendees enter directly from high school. Collaborative efforts between high school and college administrators can only strengthen understanding of the use, benefits, and concerns of communicating with students in today's high-technology environment. Particularly when it comes to high school-college transition issues, college administrators may benefit greatly by hearing perspectives from others. To be locked away in the proverbial ivory tower implies administrators may be out of touch

and unaware of the needs of Millenials. It behooves all educational administrators to gain a respect and understanding of social media.

CONCLUSION: CONNECTIVITY

This chapter details new findings regarding the use of online social networking sites by college and university administrators. It also presents a compilation of data and information in respect to many of the dominating issues surrounding online social networking, including legal issues, concerns over privacy, and how OSN may prove useful to bereaved college students. As with most topics, there are advantages and disadvantages. Online social networking is no exception. Groups and profiles exist that are fun, interesting, informative, entertaining, clever and repugnant.

Like it or not, communicating via online social networking sites is what millions of young people do each day. A market research study commissioned by MySpace, Isobar and Carat (Never Ending Friending, 2007) found a tie in the top two choices of what 15-34-year-olds would do if they had 15 minutes of time: they would either check out a social networking site or talk on their cell phone.

With approximately 90% participation among U.S. college undergraduate students, Facebook alone is transforming the way younger generations communicate (Ellison, Steinfeld, & Lampe, 2006). Institutions of higher education no longer have the luxury of serving as what Levitz and Noel (2000) refer to as "non-intrusive institutions," passively assuming students will value and be involved in their educational experience. University officials must analyze how best to use online social networks as proactive tools. As part of her College's Early Alert Team, Lowe Schneider views the Facebook pages of students struggling academically or socially. Oftentimes the profiles and postings can help her glean information about the source of the struggle or identify key support systems that might be effective to the individual student.

Most educators and university administrators agree that when student success is not left to chance, when institutions utilize all available tools to assist in encouraging and helping students, is when attrition rates are lowest. The earlier connectivity is established, the more likely a student will feel engaged to a particular college or university, and the more engaged or connected, the better chance the student has of successfully graduating. As Duke University administrator Lombardi said, students seek involvement as soon as they are accepted to a college or university, so participation in specialized online social networking groups helps them develop a community prior to arriving on campus.

Because of this connection, and the growing ethical and legal issues surrounding online social networking sites, many postsecondary institutions are electing to create and maintain their own online social networking architectural systems. Hanover College, Western Illinois University, Wilkes University, and others have campus online social networking systems available to users. The University of Alabama has further extended its networking initiatives to parents of first-year students with the development of *myBama Family Connection* (Santovec, 2006).

If nothing else, college administrators may find it imperative to take an active interest in online social networking sites for the time it is takes away from academic studies. Consider the online social networking group titled *When I Flunk Out of College, It's All* Facebook's Fault.

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This work was previously published in Social Networking Communities and E-Dating Services: Concepts and Implications, edited by C. Romm-Livermore & K. Setzekorn, pp. 189-211, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 4.16
Social Marketing in Healthcare

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ABSTRACT

Social marketing is a way to influence the behaviors of stakeholders in the healthcare system. This chapter will define the traditional transaction marketing concepts of exchange, segmentation, competition, the marketing mix, and audience orientation. Then it will describe the current paradigm shift to relationship marketing with its logic of collaboration and the cocreation of value. Relationship marketing is enhanced by the arrival of Internet-based "social media" such as blogs, file sharing sites, and social networking sites that place creativity and communication channels under "audience" control. These developments in marketing strategy and social software will profoundly affect the next generation of social marketing programs.

DEFINITION AND DOMAIN OF SOCIAL MARKETING

Social marketing is defined as "the use of marketing principles and techniques to influence a target audience to voluntarily accept, reject, modify, or abandon a behavior for the benefit of individuals, groups, or society as a whole" (Kotler, Roberto, & Lee, 2002). In reality, the social marketing field relies on more than mainstream marketing for its theory and practice; it also borrows insights from health education, communications theory, anthropology, and social psychology. Nonetheless, social marketing's primary reliance on commercial sector marketing is beneficial because the latter is "one of the most impactful and constantly evolving forces for social change in the world" (Andreasen, 2006).

The preceding definition of social marketing reveals four motivations of social marketers. First, the focus on a *target audience* (defined below) enhances program effectiveness and efficiency. Second, the goal of changing *behavior* rather than awareness or attitudes differentiates it from education. Third, the desire to advance the welfare of *society* rather than earn profits distinguishes social marketing from its commercial counterpart. Finally, the decision to stimulate v*oluntary* behavior change contrasts with law enforcement.

Education may be characterized as a "libertarian" approach to social change that informs people of the long-term benefits of a behavior but offers no prospect of short-term rewards or punishment

DOI: 10.4018/978-1-60566-356-2.ch041

(Rothschild, 1999). Since education involves neither coercion nor immediate rewards, it maximizes individual human freedom to make behavioral choices. However, an educational approach also creates externalities or costs to other parties who may not have agreed to bear them. For example, individuals who choose to smoke cigarettes may create a health hazard in the form of second-hand smoke for others around them. In contrast to education, law enforcement represents a "paternalistic" approach to social change in which people are coerced to comply through implied threats of punishment. Thus, law enforcement curtails individual freedom in order to reduce externality. In contrast to education and law enforcement, marketing may be viewed as the offering of free choice opportunities with incentives in a competitive environment, the offering of benefits that are so appealing as to be coercive and freedom-limiting, or the offering of behavioral opportunities that satisfy self-interest (Rothschild, 1999).

Social marketing is not the only means to social change, and it may not be the best choice for all social or behavioral issues. For example, marketing is inappropriate when a target audience requires basic education or a change in their values (Andreasen, 2006). On the other hand, marketing excels at addressing the lack of opportunity or ability to adhere to a desired behavior (Rothschild, 1999). Thus, the nature of the social issue dictates whether marketing should be used by itself, as a complement to other strategies, or not at all.

There is growing interest in the application of social marketing to medical education, health promotion, and national health strategy (David & Greer, 2001; McCarthy, 2003; Grier & Bryant, 2005; Hastings & McDermott, 2006). This interest parallels the market reform of healthcare manifested by the arrival of value-based healthcare competition; "pay-for-performance" programs; internet-based patient self-management; and the acceptance of joint responsibility for the production of health by the state, the private sector, the charity sector, and citizens (Porter & Olmsted Teisberg, 2007; Petersen, Woodward, Urech, Daw, & Sookanan, 2006; Forkner-Dunn, 2003; Sowers, French, & Blair-Stevens, 2007). Thus, the present milieu favors the acceptance of marketing solutions to social problems.

The remainder of this chapter will define essential social marketing concepts, describe marketing's evolution from a "transaction" focus to a "relationship" focus, explore the role of information technology, and enumerate social marketing's limitations as a discipline.

CONCEPTUAL FRAMEWORK AND CONCEPTS

Social marketing may be viewed as a management process consisting of three phases: planning and research, strategy design, and implementation and monitoring (Chapman Walsh, Rudd, Moeykens, & Moloney, 1993; Andreasen, 2006). In the planning and research phase, marketers specify the program's behavioral objectives and performance indicators. Then they conduct research to identify the target audience, analyze the competition, designate the marketing mix, and examine the target audience's preferred communication channels. In the strategy design phase, marketers develop the marketing mix and communication methods, and pretest their concepts and messages for comprehensibility and acceptability with a sample of the target audience. In the implementation and monitoring phase, products or services are delivered to the target audience, messages are communicated, and performance indicators are monitored. If performance is deemed unsatisfactory, further research is conducted so that the program can be revised and implemented again in iterative cycles of improvement. The components of the social marketing process are explicated below.

Once the behavioral objectives are specified, marketers select the group of people who will be engaged in the social change program. *Audience* *segmentation* is the activity of conducting research to characterize and divide a large, heterogeneous group into smaller, homogeneous groups called market segments on the basis of geographic, demographic, psychographic, and/or behavioral variables (Kotler et al., 2002). Marketers then evaluate, prioritize, and select one or more market segments to be the program's *target audience*. Social marketing programs do not focus on heterogeneous groups because the members of such groups are likely to differ in the factors that affect behavioral adoption. A program designed to address heterogeneous needs would be complex, expensive, and prone to failure. A segmentation and targeting strategy enhances the effectiveness and efficiency of a marketing program by narrowing the scope to the needs of one or a few homogeneous groups; this is desirable because the resources available to conduct marketing programs in the social context are typically fewer than those that are available in the commercial one.

Another early step in the social marketing process is an assessment of the *competition*. In commercial marketing, competition refers to alternative brands of products or services that can be purchased by the consumer. But in the social context, competition is defined as the existing behaviors that people do not want to give up, alternative new behaviors that people prefer over the behavior that marketers want to promote, or organizations and individuals who disseminate messages that oppose the desired behavior (Kotler et al., 2002). Social marketers analyze the benefits and costs of competing behaviors so that they can design or choose a desired behavior that has greater benefits and/or lower costs and/or is more socially acceptable than the competition. However, unlike the commercial context in which the offerings can be continually improved over time, it is an unfortunate reality in the social context that social marketers are often "stuck" offering unmodifiable solutions that may be less attractive than the competition. In such situations, marketers may seek to persuade the target audience that the competition has fewer benefits and/or more costs than the desired behavior. Another tactic is to enhance the benefits of a desired behavior by offering financial and/or non-financial incentives and rewards to adoptees (Deshpande, Rothschild, & Brooks, 2004).

Marketing programs operate on the premise of *exchange theory,* which posits that individuals act out of self-interest and voluntarily engage in economic activities when they derive value from them. Value occurs when the perceived benefits of a transaction equal or outweigh its costs. (Kotler et al., 2002; Rothschild, 1999). In commercial marketing, the pursuit of self-interest by the target audience is openly acknowledged, but in social marketing, target audiences are often asked to adopt behaviors that appear to contradict the self-interest present in their current behaviors (Rothschild). Hence, the creation of exchanges in the social marketing context is more challenging than in the commercial one. Nonetheless, a social marketing program should seek to increase the benefits of a desired behavior and decrease its perceived costs because adherence increases when self-interest can be discerned.

The *marketing mix* is the customary strategy for designing an exchange and is composed of the "four Ps" of product, price, place, and promotion. The *product* is a package of benefits that meets the needs or desires of the target audience. A social marketing product may be characterized as having three levels: the core product which refers to the societal benefit of the desired behavior, the actual product which refers to the desired behavior itself, and the augmented product which refers to the tangible objects and services that support behavior adoption (Kotler et al., 2002). An example of these product levels is provided by hand hygiene promotion programs in healthcare settings. The core product is the prevention of communicable disease transmission, the actual product is hand hygiene adherence, and the augmented product is the provision of antiseptic hand rub that enables hand hygiene behavior to be convenient and accessible.

To develop a product, social marketers research the target audience to learn what problems it wishes to solve and what benefits it desires. These findings are then used to design the product, which can either be a physical object or a service that confers the desired benefits and solutions. Benefits can be tangible entities such as cash rewards or gifts, or intangible entities such as satisfaction, enhanced self-esteem, or social approval. Benefits are also classified as direct (immediate) or indirect (non-immediate); direct benefits are considered to be more powerful motivators of behavior adoption than indirect ones. For example, smoking cessation that is packaged with the remote benefit of reducing lung cancer occurrence is not as attractive as cessation packaged with the immediate benefits of higher energy levels, more disposable income, odor-free clothing, and enhanced self-esteem. Obviously, it is advantageous for social marketers to offer benefits and solutions that are more desirable than those offered by the competition.

Price is the total cost accrued by the target audience when it adopts the product. Costs may be monetary (prices charged for objects or services) or non-monetary (loss of time or pleasure, physical discomfort, or psychological risks such as social embarrassment) (Kotler et al., 2002). In the commercial context, monetary costs predominate, while in the social context, non-monetary costs usually equal or exceed monetary costs in importance. Social marketers reduce or minimize adoption costs so that the desired behavior receives widespread adoption. Furthermore, analogous to the product concept, marketers should seek to outperform the competition in reducing the costs of behavior adoption.

Place is the location and time at which products and services are acquired and the desired behavior is performed (Kotler et al., 2002). Commercial marketers address place with "channels of distribution" (Strand, Rothschild, & Nevin, 2004). Channels are networked organizations or processes that deliver products and services to target audiences so as to enhance their benefits and reduce their costs. In commercial marketing, it may be difficult for businesses to differentiate themselves from their competition solely on the basis of a product's qualities (for example, different brands of coffee are still essentially coffee), so the channel of distribution (for example, a coffee shop) delivers not only the product but additional benefits (for example, pleasant music and aromas, a meeting place, wireless internet access) that create a total experience that is valuable to the consumer. In the social context, consideration of place leads social marketers to enhance convenience by offering closer locations, extended service hours, and product or service availability at the point of decision making (Kotler et al.). Adding convenience enhances a product's perceived benefits and reduces its perceived costs.

Promotion is communication about a product's value and availability that persuades the target audience to make a purchase. In the social marketing context, purchase equates with adopting the behavior. There is a popular misconception that promotion or advertising is marketing's predominant activity. In fact, promotion is the culmination of a multifaceted process of selecting a target audience, analyzing the competition, and designing an attractive exchange. Thus, social marketers promote not ideas but the prospect of gaining value.

Promotion involves the development of a communications strategy, the selection of communications channels, the design of messages, and the achievement of adequate message exposure intensity (Kotler et al., 2002). Research has shown that health promotion messages are more effective when they are framed in terms of gains rather than losses. For example, asking people to undergo medical screening tests to improve their health is more attractive than asking them to undergo these tests to prevent suffering or death from disease (Rothman & Salovey, 1997). Social marketers are also aware that a high level of exposure to behavior messages accomplished by repetition through diverse communication channels is more likely to change behavior than low levels of exposure (Hornik, 2002). The salutary effect of intensive exposure has been attributed to the enhancement of learning, the perception that a behavior is a social expectation, and the stimulation of discussion about the behavior in the target audience.

The preceding marketing activities presuppose an *audience orientation* in which the audience's needs and desires drive the design and implementation of the marketing program. Social marketers believe that voluntary behavior adoption is more likely to occur when the target audience has a say in the decisions that affect them. In practical terms, an audience orientation requires marketers to conduct *audience research* throughout the course of a social marketing program. As stated earlier, *formative research* is performed at the planning and research phase of a social marketing program to inform the segmentation of the audience, the analysis of the competition, the development of the marketing mix, and the selection of communication channels. Formative research helps marketers to understand what they might offer based on the audience's perceptions about benefits and costs, sources of social influence, knowledge, skills, current levels of adherence, and competing behaviors (Andreasen, 2006). A second kind of research called *pretesting* reveals whether key elements of the marketing intervention will be acceptable to a sample of the target audience. A third kind of research known as *monitoring* tracks the progress of the intervention with repeated measurements of performance indicators. Finally, *evaluation* research assesses whether a program has met its original objectives.

The customary audience research tools of social marketers are interviews with key informants, focus groups, and systematic surveys. However, "human factors research" methods employed by industrial design firms have recently captured the attention of social marketers. (Brunner, Waugh, & Kretschmar, 2007). Relying on a combination of interviews and ethnographic methods, designers seek to uncover the "latent needs and emotional triggers" of the audience by listening to stories of product usage and observing behaviors in the everyday environment. Observation is informative because members of the target audience may be unaware of their needs or unable to verbalize them. Observation can also unveil contradictions between what people say and do. The experiences of "extreme users" or nonusers of products and services are also valuable because these individuals amplify the concerns of average users and reveal interesting phenomena such as environmental cues that prompt behavior, thoughtless acts that accompany behavior, and adaptations of existing products. The preceding insights are synthesized into a "customer experience" that guides the design of solutions.

A final aspect of social marketing programs is the application of behavioral and social theories and models (Lefebvre, 2000). Social marketers rely on theories and models to learn from previous knowledge, to simplify the complexity of human behavior, and to make decisions about marketing activities (Hastings, 2007; Lefebvre). However, theories and models should not be applied thoughtlessly and must be appropriate to the context. Examples of theories or models that are relevant to social marketing include Exchange Theory, the Health Belief Model, the Transtheoretical model, and the Diffusion of Innnovations Model.

PARADIGM SHIFT IN MARKETING

The process described in the previous section is a "goods-centered" view of marketing that may be termed *transaction marketing* (Gronroos, 1994). This kind of marketing relies heavily upon the economic exchange concept and emphasizes the management of the marketing mix as the key determinant of profitability or program success. In the transaction paradigm, manufactured physical objects are considered to embed technical solutions or other forms of value, and are exchanged in short-term transactions with an anonymous body of potential consumers or adopters. This paradigm has dominated the logic of marketing since the 1960s, and retains a strong presence in some academic circles. However, confidence in this paradigm has been eroded by its inability to provide insights and managerial rationales for industrial marketing, services marketing, and customer relationship economics.

In the 1980s, marketing scholars began to challenge the transaction paradigm with a "service-centered" perspective called *relationship marketing* which emphasizes service provision, the co-creation of value, and relationships (Vargo & Lusch, 2004). *Service* provision refers to the application of specialized knowledge and skills to create benefits. *Value* is "defined by and co-created with the consumer rather than embedded in output." *Relationship* implies a long-term, continuous process of collaborating with customers, learning from them, and meeting their needs and aspirations. The desired outcomes of relationship marketing are customer satisfaction, trust, and commitment; and the desired reward is sustainable competitive advantage.

Although the relationship marketing approach does not preclude the offer of a tangible product to customers or audiences, it is the quality of the interactions in the relationship rather than the product itself that is the major source of value. Thus, the goal of relationship marketing is to "... establish, maintain, and enhance relationships with customers and other partners...so that the objectives of the parties involved are met. This is achieved by a mutual exchange and fulfillment of promises" (Gronroos, 1994). Long-term relationships empower customers or audiences to become active participants in the creation of value, and give them access to technological, knowledge-related, or social benefits. Relationships benefit companies or organizations by lowering marketing costs (long-range planning is easier and more economical because customers are stable and defined), increasing word-of-mouth advertising, lowering price sensitivity (customers are willing to pay a higher cost for service benefits), and stimulating up-selling (selling more product or service) and cross-selling (selling other products and services) (Hastings, 2003).

Social marketers need the broader perspective afforded by relationship marketing because their offerings are generally less attractive and demand a higher level of commitment than commercial sector offerings (Hastings, 2003). However, the increasing prominence of relationship marketing does not necessitate abandonment of transaction marketing or the exchange concept: "the existence of a market relation is the foundation of exchange not a substitute for it." (Gronroos, 1994). Nonetheless, relationship marketing is a different approach than transaction marketing, and the two may be viewed as opposing extremes on a strategy continuum. A prudent manager must assess whether a behavioral issue is predominantly transactional (requiring a "one-time" purchase) or relational (requiring "repeat purchases" on a long-term basis) in order to apply the marketing strategy that maximizes results.

THE ROLE OF INFORMATION TECHNOLOGY

Information technology plays an important role in social marketing programs. In the past, social marketers conducted audience research with interviews, focus groups, and paper survey questionnaires. Now, information technology can support audience research through additional modalities such as E-mail, internet chat rooms, and Web-based survey software. Advances in information technology have also affected promotion. Communication channels have expanded beyond print media, television, and radio to include E-mail, Web sites, online training software, short message service delivered on mobile communication devices, voice prompt technology, and computer-based decision support. However, it is in the domains of "developing an offering" and enhancing social influence that information technology holds the greatest promise for social marketing. The arrival of a new generation of Web-based communities and hosted services known as "social media" or *Web 2.0* now enable "the people formerly known as the audience" to create and share audience-generated content in the form of blogs (Web logs), syndication feeds, podcasts, wikis (collaborative online documents), folksonomy (collaborative annotation or labeling of Web content), digital images, and videos that can all be found easily with internet search engines (Lefebvre, 2007). Statistics about Web 2.0 usage suggest that large numbers of internet users have been empowered to create and share their own content, and would expect to be active participants in future social innovations that involve them (Lefebvre). Hence, social media offer change leaders an unprecedented opportunity to collaborate with their audiences in the design, implementation, and control of social marketing programs. Indeed, it may now be less efficient for marketers to design, build, and release the "perfect" version of a product or service than to offer the target audience a rapid prototype that they can "hack," improve, and share on their own.

In addition to giving the audience creative and sharing capabilities, Web 2.0 has replaced traditional, one-way communication with interactions. Instead of broadcasting messages to a heterogeneous audience in hopes of reaching some members of their target audience, change leaders can now converse directly with the target audience through blogs and social networking sites. Furthermore, audience members can use social media to bypass experts and talk with each other. This has profound implications for health promotion because health behaviors are not driven by personal risk perception alone: they are also strongly influenced by the conversations that people have with peers who share their condition or have had experiences in seeking help for the condition (Lefebvre, 2007). The new reality of a socially networked world should motivate social marketers to enhance existing social linkages, build and sustain new linkages, empower the peer influence of behavior, and empower communities to develop and manage their own behavior influence programs (Lefebvre).

Blogs provide an example of how the new social media have dramatically altered the communications and marketing landscape. In 2007, the Technorati Website tracked over 71 million blogs in existence on the Web (Lefebvre, 2007). A *blog* or Web log is a frequently updated online diary that can be published by anyone with access to the internet. Each blog entry or posting is instantly available to a global audience, and can be found with internet search engines or sent to E-mail- or Web-based reader accounts using a blog's syndication capability. Blogs also facilitate interaction between authors and readers by allowing readers to post their responses to viewed content. Finally, blogs can disseminate information in viral fashion by linking to other blogs to create a vast network of authors and readers called the "blogosphere" (Scoble & Israel, 2006).

The preceding points reveal that blogging is a digitally enhanced version of the traditional marketer's "word-of-mouth" advertising: "Blogging impacts marketing but also transcends it. Blogging is vital not just to outbound communications but to inbound as well. It is a crisis fighter, a superior research aggregator, a tool for recruiting, a product builder, and customer service and support enhancement. It provides two-way executive access and facilitates employee relations, customer evangelism, and interaction between companies and their constituencies. We have not yet dreamed of some of the ways it will benefit companies in the future" (Scoble et al., 2006).

By now, it should be obvious that the dialogical and creative capacities of Web 2.0 are highly compatible with the desired aims (service provision, co-creation of value, and relationship building) and outcomes (customer satisfaction, trust, and commitment) of relationship marketing. In other words, information technology can now support marketing in a socially networked world. However, information technology is still largely used to support a "command-and-control" management style in healthcare systems. For example, frontline staff members cannot use their institution's information technologies to broadcast messages to the healthcare system without administrative approval and editorial control. But ironically, Web 2.0 empowers those same people to use non-institutional computers to bypass institutional gatekeepers and communicate with a global audience. Thus Web 2.0 radically challenges conventional management norms and poses ethical dilemmas for information technology managers. For example, staff members may make unflattering statements about their institution in a personal blog, violate patient confidentiality by posting video clips recorded in healthcare settings, or create risk management issues by revealing sensitive information on social networking sites. The possibility or reality of such scenarios may prompt administrators to ask information technology managers to block institutional access to social media Websites. As a result, the potential benefits of interactive communication and enhanced creativity would be lost. Alternatively, information technology managers may be asked to introduce user policies and monitoring systems that achieve a balance between the harnessing the benefits and mitigating the risks of using social media within the healthcare industry.

LIMITATIONS AND FUTURE RESEARCH

The most important limitation of the rapidly evolving field of social marketing is an incomplete validation of its effectiveness. Until recently, social marketers needed to cite evaluation studies of communications campaigns as evidence of social marketing's effectiveness even though communications or promotion is but one aspect of the social marketing process. To illustrate, two large systematic reviews of communications campaigns will be mentioned. In the first review that included 28 communications campaigns to promote physical activity, the authors concluded that print media or information technology (telephone help lines or telephone contact) changed short-term behavior, but mass media (television or radio advertising) did not (Marcus, Owen, Forsyth, Cavill, & Fridinger, 1998). In the second review that included 48 health communications campaigns addressing a variety of health promotion issues, the interventions had measurable behavioral effects in the short term (Snyder et al., 2004). Subsequently, a systematic review of full-fledged social marketing interventions based on predefined marketing criteria has been published (Gordon, McDermott, Stead, & Angus, 2006). This review included 31 studies to improve diet, 22 studies to increase physical activity, and 35 studies to decrease substance misuse. Social marketing interventions were found to be effective in changing behavior in a range of target audiences in a variety of settings. In addition, social marketing was effective in influencing the "upstream" determinants of the physical and social environment as well as individual behaviors. However, given the narrow scope of social problems studied, the effectiveness of social marketing for many other issues remains unknown.

There are several explanations for the research deficiency mentioned above. First, social marketers are intuitive thinkers who do not always state the theoretical rationales behind their interventions. Indeed, some social marketers believe that marketing effectiveness results from experience rather than rigid adherence to theories. Second, social marketers prefer to implement flexible programs over time rather than stable ones: while flexibility allows a program to adapt to a dynamic context for the sake of effectiveness, it also weakens the program's ability to establish valid causal inferences. Third, deep-seated behavior change takes many years to attain, but campaigns with short-term funding may be too brief to capture meaningful intervention effects (Chapman et al., 1993; Doner, 2003). Consequently, there is a dearth of research that evaluates the effectiveness of social marketing programs against non-intervention control groups, as well as alternative behavior change approaches. In the absence of thorough documentation of the effectiveness of social marketing interventions in a wide range of social issues, the case for social marketing's utility rests largely upon commercial marketing's undisputed track record of success. However, this assumption may not be warranted because social marketing issues are generally more challenging than commercial ones. So despite concerns about the conflicting aims of research within social marketing, well-designed and well-funded evaluation studies are clearly needed if social marketing is to gain wider acceptance among policy makers and program sponsors.

Besides limited documentation of effectiveness, critics have asserted that social marketing is unsuited to public health issues because it conjures up unfavorable connotations of manipulation that are the legacy of commercial marketing. This is a legitimate concern because Western marketers have tended to avoid ethical debates about their activities, and may also substitute marketing rationales for moral rationales resulting in the portrayal of marketing as an amoral or neutral activity (Peattie & Peattie, 2003; Brenkert, 2002). However, ethical questions about power relations and fairness are unavoidable when social marketers set out to change the behaviors of free individuals within democratic societies. Thus, social marketing academics have begun to discuss the ethics of social marketing (Andreasen, 2001). Conversely, social marketers can provide a service to society by scrutinizing and critiquing the unethical practices of the commercial marketing sector which may contribute to public health problems (Hastings & Saren, 2003); examples include the impacts of the fast food industry on the obesity epidemic, and the tobacco industry on smoking behaviors.

The social marketing field has also been criticized for emphasizing "downstream" individual responsibility for behavior change while neglecting the "upstream" individuals and institutions that control the quality of the physical and social environment in which behavior occurs. For example, applying this concept to the improvement of healthcare services delivery, downstream marketing initiatives could target health services consumption by patients while upstream initiatives could target the diagnostic and therapeutic decisions of healthcare providers. A public health example of the preceding dichotomy is provided by the case of tobacco consumption: downstream initiatives seek to reduce tobacco usage among potential smokers while upstream initiatives target tobacco farmers, cigarette manufacturers, retailers, and politicians. Social marketers have recently begun to pay attention to how they can use the marketing toolbox to influence the upstream determinants of behavior and this will become an increasing concern in future marketing programs (Andreasen, 2006).

Finally, some marketing scholars and practitioners contend that commercial marketing concepts such as exchange theory, the marketing mix, and competition may not be applicable to social issues (Peattie & Peattie, 2003; Wood, 2008). It is asserted that the differences between the social and commercial contexts are at times so substantial as to require that social marketing develop its own methods and vocabulary. Consequently, commercial marketing theories should not be transferred to the social context in an indiscriminant fashion, and social marketers are encouraged to search for innovations in other knowledge domains such as economics, psychology, sociology, and communications theory. For example, the concept of economic exchange, which has been the cornerstone of mainstream marketing, is based on the buying and selling of tangible goods, and may be less useful in the social context than social exchange theory with its focus on friendship building and power relations (Jancic & Zabkar, 2002). In addition, commercial marketing itself continues to evolve, and new concepts such as relationship marketing and branding should be carefully considered for their potential relevance to social marketing.

In addition to the evaluation needs mentioned above, future research in social marketing should answer additional questions: When and where should social marketing be applied? How can social marketing complement other approaches to social change? Which components of the social marketing approach are essential for success? How effective are the new social media in furthering the aims of social marketers? How should relationship marketing and branding be applied to social issues? Can audience research be improved by incorporating ethnography and quantitative research methods? How can social marketers be more creative in their audience segmentation strategies and will this enhance effectiveness? What are the keys to sustaining or maintaining social change?

In conclusion, social marketing is a systematic and dynamic approach to behavior change that draws upon a rich body of multidisciplinary knowledge. Social marketing has strong potential to effect societal good because it offers value, relationships, and empowerment to individuals and communities. However, it needs to establish a more persuasive track record of success if it is to gain wider acceptance among change leaders and sponsors. Without a doubt, social marketing is a work-in-progress and its future praxis will be intimately connected to the rapid advances occurring in information technology.

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KEY TERMS AND DEFINITIONS

Audience Orientation: The philosophy that marketing programs should be responsive to the needs of the target audience.

Audience Segmentation: The activity of dividing a heterogeneous group of people into smaller, homogeneous groups with respect to characteristics that affect adherence to a behavior.

Competition: Behavioral alternatives to a desired behavior, or organizations and individuals who oppose a desired behavior.

Exchange Theory: The hypothesis that economic activity is driven by self-interest and the pursuit of value.

Marketing Mix: A strategy for creating an exchange that takes into account the benefits, costs, convenience, and attractiveness of the marketer's offering to the target audience.

Social Marketing: A program approach to behavior change that draws upon knowledge from commercial marketing and social science.

Relationship Marketing: A view of marketing that emphasizes relationships and service as a means to gaining value.

Target Audience: The homogeneous group of people whose behavior social marketers seek to influence.

Transaction Marketing: A view of marketing that emphasizes exchange theory and the transfer of physical goods.

Web 2.0: Web-based communities and hosted services that enable creativity, sharing, and communication.

This work was previously published in Handbook of Research on Information Technology Management and Clinical Data Administration in Healthcare, edited by A. Dwivedi, pp. 662-673, copyright 2009 by Medical Information Science Reference (an imprint of IGI Global).

Chapter 4.17

Social Software for Customer Knowledge Management

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ABSTRACT

Social software is assuming a significant role in electronic business, increasingly referred to as e-business, and has been utilized recently on a growing scale by companies in customer relationship management. However, it is largely unclear at what levels firms should implement social software. This chapter addresses the gap by identifying the optimal level of social software deployment for a firm that plans to maximize its transactional benefits through the management of a customer knowledge base. The conclusion reached is that the optimal level of social software depends on a range of factors: for example, the initial volume of knowledge base, transaction benefits, and the estimates of the positive and negative effects of social software use. The chapter offers insights and guidance for business managers and practitioners.

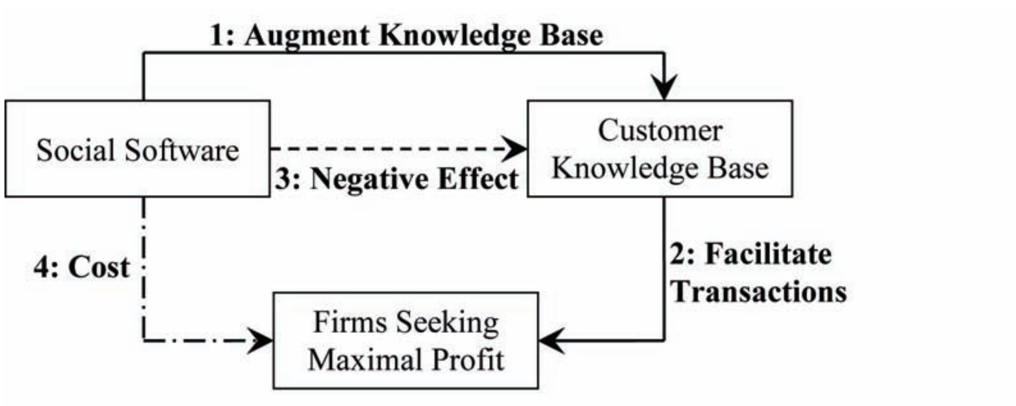
INTRODUCTION

Social software is defined as computer software that "supports, extends, or derives added value from human social behavior" and includes "message-boards, musical taste-sharing, photo-sharing, instant messaging, mailing lists, social networking" (Coates, 2005). In business contexts, social software is commonly referred to as *social and networking software* used by companies to organize internal and external communication. For instance, IBM launched Lotus Connections to compete with Microsoft's SharePoint for the enterprise-wide social software market (Lynch, 2008).

The recent development of Web 2.0 technologies has created remarkable opportunities for Knowledge Management (KM). In particular, companies have recently started to apply social software for managing customer knowledge, maintaining good customer relationships, and enhancing customer satisfaction (Johnston, 2008). Applying social software on their electronic storefronts, firms can create virtual communities for customers to interact with each other and share information and knowledge about products and services. For instance, CircuitCity (2006) launched its online forum to provide better customer experiences and is partnering with IBM to explore the application of virtual worlds in business. Currently available Web 2.0 technologies enable firms to implement different types of social software, from the very basic ones, such as electronic bulletin boards, to

DOI: 10.4018/978-1-60566-368-5.ch044

Figure 1. Four types of effects of social software implementation



those with advanced features, including tagging, blogging, and wikis.

Although social software is gradually assuming a more essential role in e-business, it is still unclear at what level firms should implement social software. Since there exits a wide range of social software applications (including online forums, social tags, blogs, wikis, as well as Lotus Connections and Microsoft SharePoint), firms have to decide which one to implement on their electronic storefronts. This chapter seeks to address this gap by modeling and analyzing the relationship between social software and customer knowledge management. We maintain that social software dynamically influences customer knowledge bases and subsequently describe four types of direct and indirect effects of social software implementation on businesses, as shown in Figure 1. The first and second effects relate to the transactional benefits that firms can obtain by implementing social software to achieve effective customer knowledge management. For instance, social software can provide a platform for customers to interact with each other and acquire valuable information before completing their transactions and supplementing the deficiency of a "static" customer knowledge base. Therefore, social software can complement customer knowledge base by facilitating potential customers' transactions. The third effect describes the negative influence that social software may have on the customer knowledge base. Specifically, customers who are dissatisfied with their shopping experiences may impact the current knowledge base affecting the transactions of future potential customers. Finally, the fourth effect encompasses the costs that firms should incur from maintaining and managing social software.

The purpose of this analysis is to identify the best strategies to implement different types of social software as well as understand the tradeoffs for firms seeking maximal profits.

Specifically, in this chapter we would like to address the following three research questions:

RQ1: *When should firms employ social software to "dynamically" manage customer knowledge*? Most companies have built knowledge bases for "static" customer knowledge management. However, few of them have experiences in utilizing social software as effective tools of "dynamic" customer knowledge management. We are interested in the sufficient conditions for firms to migrate to "dynamic" customer knowledge management with social software.

RQ2: *What is the optimal level for firms to implement social software*? Based on different direct and indirect effects of social software on firms through customer knowledge management, we intend to explore the best level of social software for firms to dynamically manage customer knowledge assets.

RQ3: *How does the optimal level of social software change with different influential factors*? From our framework illustrated in Figure 1, we identify several critical factors of implementing social software and investigate how the optimal level of social software changes with these factors.

The rest of the chapter is organized as follows. The next section presents the background of this research by reviewing related literature on social software and customer knowledge management. The "Analytical Model: Analysis and Discussion" section explicates the main focus of the chapter, detailing our model formulation, derivation of analytical results, and discussion of managerial insights. The "Future Trends" section outlines the directions for future research, and the last section provides a concluding discussion of the results.

BACKGROUND

In this section, we review prior literature, focusing on two recent streams of research in Knowledge Management (KM): that is, the role of social software in knowledge management and customer knowledge management.

Social software provides the following three major types of support for people to interact and communicate with each other: (a) support for conversational interaction between people or groups, (b) support for social feedback, and (c) support for social networks (Boyd, 2006). Therefore, the key areas of social software considered are blogs, wikis, as well as various social network services, such as online forums and social bookmarking.

Recent studies have shown a growing interest in the relationship between social software and KM, especially the role of social software in disseminating and creating knowledge. For instance, Avram (2006) analyzes how to use social software to regulate the core knowledge management activities. Efimova (2005) examines how to use blogs for personal knowledge management, particularly "personal knowledge repositories, learning journals or networking instruments" (p. 1). In a special report, Greenfield (2007) assesses four enterprise social bookmarking solutions that are currently available to e-buisnesses and argues that social bookmarking applications can provide an effective KM platform. From a technical perspective, Kim and others (2007) establish a conceptual framework that combines the social network activities and knowledge processes through social software agents. They build a prototype, called *WANT*, in a wiki-based environment for knowledge workers to collaborate and communicate via a software agent. Based on the survey of a number of different social software websites, Chai, Potdar, and Chang (2007) analyze and categorize the revenue models of social software, including advertising, premium memberships, affiliate programs, donations and merchandise sale.

Customer Knowledge Management (CKM) is the other emerging research stream for knowledge management. *CKM* refers to the management of organizational knowledge residing on the customer side. Gibbert, Leibold, and Probst (2002) illustrate the concept of CKM and propose five styles of CKM: prosumerism, team-based co-learning, mutual innovation, communities of creation, and joint intellectual property. Bueren, et al. (2004) describe how to utilize information technologies to support Customer Relationship Management (CRM) with an integrated CKM process in order to achieve knowledge transparency, knowledge dissemination, knowledge development, and knowledge efficiency. García-Murillo and Annabi (2002) argue that approaches in marketing and CRM cannot successfully capture knowledge from customers, so appropriate methods of CKM have to be employed to retrieve and manage customer knowledge. Rowley (2002) contends that customer knowledge is the indispensable element for firms engaging in e-business. Rowley discusses various topics of customer knowledge: such as, the role of customer communities in CKM, the boundary and structure of knowledge communities, the ownership of knowledge assets, the integration of customer knowledge across different channels, the comparison of customer knowledge management with customer relationship management, and the necessity for organizations to develop strategies to dynamically integrate systems and people. Rollins and Halinen (2005) regard CKM as an integrated management approach with an ongoing process of generating, disseminating, and using customer knowledge; they propose a theoretical framework of CKM that integrates with CRM processes.

Despite the growing interest in social software and customer knowledge management, the economic values of social software for firms are not well understood. Prior research in the field provides a solid foundation for understanding the role of social software in KM and the unique features of CKM; yet, there is a paucity of research investigating social software as it relates to CKM. In particular, the possible economic benefits that social software can bring through managing customer knowledge assets have not been examined.

ANALYTICAL MODEL: ANALYSIS AND DISCUSSION

This section details our model formulation, analysis, and discussion. Beginning with the presentation of our analytical model of social software for customer knowledge management, we then proceed to derive meaningful results from the model and provide managerial insights. Finally, we show the optimal level of social software and discuss how it changes with various influential factors.

We consider a firm which implements social software to manage its external knowledge assets, primarily those related to the customers who regularly visit the firm's electronic storefront. The cost $C(T)$ for implementing the social software is a convexly increasing function of its level T, which means that if the firm wants to implement the more sophisticated social software, it will incur a higher cost.

Customers visit the firm's website to solve certain problems and eventually make transactions. Before completing their transactions, customers would like to utilize both the social software and the customer knowledge base integrated with the firm's website to make sure that their problems are solved and the transactions are beneficial for them. Given the technology level T of the social software and the current volume K of knowledge stored in the customer knowledge base, a customer's problem will be solved, and he or she will eventually consummate the transaction with the probability $p(T, K)$, which benefits the firm with a profit B. Here, the probability function $p(T, K)$ parameterized with T and K is a concavely increasing function of the technology level T of the social software and an increasing function of the volume of the customer knowledge base K; this implies that: (1) when the technology level of the social software is higher, it is more likely that customers will complete their transactions; (2) when the volume of the customer knowledge base is larger, consumers are more likely to complete their transactions; and (3) the rates of both increments of the probability decrease with the level of the social software or the volume of the knowledge base.

We assume that once the transaction is made, the customer will always be satisfied with the service or goods he or she received from the transaction with the support of the social software and the current customer knowledge base. It is also assumed that customers will always tend to participate in the social activities related to the customer knowledge base, such as writing a review of his or her experiences and transactions. Therefore, if the customer makes a transaction, he or she will try to contribute to the current customer knowledge base in a positive manner. The positive contribution σ that a consumer can make to the

Table 1. Summary of notations

B	benefit of individual transactions to the firm
$C(T)$	cost of implementing social software at the level T
δ	negative effect on customer knowledge base
K_0	initial volume of customer knowledge base
K_i	volume of customer knowledge base in i^{th} period
λ	discount rate
n	total number of periods
$p(T, K_i)$	probability of a customer's problem being solved
σ	positive effect on customer knowledge base
T	level of social software

knowledge base is assumed to be equal for all the customers. As a parallel, a customer's problem may not be solved with the probability $1 - p(T, K)$ due to insufficient knowledge in the base or poor capabilities of social software; therefore, the customer may have an unpleasant experience and shall give negative reviews, negatively impacting the knowledge base by the amount of δ. Hence, the influences of current customers' experiences and transactions on the current knowledge base will affect the experiences and transactions of future potential customers.

Consequently, the firm's problem is to maximize its total expected profit π over n periods by determining an optimal level T of social software. We grant that customers are visiting the firm's electronic storefront uniformly. Then, the firm's decision problem [P] can be formulated as

$$\max_{T} \quad \pi = \sum_{i=0}^{n} \lambda^{i} \cdot B \cdot p(T, K_{i}) - C(T), \tag{1}$$

where

$$K_{i+1} = K_{i} + \sigma \cdot p(T, K_{i}) - \delta \cdot (1 - p(T, K_{i})) \tag{2}$$

And λ is the discount rate. All the notations are summarized in Table 1.

To derive meaningful results without compromising the generality of our model, we assume that T and K_i are multiplicatively separable in the function $p(T, K_i)$; and, thus let $p(T, K_i) = \rho(T) \cdot K_i$, where $0 \le K_i \le 1$ and $\rho(T)$ serve as a concavely increasing function of T with $\rho(T) \in [0,1]$. The concave and increasing function of $\rho(T)$ with respect to T ensures that the probability function $p(T, K_i)$ concavely increases in the level T of social software. Based on the simplification of the probability function, we next show the solution to the optimal level of social software in the following proposition.

Proposition 1. *For a infinite time horizon (when $n \to \infty$), the optimal level T of social software can be solved from the following equation*

$$B(K_{0} - \delta\lambda) \cdot \frac{1 - \lambda}{\{1 - \lambda[1 + \rho(T)(\sigma + \delta)]\}^{2}} = \frac{C'(T)}{\rho'(T)} \tag{3}$$

with the sufficient condition as follows,

$$\rho(T) - \frac{2[\rho'(T)]^{2}}{\rho''(T)} \le \frac{1 - \lambda}{\lambda(\sigma + \delta)}. \tag{4}$$

Proof. See Appendix A. ■

In Proposition 1, the condition captured by Inequality (4) ensures that the firm's expected profit is a concave function of the level T of social software so that the global optimal level T^* of the social software can be derived from Equation (3). It can be observed from Equation (3) that the optimal level T^* of social software increases with the transactional benefit B for the firm. This suggests that the firm should consider implementing the most advanced social software applications if transactional profit is significant. In addition to the positive effect of the transactional benefit, several other critical factors modeled in our framework also influence the optimal level T^* of social software. These are summarized and discussed in the next three propositions.

Proposition 2. *When the initial volume K_0 of the customer knowledge base is sufficiently large, such that $K_0 > \delta\lambda$, the feasible solution to the optimal level T^* of social software will exist. In addition, the larger the initial volume K_0 of the customer knowledge base, the higher the optimal level T^* of social software.*

Proof. Equation (3) clearly shows that when $K_0 - \delta\lambda > 0$, the left hand side of the equation is positive and the solution of T may exist. In addition, when K_0 increases, the left hand side of the equation increases as well, resulting in a larger optimal level T^* of social software. ■

Proposition 2 specifies the necessary condition for social software implementation by firms that seek to complement their extant customer knowledge bases. The condition implies that the initial volume of knowledge stored in the customer knowledge base should be large enough for the firm to be able to utilize social software effectively and efficiently. In particular, the initial amount of knowledge data in the knowledge base should be sufficiently large to compensate the discounted negative effect $\delta\lambda$ on the customer knowledge base from customers in one period. Additionally, the proposition demonstrates that the firm should employ advanced social software technologies on its website if it starts with a large consumer knowledge base. This proposition also suggests that the application of social software for "dynamic" CKM is suitable for firms with experience in "static" CKM as well as firms that have established mature knowledge bases for their customers. Only when the above condition is met, firms will be able to withstand the possible negative impact of implementing social software and manage the knowledge assets when dealing with the potential customers. Having illustrated the necessary condition for the adoption of social software products, we next turn to investigating the effects of social software utilization on customer knowledge base. The next proposition indicates how the optimal level of social software changes when the effect of social software is positive.

Proposition 3. *The optimal level T^* of social software increases with σ*, the positive effect of social software on the customer knowledge base.

Proof. See Appendix B. ■

Proposition 3 implies that the larger the incremental positive effect of social software on the customer knowledge base, the more elaborate social software should the firm implement. If social software can bring profit through augmenting the current customer knowledge base, the firm should adopt social software packages with advanced features and take advantage of their positive impact. However, parallel to the positive effect, the negative effect of social software implementation on the customer knowledge base can also influence the level of adoption, which is formally summarized in the next proposition.

Proposition 4. *There exists a threshold level of social software as follows,*

$$T_c = \rho^{-1}[\frac{1-\lambda}{2K_0 + \lambda(\sigma - \delta)}] \quad . \tag{5}$$

When the optimal level T^* of social software is greater than the threshold level T_c of social software, or $T^* > T_c$, the optimal level T^* of social software increases with the negative effect δ of social software on the customer knowledge base; in contrast, when the optimal level of social software is lower than the threshold level of social software, or $T^* < T_c$, the optimal level T^* of social software decreases with the negative effect δ of social software on the customer knowledge base.

Proof. See Appendix B. ■

Proposition 4 demonstrates that there exists a threshold for the level of adoption of social software: only when the optimal level of social software is lower than this threshold, should the firm implement less advanced social software applications. When social software technology applied is not advanced, the firm may continue adopting a less advanced version of social software since potential customers may jeopardize the existing knowledge base by misusing the implemented software. In contrast, the other part of the proposition indicates that when the firm's optimal level of social software is advanced and the negative effect of social software on the consumer knowledge base increases, the firm should apply more elaborate social software products to mitigate the negative effects.

The threshold level of the social software displayed in Equation (5) in Proposition 4 also has some important implications. First of all, when the firm has a fairly large amount of knowledge data in consumer knowledge base, the threshold level of social software will become low; therefore, the optimal level of social software will mostly increase with the negative effect of the social software on the customer knowledge base. Second, when the positive effect of social software on customer knowledge base in each period is significant, the threshold level of social software will be low; so the optimal level of software will mostly increase with the negative effect of social software on the customer knowledge base as well. Finally, when the negative effect of social software on the customer knowledge base in each time period is significant, the threshold level of social software will be high; hence, the optimal level of social software will most likely decrease when the effect of social software on the customer knowledge base is negative.

Based on the above analysis and discussion, firms should implement varying levels of social software under different conditions. Table 2 summarizes the diverse strategies that a firm should consider when it encounters various scenarios regarding the changing parameters: the initial volume of customer knowledge base, the transactional benefit, and the positive, and negative effects of social software on customer knowledge base. For instance, a firm can implement highly sophisticated social software technologies when the potential transactional benefits are foreseeable, when the firm initially has a large volume

Table 2. Changes of optimal level T with various parameters*

Parameters	Optimal Level T^*
transactional benefit $B\uparrow$	increase
initial volume of customer knowledge base $K_0\uparrow$	increase
positive effect of social software $\sigma\uparrow$	increase
negative effect of social software $\delta\uparrow$ when $T^* < T_c$	decrease
negative effect of social software $\delta\uparrow$ when $T^* > T_c$	increase

of knowledge data in customer knowledge base, or when the positive effect of social software has a significant impact on the customer knowledge base. These strategies provide valuable guidance for managers to integrate appropriate levels of social software on their electronic storefronts.

FUTURE TRENDS

Our proposed model and strategies for implementing social software are by no means the best strategies available to manage external customer knowledge assets with the help of social software technologies. However, the suggested social software strategies provide some insights for understanding the relationship between social software and customer knowledge management, which also lays a foundation for related future research.

For the purpose of tractability, the results derived from the above analytical model are based on an unlimited timeframe. For firms who want to seek the best knowledge management strategies within finite periods of time, the model may yield different results. It might be useful in future research to focus on specific scenarios within a certain timeframe, which will offer additional guidance for practicing managers.

The current model considers the expected total profit from a firm's perspective. Future research should investigate customers' rational behaviors by incorporating customers' strategies into the framework and analyze how a firm should design incentives to align customers' interests with the firm's goals utilizing social software applications.

The knowledge management discussed in this chapter is limited to potential customers. The general view of knowledge management can be integrated by utilizing customer knowledge as the interface. In this regard, social software technologies implemented for managing customer knowledge will be able to influence the entire organization. Therefore, future research should examine how social software strategies can be adjusted for managing customer knowledge at different levels, both within and outside of organizations.

Furthermore, the proposed model of social software should be empirically tested to reveal the impact of critical factors of social software adoption and implementation on effective customer knowledge management. Empirical tests may corroborate the usefulness of the implementation strategies outlined in our chapter and help us understand the intricacies of the adoption process.

CONCLUSION

Knowledge management has been commonly regarded as an important business practice for organizations to gain a competitive edge. With the rapid development of Web 2.0 technologies, many organizations begin to use these new tools to manage knowledge assets related to their customers. Based on the analysis of the appropriate strategies for using social software to manage customer knowledge assets, we conclude the following:

The first research question asked about the optimal timeframe for firms to employ social software. The chapter presents an analytical model of implementing social software technologies for effective customer knowledge management over multiple time periods. The model captures the major effects of social software on firms that aspire to maximize the total expected profit through managing customer knowledge base, which lays the foundation for a further discussion of the relationships between social software and customer knowledge management.

The second research question considered the optimal level of social software implementation. The proposed model is solved over an infinite time horizon under certain conditions. The analysis indicates that given a sufficiently large volume of knowledge in a customer knowledge base, a firm can successfully integrate appropriate levels of social software on electronic storefronts to take advantage of the "dynamic" effects of social software on the consumer knowledge base. The initial volume of customer knowledge base ensures the firm to be strong enough to withstand the potential negative effect of the adoption of social software on the customer knowledge base.

The third research question examined the essential properties of the optimal level of social software with respect to several critical factors. Specifically, we investigate how the derived optimal level of social software changes with the initial volume of the customer knowledge base, the transactional benefits, and the positive and negative effects of social software on the consumer knowledge base. The analysis shows that the larger the initial volume of customer knowledge base, the higher the optimal level of the adopted social software. When the transactional benefits are high, the optimal level of the adopted social software is also high and the positive effects of social software on the customer knowledge base increase. Finally, the results demonstrate that there exists a threshold level of social software implementation that may influence the optimal level of change and negatively affect the customer knowledge base.

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KEY TERMS AND DEFINITIONS

Customer Knowledge Management (CKM): *Customer knowledge management* is a subfield of knowledge management that deals with the creation, storage, transfer, and application of consumer knowledge assets, typically with the help of information technologies.

Customer Relationship Management (CRM): *Customer relationship management* describes all aspects of a company's strategic relationship with its customers; it is often referred to as *software-based techniques* in order to attract, retain, and manage customers to increase customer satisfaction.

e-Business: *e-Business* stands for electronic business and any kind of sales, purchasing, services or other business activities on the Internet. It also refers to the processes and tools that enable organizations to utilize Internet-based technologies and infrastructure, both internally and externally, in conducting daily business operations.

Knowledge Base: A *knowledge base* is a specialized database with a collection of data, information, and knowledge within an organization that can be used for problem solving, decision making, project management, or other business-related activities.

Knowledge Management (KM): *Knowledge management* involves the design and implementation of both social and technological processes to improve the application of knowledge to achieve organizational objectives. Knowledge management defines the processes organizations utilize to systematically gather, create, store, transfer, and apply knowledge.

Social Software: *Social software* refers to a range of web-based software programs that allow users to interact and share data, information, and knowledge with each other.

Web 2.0: *Web 2.0* refers to the second generation of Internet-based applications and services that encourage people to produce content, share information and engage in social interactions

APPENDICES

A. Proof of Proposition 1

Proof. With our assumption that $p(T, K_i) = \rho(T) \cdot K_i$, where $0 \le K_i \le 1$, Equation (2) can be simplified as

$$K_{i+1} = K_i + \sigma \cdot \rho(T) \cdot K_i - \delta \cdot (1 - \rho(T) \cdot K_i)$$
$$= [1 + \rho(T)(\sigma + \delta)]K_i - \delta,$$

which suggests that the volume of customer knowledge base can be expressed as the function of the initial volume of the customer knowledge base as follows,

$$K_i = [1 + \rho(T)(\sigma + \delta)]^i K_0 - [1 + \rho(T)(\sigma + \delta)]^{i-1}\delta, \forall i = 1, 2, \ldots n.$$

Therefore, the firm's total expected profit can be reformulated as follows,

$$\pi = \rho(T)\sum_{i=0}^{n} \lambda^i \cdot B \cdot K_i - C(T)$$
$$= \rho(T)B\{K_0 + \frac{K_0\lambda[1 + \rho(T)(\sigma + \delta)][1 - \lambda^n(1 + \rho(T)(\sigma + \delta))^n]}{1 - \lambda[1 + \rho(T)(\sigma + \delta)]}$$
$$- \frac{\delta\lambda[1 - \lambda^n(1 + \rho(T)(\sigma + \delta))^n]}{1 - \lambda[1 + \rho(T)(a + \delta)]}\} - C(T).$$

When the total number of periods goes to infinity, i.e., $n \to \infty$, the firm's total expected profit will become

$$\pi = \rho(T)B\left\{K_0 + \frac{K_0\lambda[1 + \rho(T)(\sigma + \delta)] - \delta\lambda}{1 - \lambda[1 + \rho(T)(\sigma + \delta)]}\right\} - C(T)$$
$$= \frac{\rho(T)B(K_0 - \delta\lambda)}{1 - \lambda[1 + \rho(T)(\sigma + \delta)]} - C(T),$$

where first order condition with respect to T can generate the following condition,

$$B(K_0 - \delta\lambda) \cdot \frac{1 - \lambda}{\{1 - \lambda[1 + \rho(T)(\sigma + \delta)]\}^2} = \frac{C'(T)}{\rho'(T)}.$$

In addition, the second order condition indicates that the sufficient condition for T from the above equation to be the optimal solution is

$$\rho''(T)\{1 - \lambda[1 + \rho(T)(\sigma + \delta)]\} + 2\lambda(\sigma + \delta)[\rho'(T)]^2 \le 0,$$

which further implies that

$$\lambda(\sigma + \delta) \leq \frac{1 - \lambda}{\rho(T) - 2[\rho'(T)]^2 / \rho''(T)}$$

or

$$\rho(T) - \frac{2[\rho'(T)]^2}{\rho''(T)} \leq \frac{1 - \lambda}{\lambda(\sigma + \delta)}.$$

Therefore, for an infinite time horizon (when $n \to \infty$), the optimal level T of social software can be solved from the following equation

$$B(K_0 - \delta\lambda) \cdot \frac{1 - \lambda}{\{1 - \lambda[1 + \rho(T)(\sigma + \delta)]\}^2} = \frac{C'(T)}{\rho'(T)}$$

with the sufficient condition as

$$\rho(T) - \frac{2[\rho'(T)]^2}{\rho''(T)} \leq \frac{1 - \lambda}{\lambda(\sigma + \delta)}. \quad \blacksquare$$

B. Proof of Propositions 3 and 4

Proof. When the positive effect σ on the knowledge base increases, the left hand side of Equation (4) will also increase. Therefore, the optimal level T^* will increase as well.

The first order derivative of the left hand side of Equation (3) with respect to the negative effect δon the knowledge base suggests that when the following condition holds, or

$$-(1 - \lambda) + \lambda \cdot \rho(T) \cdot (\sigma + \delta) + 2\rho(T) \cdot (K_0 - \delta\lambda) < 0,$$

the optimal level T^* of social software decreases with the negative effect δon the knowledge base.

The above inequality can be rearranged as

$$\rho(T) < \frac{1 - \lambda}{2K_0 + \lambda(\sigma - \delta)}.$$

Similarly, it can be shown that when the following condition holds, or

$$\rho(T) > \frac{1 - \lambda}{2K_0 + \lambda(\sigma - \delta)},$$

the first order derivative of the left hand side of Equation (3) with respect to the negative effect δon the knowledge base is positive, so the optimal level $T^*$of social software increases with the negative effect δon the knowledge base.

If we define the threshold level for the social software as follows,

$$T_c = \rho^{-1}[\frac{1-\lambda}{2K_0 + \lambda(\sigma - \delta)}],$$

then the optimal level T^* of the social software increases with the negative effect δ on the knowledge base when the optimal level of social software is greater than this threshold, or $T^* > T_c$ and decreases with δ when the optimal level of social software is lower than this threshold or, $T^* > T_c$. ■

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 496-508, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 4.18
Social Networking Behind Student Lines in Japan

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ABSTRACT

In a cross-cultural educational context of TEFL in Japan, the author sought to enhance the integrative motivation of students toward the target language community through a supplementary online dimension. The social networking site (SNS), Mixi, was selected because it is familiar to most college students in Japan. The Mixi Japanese language interface is illustrated in this chapter, describing functions possibly applicable to education. A YouTube video that introduces Mixi in English, made in authentic collaboration with students, is also referenced as a representative CALL 2.0 classroom activity. More importantly, joining Mixi presented an opportunity to go behind the lines into student territory. Teachers and students, whether foreign or Japanese, customarily maintain their social distance in terms of separate affiliations. Social networking with Japanese students further involves issues of online technological proficiency, biliteracy, and the necessity of an invitation. The author negotiated with three 2007-08 classes on networking through Mixi, with varying outcomes extending beyond the classroom and the school year. Metaphors of lines and perspectives including "technoscapes" (Appadurai, 1990) are proposed to interpret the results, but Japanese socioculture may be most salient to account for the particulars. Student attitudes are probed as to a possible ambivalence in valuing their free expression in Mixi versus the integrative motivation of social involvement with a teacher. One prediction was that results would differ as to whether or not a teacher was welcome in a student community depending on how students were approached for an invitation. Social networking is proposed as a Web 2.0 educational approach that is authentic, collaborative, and immersive in cutting through power hierarchies and positively blurring the distinction between the classroom and the real life of students and teachers, which nowadays includes a virtual dimension.

DOI: 10.4018/978-1-60566-190-2.ch010

INTRODUCTION

This chapter introduces Mixi, a social networking site (SNS) in the purview of most college students in Japan. More importantly, the chapter aims to describe and analyze what happened when a teacher went behind the lines into student territory in order to enhance their integrative motivation toward learning EFL. Metaphors of lines, which do not map predictably across cultures, are employed as a framework for understanding cross-cultural pedagogical issues particular to social networking with students. Among the metaphors employed are reading between the lines, reading and going behind the lines, crossing lines and, as delineated aggregations, territory, maps, and landscapes. Extending the latter perspectivity to technology in Web 2.0, Appadurai's "technoscapes" are considered for possible theoretical support in analyzing students' views of social networking. The methodological approach is to apply an understanding of the languages, cultures and technologies involved, not to generalize about populations but to discern particulars and variations that might be linked to pedagogical interventions. Drawing from sociocultural theory, social constructivism, and the concept of integrative motivation, even one student in a clarified context can provide significant data for understanding complex technology-enhanced L2 learning across non-cognate cultures.

EFL UPTAKE AND TECHNOLOGY USE AMONG STUDENTS IN JAPAN

Briefly with regard to the subjects of this study, the EFL situation in Japan is problematical in a number of dimensions. While nearly everyone studies English for at least six years in secondary school, and children's English is increasingly popular among parents, the Japanese language predominates outside of classes, which do not meet often enough or provide enough listening input and speaking practice. English serves as a test subject for gatekeepers to rank students academically, affecting their future willy-nilly, whether they ever need English or not, so in compulsory EFL classes some students naturally regard the work as an imposition. A disincentive tied to a mutually exclusive sense of cultural identity is that a student who speaks a foreign language fluently may be singled out from her peer group as different or crossing over in affiliation, which threatens the vulnerable young person living in a social world with exclusion. Educational officialdom is more concerned with maintaining Japaneseness than encouraging goals of bilingualism and biculturalism, so there is a pervasive ambivalence about English. Thus motivation tends to be extrinsic or instrumental rather than intrinsic or integrative. Yet teachers are expected to motivate students, so they either read their lines perfunctorily or go to great lengths including innovations in CALL (Computer-Assisted Language Learning).

The technological background of students is that of an advanced nation, but ubiquitous use of Internet-capable mobile phones with cameras and ever more functions has somewhat stunted the computer skills of students beyond what is necessary or convenient for school work. Despite a shortage of IT workers, computer-related courses are relatively less popular in Japan than in many other countries, which heightens the challenge of teachers to innovate while starting from where the students are in computer proficiency. As this chapter will show, however, social networking is very popular among young people and works to converge computers and mobile phones as they access the same platform.

The subjects of this study are female students, who tend to be shy with computers compared to males, as a sort of believed self-stereotype. Osaka Jogakuin College (OJC) has a women's 2-year and 4-year program where everyone majors in English. Unlike the general situation described above, the students have chosen EFL, so intrinsic motives can be activated. The college encourages women's empowerment, so a teacher can promote technological empowerment. The integrated content-based curriculum, recognized as "Good Practice" by the Education Ministry, has the effect of integrating the faculty as well, Japanese and non-Japanese, full-time and part-time. Like most other private colleges in an ageing society, OJC is not difficult to enter, but students have to work hard and therefore tend to achieve remarkable growth in English proficiency. More classes are taught in English by native speakers than at most colleges in Japan. In this institutional culture, teaching is emphasized more than research and each student is valued as an individual.

HYPOTHESES AND PURPOSES OF THIS CHAPTER

The author sought to join the social networking site Mixi in order to go behind the lines into student territory for educational and research purposes. It was hypothesized that voluntarily entering students' virtual communities and friendship networks could help overturn some inhibiting barriers that Japanese students assume in relation to a teacher. Transformative learning experiences might be facilitated in students provided an expanded and more approachable teacher-student relationship is initiated on the simulated level playing field afforded by a social networking site. Particularly in the case of a teacher representing the target culture, social networking is hypothesized to have considerable potential to create a supplementary learning environment enhancing students' integrative motivation to communicate with the L2 target community.

However, in three 2007-2008 classes where most students already belonged to Mixi, results varied in negotiating involvement in this extra social or personal dimension. Thus one purpose of this chapter is to interpret reasons for those particular outcomes, ostensibly within the same culture, hypothesizing that whether a teacher was welcome in a student community or not could depend on precisely how students were approached for the necessary invitation, and in terms of their sociocultural norms. Another reason to join Mixi friendship networks and topical communities was to confirm the hypothesis that more interaction, feedback and collaboration with students beyond the classroom could be realized. An essential purpose of this chapter is therefore to report on what became possible that had hitherto been difficult or piecemeal at best, and to describe what educational potential was realized after receiving an invitation to join Mixi.

THEORETICAL FRAMEWORKS AND METHODOLOGICAL CONSIDERATIONS

Various aspects of Web 2.0 for language learning are defined in complementary ways in this volume. To this author Web 2.0 is imprecise shorthand for a second generation of Web-based technologies that tend to be free, easy to use and to share content, influenced by and therefore reflecting users' collective needs, desires and intelligence. The technologies ascribed to Web 2.0 can be as diverse as mobile phones and 3D virtual worlds, raising the question whether they are related or merely contemporaneous. However, mobile phone Internet content is largely Web-based. As an example, mobile phone home pages can be made and simulated on the Web with Winksite, a free site characteristic of Web 2.0. 3D worlds still have a Web interface, with Second Life SLURLs utilizing Web browsers to open the 3D program at a certain in-world location. Earlier Web-based technologies called Web 1.0 after the fact, such as Web directories or pages or links, tended to be less up-to-date and interactive. For the purposes of this chapter, many Web 2.0 technologies can be applied to education, alluded to in terms such as CALL 2.0, because students in a computer lab can readily sign up for a Web service, including mobile m-learning or 3D sites, and engage in activities that are authentic, collaborative, and immersive. Social networking is characteristic of Web 2.0 and combines many Web 2.0 technologies into a platform that serves as a virtual gathering place. Individual Web 2.0 sites are also useful in activities such as making videos, podcasting student performances, or various means of distance communication (Lee & McLoughlin, 2007; McLoughlin & Lee, 2007). When browsing becomes three-dimensional and activities are native to 3D virtual worlds, then Web 3.0 can be said to have arrived.

Much has been written about social networking sites (SNS) for educational purposes generally (Boyd & Ellison, 2007), and social software as characteristic of Web 2.0 technology (McLoughlin & Lee, 2007). While hybrid or blended media, offline and online, are not entirely new pedagogically, SNS can be regarded as integrated platforms containing communication tools such as blogs, and Web 2.0 functions that students can use much more easily and authentically than they could with Web 1.0 learning management systems (LMS).

For the scope and purposes of this chapter, a general knowledge of SNS is assumed, and comparisons are drawn when discussing the limitations of Mixi functionality. Compared to Facebook, the U.S.-based counterpart to Mixi, little has been published in English about a site with an exclusively Japanese language interface yet experienced by about ten million users. Mixi functions such as blogs are simple to use, and most functions are accessible by mobile phone as well as computer, bringing the technology within the purview of nearly all young people in Japan. Of possible relevance to cross-cultural TEFL situations with high technology but questionable intrinsic motivation, this chapter aims to lift the veils of language and culture while suggesting an approach to foster integrative motivation in students toward the international community using English.

Alm (2006) shows how Web 2.0 activities can be motivating for L2 learning in the case of German in Australia. She mentions that the "phenomenon of social networking shows the strength of the need for relatedness" (p. 32), a component of motivating learning environments along with a sense of competency and autonomy. However, it remains to be investigated whether "self"-centered models such as self-determination theory are as overarching in non-Western cultures such as East Asia. This issue can be revisited after describing the group dynamics of Japanese students deciding about Mixi relationships. Japanese culture includes a strain of rigid conservatism, but the situational relativism of time, place and occasion also informs a repertoire of roles or social gears, and a fluid identity may more readily allow for transformation.

Transformative Learning and Motivational Transformation

The limitations of the seminal theory of "transformative learning" (Mezirow, 1991, pp. 90-91, 167) have been discussed by McCarty (2006). For the purposes of this chapter, learning is understood as transformative when not the content so much as the whole frame of reference of the transaction is expanded to the benefit of the learner's worldview. It is in that sense that transformative learning is hypothesized to become possible through supplementary online technologies, in this case because of the expanded teacher-student relationship afforded by social networking sites (SNS).

Theoretical support for motivation as discussed in this chapter is found in social constructivism and in the psychology of language learning, where individual and social factors are balanced:

[E]ach individual is motivated differently. People make their own sense of the various external influences that surround them in ways that are personal to them ... However, an individual's motivation is also subject to social and contextual influences. These will include the whole culture and context and the social situation, as well as significant other people and the individual's interactions with these people. (Williams & Burden, 1997, p. 120)

Whether or not the teacher is a significant other to the student may correlate with possibilities for transformative learning. Motivation has often been studied in terms of personal attitudes, and despite Gardner's clarifications about dynamism, personality tests in this genre may tend to reify attributes into personality traits that mitigate against change. Lamb (2007) makes similar arguments in the context of EFL in Indonesian schools. Motivation declines on average over the years, and a student may be typecast with the attribute of "unmotivated," yet the main cause of the decline, teaching methods, can also be the source of positive change. If the pedagogy is changed, student motivation is also subject to transformation.

Integrative motivation is also employed in this chapter as subject to change, referring to integrative motives for learning, a learner's sense of integrativeness, and as an orientation, which Dörnyei defines as "a positive disposition toward the L2 group and the desire to interact with and even become similar to valued members of that community" (2001, p. 16). An orientation exists at a certain moment in the changing flow of a person's life. Integrative motivation is thus regarded not as a fixed attribute but as possibly enhanced, with a view to the potential for transformative learning experiences to bring about motivational transformation.

Treating Students as Subjects, not Objects

From a fundamental perspective, treating students as unique individual subjects, not as objects, in research as well as teaching, has methodological support in sociocultural theory (Swain, 2000; Kramsch, 2000; Pavlenko & Lantolf, 2000; van Lier, 2000). Students' contextual and developmental particulars can be of more value for teaching and research than abstract generalizations about populations. To deal even in terms of cultural identities can be constraining, as it may reinforce loyalties that are akin to branding. Social roles may be observed instead, while recognizing individual agency, creativity and self-reformation processes (Roebuck, 2000) as inherent in learners. Thus the interpretation of descriptive and contextual data on even one student can be of interest for research.

Treating students as subjects, not as objects, is evidently practiced in the Osaka Jogakuin College (OJC) curriculum. Classes with one student enrolled have not been canceled outright, and a Computer Communication class with one student enrolled in 2007-2008 will nevertheless be offered again the following year. The educational philosophy of OJC, a women's college where all students major in English, treats each student as "a unique individual of immeasurable worth" (Swenson & Cornwell, 2007, p. 109). Whether due primarily to institutional culture, selection by the student, or treatment by the teacher, an individual student will be seen to make a difference in this research.

Metaphors of Lines, Social Spaces and Perspectives

This chapter attempts to illustrate complex social phenomena with scaffolding metaphors of lines, territories, and perspectives thereupon. In cross-cultural education there are social lines that can be crossed, others that cannot, and further lines that are negotiable with a proper introduction, suitable preparation or pedagogical intervention. In another sense, a teacher may read between the lines of words, behavior or unexpected inaction by students. An observer with second culture literacy might also read *behind* the lines of normative texts, individual behavior, or group dynamics in that culture. But in cross-cultural education the affiliations and socially bounded spaces of the teacher and students differ both culturally and hierarchically within the institution. Yet *going* behind student lines strategically for TEFL in a communicative space such as Mixi is hypothesized to foster integrative motivation, insofar as relationships formed are authentic and collaborative. The territory for teacher-student interaction can be expanded into the virtual with this technology, provided both sides access the SNS for voluntary communication.

Default Lines of Human Relationships

Lines in this metaphorical sense first represent boundaries between affiliations that constrain behavior according to the unwritten social contract of a given culture or subculture. Generally it is safer not to cross these lines but to move within the acceptable paths formed by these boundaries, staying on the side of one's affiliation. These lines are generally heeded as warning signs not to go out of bounds and risk punishment by daring to be different from the prescribed social norm. These default lines are supported by taken-for-granted assumptions about the roles different types of people should play, in this case particularly the social distance or power relationship between teacher and student. Social-constructivist approaches may not transplant smoothly into non-Western classrooms where teachers are expected to be authorities, although Japanese education includes both instructivism and constructivism, depending on whether the objective is academic achievement or social adjustment (McCarty, 2007).

In any case the practitioner needs to know where the invisible lines are drawn in order to estimate the dangers and benefits of a creative intervention. In intercultural communication the invisible signposts or routes to accomplish goals do not readily map onto one other. In a contrasting culture, for instance a native English speaker teaching in Asia, social action can be like navigating a minefield with invisible tripwires. To change default patterns of relationships across cultures thus requires intercultural sensitivity and thoroughgoing negotiations.

Reading Between the Lines in Teaching Across Cultures

Reading between the lines can mean reading the meaning of others' actions or omissions, interpreting the nuances of spoken or written language in a certain cultural context, and discerning implications or motives thereof. The teacher should notice changes in the atmosphere of classes or transformations in the attitude of individual students, accepting it all as feedback on the task or sought objective. Knowledge of the students' native language and cultural literacy about the community beyond the classroom can help in contextualizing observed phenomena, in communicating with the various stakeholders involved in education, and in regarding students as subjects rather than as undifferentiated surfaces that could become psychological screens for unprofessional projection. Knowledge of where students are coming from can help in assessing where they can possibly go, including what social lines they might be inhibited from crossing.

Between and Behind the Lines of Language Policies

Where the lines refer to language policies, "reading between and behind the lines" can turn the focus to the local context and the agency of practitioners, opening up "spaces for transformative pedagogical interventions" (Ramanathan & Morgan, 2007, p. 448). Taking policies not as fixed entities but as engagements subject to interpretation, it is in these "spaces between the lines" of policies "that practitioner agency emerges" (p. 451).

There are also lines of group affiliation between national policy makers and local practitioners, particularly teachers who are on the front lines with students. So the notion of reading behind the lines can point to a deep and empowering understanding of the rationale behind policies, in order for instance to mitigate the effects of political ideologies. In this context, not just to read but to go behind the lines would imply trying to work through channels in the given hierarchy by taking administrative responsibilities or trying to convince governmental authorities to reform policies in response to local needs.

GOING BEHIND STUDENT LINES WITH MIXI

The teacher would be going into student territory by social networking through Mixi, which is popular among students and other denizens of youth culture, since basic exchanges like blog entries and personal messages are available to the mobile phones ubiquitous in Japan as well as to networked computers. As Mixi tends to be a peer medium, with relatively new technologies, a teacher must cross some technological and social lines in order to join. Japanese teachers generally represent different affiliations in terms of age, status, lifestyle, power, and social distance from students, with little in common volitionally, while not many teachers keep up with computer technologies beyond their utilitarian needs. With most foreign teachers there is the further barrier of having to navigate the Japanese language interface of Mixi.

The need for an invitation from an existing member to join Mixi subtly reinforces a social psychology of in-groups and out-groups, pronounced *uchi* and *soto* in Japanese. The latter Chinese character is used in the word for foreigner, literally meaning outside person. Yet even within the culture, anyone outside of a student's peer group would have to negotiate for an invitation, if only because such action would not occur to a student without some prompting. If a teacher expressed a willingness to stay in touch after classes ended, it would probably be a pleasant surprise to students. After a person of interest is known in student circles as a Mixi user, then requests to become a friend or to join a thematic community tend to ensue. This agglutinative process of friend-of-a-friend expansion of individuals' social networks through commonalities not only matches traditional social patterns in Japanese culture but is furthermore enhanced by the affordances of SNS like Mixi.

Yet in a social context where actual teacher-student friendships are not the norm, to do more than is necessary as a faculty member involves crossing some default social lines. Thus a new teacher-student relationship, not incompatible with the institutional culture, must be negotiated in order to bear positive results. A new relationship can be supported by pedagogical consistency in where the lines are redrawn, and reinforced by classroom activities that:

- Promote agency and investment, such as by asking students if they would like to do an activity or offering choices for them to decide.
- Are immersive, not just in a technical sense such as entering a virtual learning environment or 3D virtual world, but any tasks, projects or activities that are interesting and absorbing enough so that students lose a sense of time and other classroom parameters. With content-based real-world activities, voluntary immersion in the target language might also be a part of students' experience of flow.
- Are authentic and involve teacher-student collaboration, such as the YouTube video made about Mixi for an international conference in Japan in 2008 (Thomas, in preparation). Discussing actual global issues with students, assisting in their portfolio products or performances, while de-emphasizing grading and the like, can help cut through power hierarchies and positively blur the distinction between the classroom and the real life of students.
- Could result in polished student performances that merit being published later as student-generated content, for example made available online for other EFL learners or for those interested in Japan (Sener, 2007; Lee & McLoughlin, 2007). When students' work is posted online in some form such as a podcast, they gain a motivating sense of addressivity in their English performance, addressing a global audience as content-creating members of the target

language community. When their efforts receive responses or recognition abroad, it palpably reinforces their integrative motivation to become bilingual and to join that larger world.

TECHNOSCAPES BEHIND STUDENT LINES

With regard to reading the technological landscapes behind student lines from their standpoint, Appadurai's concept of "technoscapes" (1990) may contribute to a theoretical framework calling attention to the technological schemata of students or how they are viewing experiences mediated by information and communication technologies (ICT):

The new global cultural economy has to be understood as a complex, overlapping, disjunctive order ... [A]n elementary framework for exploring such disjunctures is to look at the relationship between five dimensions of global cultural flow which can be termed: (a) ethnoscapes; (b) mediascapes; (c) technoscapes; (d) finanscapes; and (e) ideoscapes. I use terms with the common suffix scape to indicate first of all that these are not objectively given relations which look the same from every angle of vision, but rather that they are deeply perspectival constructs, inflected very much by the historical, linguistic and political situatedness of different sorts of actors ... Indeed, the individual actor is the last locus of this perspectival set of landscapes, for these landscapes are eventually navigated by agents who both experience and constitute larger formations, in part by their own sense of what these landscapes offer. These landscapes thus are the building blocks of what, extending Benedict Anderson, I would like to call "imagined worlds," that is, the multiple worlds which are constituted by the historically situated imaginations of persons and groups spread around the globe. (Appadurai, 1990, para. 4)

The disciplinary context of the author's formulation is the anthropology of globalization, and he comes from India, which, unlike contemporary Japan, has a large diaspora that takes on a collective transnational role such as he describes. A global level of generality can only be painted in broad strokes:

By "technoscape" I mean the global configuration, also ever so fluid, of technology, and of the fact that technology, both high and low, both mechanical and informational, now moves at high speeds across various kinds of previously impervious boundaries. Many countries now are the roots of multinational enterprise ... The odd distribution of technologies, and thus the peculiarities of these technoscapes, are increasingly driven not by obvious economies of scale, of political control, or of market rationality, but of increasingly complex relationships between money flows, political possibilities and the availability of both low and highly-skilled labor. (Appadurai, 1990, para. 7)

The metaphor of landscapes captures in part the perspectivity of the individual Japanese student in a CALL laboratory functioning in English as an International Language (EIL), clearly in the midst of global cultural flows. Yet the definition of technoscapes in the original source could not have anticipated the particulars of current ICT applications to education represented by Web 2.0 activities, m-learning, and rapidly approaching Web 3.0, where activities will be native to 3D virtual worlds such as Second Life. Nevertheless, Appadurai perceived the trend to accelerating technological changes now reaching the intercultural networked classroom, which can be seen as disjunctive or disruptive, hybrid or ambivalent, or in a more positive light as follows:

it is wrong to assume that the electronic media are the opium of the masses ... [T]he consumption of the mass media throughout the world often *provokes resistance, irony, selectivity, and, in general,* **agency**. *(Appadurai, 1996, p. 7)*

However true, for this chapter's analysis a global generalization cannot be assumed to hold for Japan without examining the particulars of the local situation. But nuances in the global perspective that resonate in the case of TEFL in Japan may support Appadurai's theory while shedding light on this study:

[A]s group pasts are becoming increasingly parts of museums, exhibits, and collections, both in national and transnational spectacles, culture becomes less what Pierre Bourdieu would have called a habitus (a tacit realm of reproducible practices and dispositions) and more an arena for conscious choice, justification, and representation, the latter often to multiple and spatially dislocated audiences. (Appadurai, 1996, p. 44)

While critical thinking is essential toward all media, global forces such as advertising on television and other mainstream media are far more insidious and liable to overwhelm the unwary with a false sense of agency than the Web as utilized in higher education. The point in the above quotation about the uses of culture is relevant to the content selected for student homepages and e-portfolio products. Students can imagine correctly that there are Websurfers in other countries interested in Japanese culture, so introducing highlights of their home region provides an educational service that justifies publishing in the global medium of the open Web. When a self-introduction is contextualized by demonstrating the student's cultural background, expectations or communicative conditions are met, and Websurfers are more likely to respond to the product. Teachers in different countries can mutually announce student-generated content, delivering an audience and making the imagined involvement real. As an example, a Computer Communication class activity characteristic of Web 2.0 was to make a narrated slide show with Voicethread, and a student introduced the UNESCO-designated World Heritage Site in her home region. Even though technical obstacles arose and overtime work was needed for its completion, a voice comment posted to the show by an EFL educator in Europe was palpably motivating to the student.

MIXED RESULTS CROSSING STUDENT LINES

To join Mixi in the first place requires an invitation, and it may be pointless at best to try social networking with students in Mixi if the teacher is unable to acquire an invitation from one of their cohort. However, in one class it turned out to be a complex issue to find a student to be the one to implement the invitation among others in the class and, after joining Mixi, to form a topical Mixi community in another class, suggesting that there were invisible lines to cross.

Three 2007-08 classes were negotiated openly, with varying results. To examine why, basic characteristics of each class are next described, starting with the first class approached. Analyzing reasons for the different outcomes, one factor considered is to what extent the class subjects were actually related to social networking. Reading behind the lines, results are interpreted in terms of Japanese cultural values and group dynamics as well as spatial metaphors including technoscapes.

Mixi presents a different situation from mobile phones, which could extend the learning infrastructure informally because of their ubiquitous use among students, or iPods, which all OJC students receive and are thereby an extension of the campus network. While the majority of the OJC students in the classes discussed below already belonged to Mixi, not all did, so there could have been lines dividing the students or cleavages among their technoscapes. They were certainly not monolithic classes but held their own disjunctures, discernible in their various actions and inhibitions. This complexity compounded the challenge of forming new relationships with students above and beyond the class subject matter, but recognizing individual differences along with group dynamics may help explain the diverse outcomes.

A Bridge Too Far in a Bilingual Education Class

A Bilingual Education class at the 4-year college met four hours a week for one semester, with a total of 13 students in their third or fourth year. The class was thematically unrelated to social networking, but with e-mail available, blog links to class-related documents recommended, and lectures of the previous year's course available online, which is termed coursecasting.

The author brought up the subject of Mixi to the class as a whole and asked for an invitation. Attention seemed to turn to one student who had been especially responsive to the teacher in class discussions, otherwise seemingly popular and well-adjusted like many others in her cohort. She agreed, perhaps too quickly in Japanese terms to fully negotiate the issue with her group. Some time later the author asked her again and she agreed, yet she never sent the invitation. One can surmise that she may have had second thoughts about being perceived by her peers as being too much of a teacher's pet. There is a line of affiliation dividing teacher and students that the latter may find safer not to appear to their peer group as having crossed. In general education at many other schools in Japan, students may not speak English in class as fluently as they can for fear of being seen as different from their peers or crossing over in a mutually exclusive sense of cultural allegiance. So this particular student had already crossed some cultural lines, encouraged by OJC course content to embrace bilingualism and biculturalism, yet still finding the invitation to her teacher to join Mixi a bridge too far.

Hierarchical Lines Hard to Cross on Both Sides of the Teacher

To place this issue in a broader perspective, during the same academic year, the author considered trying to start social networking with a Japanese administrator who students had said was active in Mixi. Both the author and administrator were bilingual and on cordial terms in committee work and so forth. Yet this idea evoked inhibitions in the author, evoking a teacher-administrator social boundary difficult to cross, whether Japanese society's reputedly rigid hierarchy truly constituted an obstacle or not. In any case, as a result the author could empathize with any corresponding student embarrassment or hesitancy to cross default student-teacher lines.

Inconclusive Negotiations on a Discussion Class Mixi Community

During the semester after the Bilingual Education class, a year-long Discussion class was in its second semester, meeting three hours a week, with 26 first-year junior college students. The subject of topic discussion was thematically unrelated to SNS, but with e-mail available and Web references recommended. Through OJC faculty-created content-based materials (Swenson & Cornwell, 2007), students had become able to discuss global issues in English to some extent. Some welcomed or sought extra speaking opportunities, again with little connection to SNS. Two students who had won a campus English dialogue contest were excited to record it later as a podcast which, along with their original script, was uploaded for other EFL learners to read while listening, so there was a seed thought in the class about reaching a global audience through the Internet.

In class discussions particularly with a group of four, different from the above-mentioned two, it was agreed that the students would form a Mixi community for this class to stay in touch. It would include the author, who offered technical help if needed, though the Mixi interface is in Japanese. Such a community would be an affordance well-suited to the peer culture and to the situation where their closely-knit class and teacher would be scattered the following year. Yet negotiations proceeded inconclusively. At one point, one of the four, who had palpably worked hard in the second semester to become relatively fluent in English speaking like the other three, mentioned that she did not belong to Mixi yet. Thus it was probably the consideration of the students already in Mixi, not wishing to make any of their peers feel left out, that inhibited them from forming a Mixi community for their class. They may either form a community later or regret not having done so, but they maintained the Japanese cultural value of sacrificing their own wishes rather than risking the appearance of excluding any peers, which they would not wish to happen to themselves. Rather than possibly splitting along fault lines in their technoscapes, they maintained the unity of their peer group.

A Computer Communication Class Fits the Task

In the same second semester, there was a one-semester Computer Communication class that met two hours a week in a computer lab, open to junior college students. The previous years of this class had been enjoyable, but it offered only one credit as a hands-on practicum. This time only one second-year student enrolled, although during three of the 13 two-hour sessions, three other students participated, motivated by intrinsic interest.

For a diminutive Japanese student, being the only student in a class tends to be stressful. She might miss the usual peer solidarity or consider how the teacher views the situation. Online communicative activities simulating distance education with other students in the class were precluded. Mixi was not a formal part of the syllabus or inserted into planned class activities, but Computer Communication was thematically related to social networking. The class subject thus fitted the task. Having one student also made the request for an invitation easier for her to accept, because she was not placed in the position of representing her classmates by extending the invitation.

After several weeks, with rapport established, the Computer Communication student readily invited the author into Mixi. She was a regular user, and the complex group dynamics in other classes alluded to above did not hold in this situation. But the Mixi friend connection with her teacher was by no means kept secret, as friends of hers soon sent friendship requests from within Mixi, some later introducing themselves to the author through this established commonality. As the circle widened, the inference could be drawn that, if there was a student-teacher boundary or social line that was to be crossed, a number of students gladly crossed it after being convinced that it was permissible, or that they were welcome on the other side, responding to the encouragement of integrative motivation as hypothesized in this chapter.

SOCIAL NETWORKING BEHIND STUDENT LINES

Outcomes in the three classes show the importance of the local or immediate context from the vantage point of Asian students. Approaching a group of students for an invitation is evidently more complex, despite or because of the fact that only an individual can issue the invitation. The group may contain greater aggregate desire for relatedness with the teacher, yet the individual extending an invitation becomes a representative or leader, so she needs assurance of representing an unequivocal group consensus lest she become singled out. Establishing new relationships is the hardest part, but it seems quite possible for a teacher to approach a class successfully to network, as evidenced by the invitations the author has been receiving since breaking the ice by becoming a Mixi member.

The small class was conducive to authentic, collaborative activities such as making the YouTube video about Mixi for the Wireless Ready 2008 conference presentation (Thomas, in preparation). The student operated a digital video camera for the first time after learning some techniques. She zoomed in on scenery outside the college window toward Osaka Castle, then focused on the author's introduction of the video. In the main segment, the enrolled student focused the camera on the computer screen while the author browsed his Mixi site, explaining basic functions in the Japanese language interface.

Another student and Mixi user was also present during the filming, and while there was no objection to the idea of inviting Japanese or foreign teachers into their social networks, a sense of ambivalence did emerge. While they themselves had nothing in particular to hide from teachers in their blogs, photos, and other Mixi contents, they could imagine more free-wheeling thoughts and images that some students would prefer only their peers to view. The thought of restraining their free expression because of a wider audience soon occurred to the students, so the opportunity to cross such a social line, or to let others behind one's own lines, is liable to be regarded with ambivalence. All this discussion in English came out before, during and after the filming of the Mixi video in one two-hour class session, so the collaborative authenticity of the activity may have encouraged students to speak out frankly.

SOCIAL NETWORKING WITH MIXI FUNCTIONS

Figures 1-3 introduce the main functions of Mixi that may be of interest for educational purposes. Some limitations of Mixi functions will then be discussed, and comparisons with other social software drawn, particularly with Ning, a more versatile SNS with an English interface that can be used for group collaboration, virtual organizations, academic events, or in lieu of a learning management system. One can enter contents in any language, so with some orientation it may be possible to use Mixi without reading Japanese by clicking intuitively.

Figure 1. Introducing the top of a Mixi member's profile page

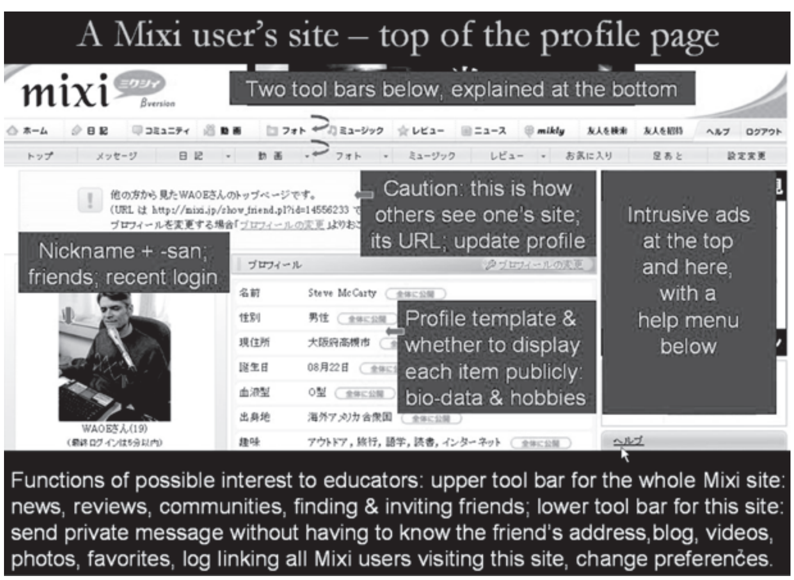
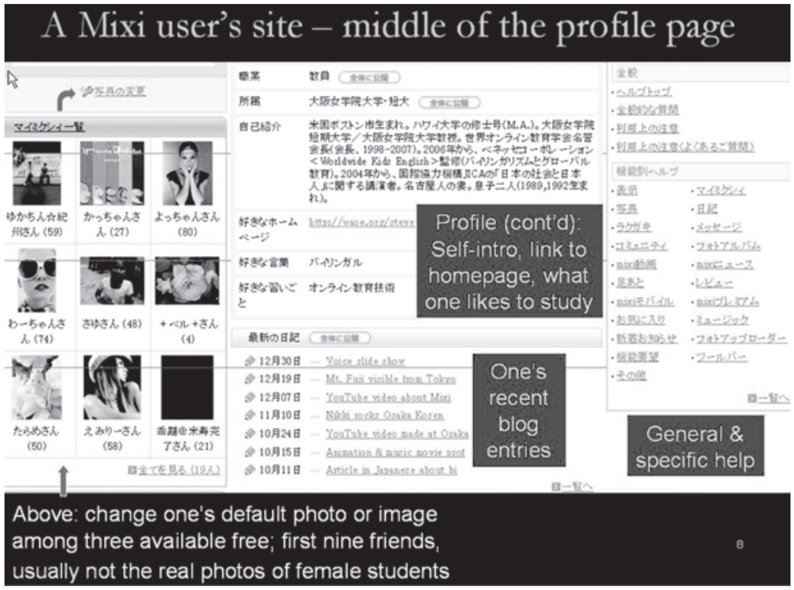
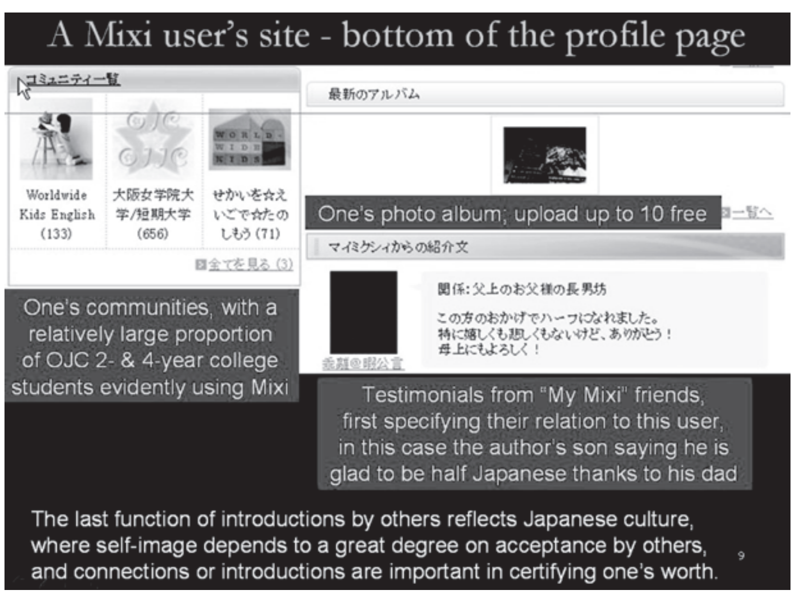


Figure 2. Introducing the middle of a Mixi member's profile page



In addition to the above information, if one clicks on links to specific areas such as one's photo album or blog entries, it will be seen that friends can leave messages, often showing appreciation of the content or turning the thread into a dialogue with other users. While the profile page illustrated above is useful for getting started and for indicating how one's site will look to visitors, the user actually adds more content from the top page, which is reached by clicking the link at the extreme left of the lower tool bar for navigating the user's own site. While the top page is largely similar to the profile page, the big difference is that, rather than centering on one's own content

Figure 3. Introducing the bottom of a Mixi member's profile page



such as the personal profile, it features RSS-style syndicated content from blogs, photo albums, and videos of one's friends and topical communities. It also prominently features a search function for various groupings of Mixi content and people. Thus one's Mixi homepage is more outward-looking or socially oriented, while visitors see the profile that the user ordinarily does not need to see.

The top page also includes some widgets such as a weather report for one's region identifiable from the profile bio-data. One's most recent blog entries and photo album are displayed as links with their date of posting shown. There are further links to write a new blog message or a review of a book, event or product, to work on one's photo album, or to upload videos. Clicking on the video link, one is prompted to search for a file on local disk drives or from a mobile phone.

Albeit with a much smaller interface, most of the Mixi functions of browsing, sending and receiving data can be managed from Japanese mobile phones. Widespread use of the mobile mode is simply a result of what users have at hand. Insofar as a networked computer is available, along with a digital or video camera, more powerful content can be created and uploaded more efficiently. However, for simple text functions such as blogging and personal messages, users can do without a networked computer. Moreover, using the Internet on top of the frequent short messaging that Japanese young people enjoy can quickly become prohibitively expensive.

One of the more intriguing and time-consuming affordances of Mixi is the tracking of visitors to one's site. Users can follow links to sites of people who have visited their site, thereby gaining access to the friends of those visitors, and so forth. Their circle can be widened agglutinatively in this manner, but they soon leave the safe ground of certified friends of friends for a world of strangers.

A more integrated approach to uploading media by computer to Mixi is to append files to blog posts along with a text message. After writing the title of a blog post, above the text area are icons to click on to add videos or photos already uploaded to one's Mixi site, or one can make links to embed videos hosted at YouTube, but not other video repositories, by simply specifying the YouTube URL of the video. Another icon is for emoticons, and many Japanese-style pictographs, some animated, are available to enliven blog posts and other messages. These are used extensively by Japanese young people, along with other emoticons created by typing combinations of English letters, symbols, and Japanese characters. Some of the latter are quite elaborate and may not be understandable without background cultural knowledge of gestures such as bowing deeply. Two more icons are a simple paint function for graffiti and Google maps, a vital function for people needing to meet in a land where few streets have names.

It will be found that functions such as writing in HTML code or sharing various media by embedding code are lacking in Mixi, as of this writing, compared to blogging software like Movable Type or a versatile SNS such as Ning. In the latter but not in Mixi, one can select a design template for one's site. More importantly, Mixi limits the amount of media a site can hold, whereas most kinds of media and widgets can be freely uploaded or embedded in a Movable Type blog or Ning SNS.

AFFORDANCES OF SOCIAL NETWORKING WITH STUDENTS

In the context of TEFL in Japan, a key question is what the teacher was able to do with or for students that had not been possible systematically before joining Mixi. These considerations may be applicable to online technologies in Web 2.0 and beyond that can serve as platforms for sustained teacher-student communication outside of limited classroom hours.

Starting with the long view, joining Mixi friendship networks and communities is not only for the sake of students. After a semester or eventually, students move on, and teachers may wish to know milestones in the life of former students, such as their future use of English for intercultural communication. It was hypothesized in this chapter that voluntary supplementary online involvement with students could create a learning environment transformative in terms of their integrative motivation toward L2 learning and a bilingual identity. With SNS involvement now outlasting the face-to-face semesters, longitudinal observation has become possible to gather evidence toward testing such hypotheses. At the very least, after sharing time and mutual effort toward class goals, both teacher and student may wish to keep in touch rather than having arbitrary schedules turn a human relationship into a temporary juxtaposition. Teachers can now find out more about the long-term results of their teaching in their students' actual lives. Conversely, students can continue to draw motivation from messages to them or milestones in the teacher's life and research posted to Mixi.

So far the greater part of one semester has transpired and its aftermath continues with the teacher networking with some students and Mixi communities of the college and beyond. The teacher has posted content to his site in English and Japanese, so as not to set up a bar to participation but rather to nurture a bilingual environment. The photo album and blog posts including videos and other media have included both family milestones and demonstrations of Web 2.0 educational technology. Most of those entries have drawn comments from students and others, often in English. The entries have thus opened up new spaces for authentic English communication in a largely foreign language environment. While a comment or message may be simple, possibly to avoid errors, the very act of using English for an authentic purpose may be significant to the student as a communicator in a social world of broadening scope.

On the level of one-to-one communication through e-mail and Mixi messaging, the author has responded to friendship requests and private messages, with the Mixi affordance that a student can be reached the next time she logs on without having to know her contact information. It may be preferable not to know such personal information in terms of administrative imperatives, for protection of the teacher as well as the students, and for trust and assurance of the teacher's motives. As compared to a blog comment visible to peers, a private message from a Japanese student is not likely to be decided upon lightly, which means that there is probably a strong personal investment in the message. Replying to such messages is therefore important, reinforcing the human bond with that person, and possibly representing a teachable moment or opportunity to enhance a student's integrative motivation to communicate with the L2 target community.

On a broader social level, as soon as the teacher was invited into Mixi, word traveled among students, and it became a lively topic in campus conversations. Establishing a commonality in the usually partitioned teacher-student relationship was a shift that resonated with Japanese socio-culture, while the crossing of lines shook up the default social system in a sense, allowing for new movement. Some former students rekindled an active relationship with the teacher through Mixi. Some friends of the student who had provided the invitation approached the teacher in hallways or at his office, introducing themselves as the teacher's friend in Mixi with a certain nickname. The teacher could also invite former students to stay in touch as Mixi friends when seeing them in the hallways or at their graduation party.

Proactively, the author published his Mixi nickname in campus publications to welcome students to visit his site, as the nickname suffices for a search in Mixi. This kind of identifier signals online technology use while encouraging friendly communication on equal terms. SNS nicknames could be seen as another contact point to include in a 21st Century calling card (*meishi* in Japanese) along with e-mail and messaging addresses, homepage URLs, and graphic images such as QR codes that mobile phone cameras can read like bar codes to access one's mobile phone Website. When the teacher utilizes technologies that students use, the generational barrier is crossed. Furthermore, if the teacher utilizes cutting-edge technologies that students would like to learn, the motivational excitement of curiosity or a sense of challenge can be kindled. If the teacher can do it, perhaps she can, and the teacher becomes a model of technological empowerment as well as of bilingualism.

FURTHER DISCUSSION OF FINDINGS AND HYPOTHESES

The potential affordances of social networking with students, through Mixi in this case for EFL educational purposes, have been shown to run deep in terms of personal engagement, which in turn is linked to motivational factors enhancing possibilities for transformative learning.

Having considered the technical limitations of Mixi compared to other SNS such as Ning, the main reason one would choose Mixi is because it is currently a gathering place for millions of Japanese people. Social networking sites are not sought for solitary self-expression, or even for the latest technology, but rather to connect for social communication where the largest number of potential online acquaintances can be contacted.

Compared to other Web 2.0 technologies, Mixi has been readily indigenized to enhance pre-existing Japanese social communication patterns. Its popularization thus reflects its usability for individuals in pursuing their own desires or social aims.

Unlike nascent technologies such as 3D virtual worlds, which will be attractive to students as powerful graphics computing becomes available to them, Mixi is already a part of Japanese student technoscapes. Not to the ubiquitous extent of mobile phones, but some familiarity with Mixi among college students can be assumed when bringing up the topic of supplementary online teacher-student communication.

As to whether a foreign teacher could smoothly go behind student lines through Mixi, the need for an invitation from an individual activated complex Japanese group dynamics in approaching a class openly as a whole. After the teacher was invited into Mixi in a one-to-one situation the group approach could not be further tested, but it should be quite possible for a teacher to successfully negotiate with a group of students for an invitation, provided the existing sociocultural contours of Japanese group dynamics are respected. At the time of the Discussion class with first year students the teacher was a Mixi member and welcome in the proposed class Mixi community, but the problem was that not all the *students* were members.

As to the desirability of social networking with students in terms of educational principles, Dörnyei (2001, pp. 31-39) finds it quite appropriate in creating basic conditions for motivation to develop personal relationships with students. After the teacher became a Mixi member the unprecedented approaches from students showed that there was an intrinsic demand for such relationships through social networking. It was as if pent-up demand for more personal communication with a foreign teacher was released, perhaps as a proxy or safe halfway house, as it were, for students' intrinsic motivation toward communication with the target language community.

If one were to investigate whether a foreign teacher is welcome or not in student social networks, the complexity has been evidenced by the differences displayed by students when alone with the teacher versus the particular social and technological compatibilities of a certain peer group. The author would predict that surveying students as to whether they would like to invite a foreign teacher into their SNS or not would produce different results depending on precisely how the students were approached. If such a question were circulated by a Japanese student, for example, in Japanese regarding teachers in general, a different set of considerations might be activated than if their foreign teacher surveyed students directly in writing or in person in English. All sorts of variations could result, with variables including individual student motives and their calculus of trust, risk and other attitudes toward a certain teacher. Rather than arriving at a generalization about a presumptively monocultural population, the answer would be more like a question of just what factors in what weighting could cause such variations. Ultimately the question may be rather how the cross-cultural educator can employ technology to create conditions that work in this cultural context to foster bilingual development.

This chapter has alluded to breaking down the artificial distinction between real life and virtual life. What resulted from joining Mixi was not just the supplementation of classroom communication with an online dimension but also a washing back of virtual relationships into so-called real life.

This chapter has also alluded to the metaphor of agglutination, a characteristic of rice that has been ascribed to the Japanese language in JSL and JFL studies (Minami, 2007, p. x). The pattern described in this chapter, where friends of a friend took Mixi linkage as sufficient commonality to boldly introduce themselves, could similarly represent an agglutinative social pattern in Japanese culture.

Educators may have reasons not to cross certain lines or to maintain their authoritative distance from students, in order to meet local expectations or for class management. The supplemental online dimension explored in this chapter is entirely voluntary and soon goes beyond the framework of a certain class into the wider world of human relationships. In the context of that larger frontier, social networking has been shown to provide a way that is congruent with Japanese culture for a cross-cultural educator to go behind student lines and expand the scope for EFL motivation and positive learning experiences beyond the classroom.

CONCLUSION

A number of hypotheses were proposed in connection with going behind student lines with Mixi in the context of TEFL in Japan. Then the findings from actual negotiations and interactions with students were described and interpreted on sociocultural and technological levels. The main functions of the Mixi social software were illustrated, with the Japanese interface explained in English. How the affordances of Mixi were actually utilized by the teacher and students was also detailed. Moreover, Mixi functionality was found to fit and thereby enhance social communication patterns already established in Japanese culture.

The hypotheses and findings raised a number of questions that call for deeper examination. It was shown how results varied in different classes, acknowledging individual differences in intrinsic motivation and so forth. But if social gear-shifting, time-place-occasion sensitivity, and group dynamics are considered as cultural characteristics, Japanese values provided sufficient explanations for student decisions, belying a cultural consistency in the ostensibly varying outcomes.

Another question was whether or not metaphors of lines, social spaces and perspectives served as suitable scaffolding for understanding the cross-cultural educational issues involved. Such metaphors as invisible lines, crossing boundary lines, hierarchical lines, and social territories proved useful at the very least by forefronting sociocultural norms and expectations that most often go unstated, while what is taken for granted differs between interlocutors in cross-cultural encounters. Extending the metaphors consistently, particularly reading or going behind the lines, seemed to bolster the explanatory framework. But “technoscapes” did not seem so salient to map individual and group perspectives on technology in this case. "Global flows" lack precision to account for the particular context in Japan. While the notion of landscapes could serve to place the focus on perspectives, student perspectivity was already acknowledged in treating them as unique subjects.

Another question is whether or not social networking with students, as hypothesized, actually enhances their L2 motivation. It could not be confirmed longitudinally, and yet communication is continuing autonomously through Mixi where it would have otherwise ended with the semester class or graduation. Science tends to be tone-deaf in gauging the significance of what is normally observed as palpable excitement, and which in education is believed to be a sign of positive if not optimal motivation.

It can be reasoned in many ways from the results that motivation was enhanced. If a supplementary educational opportunity is offered in a purely voluntary online environment, for students to go out of their way and engage with it represents a movement that must have a motive or motivation corresponding to the opportunity. If a student was already intrinsically motivated, for it to be reinforced as opposed to being neglected outside of class also represents a relative enhancement of their L2 motivation. As another example, students previously unrelated to the teacher agglutinated to the social networking involving English once the wall was breached by one student. A commonality can provide an opening for new relationships in Japanese socioculture when a formal introduction or group connection is not available. When students introduced themselves to the foreign teacher of their own volition in writing or in person, such a movement out of familiar circles reflected their motivation. If they felt welcome in such a new relationship involving English, then it stands to reason, since people cannot remain the same, that their integrative motivation was enhanced.

Nevertheless, myriad issues in social networking and other technologies applied to education call for further research. But one-size-fits-all theories and multiple-choice grids cannot be prescribed as global standards to all local contexts. This chapter attempted to acknowledge the variegated particulars in one sociocultural context, and meanings emerged bottom-up from the details and patterns observed in the Japanese social repertoire. In the motivation literature, self-determination theory figures prominently, but it remains to be shown just how well the map fits the actual terrain in non-Western educational situations including instructivist institutional cultures. Alm (2006) cites self-determination theory in finding Web 2.0 activities motivating in an Australian context. But even aside from student views of the technology itself, it remains to be shown whether individualistic theories could most accurately account for both success stories in EFL education and trends toward declining motivation in East and Southeast Asia (Lamb, 2008). In any case, further study is warranted to avoid overgeneralizations.

This chapter, while recognizing individual agency, often traced student decisions to group dynamics in Japanese socioculture. In this balance, "self"-centered theories may be less salient than socially grounded explanations, particularly with respect to SNS. Sociocultural and social-constructivist theories and methodologies, perhaps combined with local or indigenous knowledge of the educational context, may shed new light on motivational transformation. A fluid concept of self as continually created, often in social situations including education, may be more suitable to a Japanese style repertoire of shifting gears or roles, while also allowing for identity transformation free of typecasting. For as identity changes, particularly as EFL learning experiences open up new avenues for bilingual and bicultural development, motives and motivations constitutive of the individual also transform.

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FacebookS. N. S.http://www.facebook.com

Life, S. http://secondlife.com

Mixi, S. N. S. http://mixi.jp>. For an invitation needed to join Mixi, e-mail: (waoe@mail.goo.ne.jp

Ning, S. N. S. (http://www.ning.com). WAOE 2.0 (example Ning site): (http://mywaoe.ning.com)

Type, M. (http://www.movabletype.com); in Japanese: (http://www.sixapart.co.jp/movabletype). An example of a blog utilizing this social software: (http://commune.wilmina.ac.jp/weblog/waoe)

Voicethread: (http://www.voicethread.com)

Winksite: (http://winksite.com)

YouTube. (http://www.youtube.com). Video filmed in the Computer Communication class as a Web 2.0 activity: "Social Networking in Japanese Student Territory with Mixi": (http://www.youtube.com/watch?v=RXBwr6gMrrM)

KEY TERMS AND DEFINITIONS

Integrative Motivation: A type of motivation that is particularly relevant to learning foreign languages, it refers to a learner's intrinsic orientation or desire to communicate with, be more like, or to join the L2 (second or foreign language) user community. Developed chiefly by R. C. Gardner, the concept has been refined by Z. Dörnyei and others, moving away from fixed attitudes toward the possibility of transformation as hypothesized in this chapter.

Mixi: The most popular SNS in Japan with users estimated at over ten million, possibly over a tenth of the whole population, predominantly students and young adults. Most of its functions are accessible from the mobile phones ubiquitous in Japan. In this chapter Mixi provides a supplementary online dimension for a teacher to motivate EFL students and continue the human relationship after classes end.

Second Life: Sometimes referred to as simply SL, Second Life is a 3D virtual reality developed by the Linden Lab in California, USA, that was launched in 2003. It became more prominent in late 2006 as a number of global corporations and educational institutions opened buildings there. Based on a free downloadable client, Second Life estimates that up to 18 million accounts have been registered there as of early 2008.

SNS: Social networking site or sites, sometimes social networking service or services. To users it is an online gathering place for enhancing relationships and making new acquaintances by sharing words and media about oneself and one's world. Successful SNS companies provide mostly free services and gain revenues through advertisements rotating on users' Web pages. Functionality differs according to technology and culture, but common functions are profiles, blogging, photos and short videos, with messaging and RSS-style notifications of new entries by a user's friends and topical communities.

Socioculture: The combination of social factors, some of which may be incidental to contemporary institutions, with cultural factors that are deeply ingrained and passed across generations, strongly coloring people's identity and communication style. The resultant combination affects people's tendencies to affiliations that can be related to languages, and this chapter utilizes metaphors of lines to symbolize existing sociocultural borders that may constrain cross-cultural communication along with other patterns of behavior.

Technoscapes: A type of global cultural flow in A. Appadurai's anthropology of globalization. It foregrounds the various perspectives people have on technologies, and this "perspectivity" can be useful in considering the varying background knowledge of students in CALL (computer-assisted language learning) classes. Globalization generally affects such students in Japan, but this chapter finds that knowing the specific cultural background of students is essential to interpreting their use of social networking technology.

TEFL: Teaching English as a Foreign Language (EFL). Teaching English where another language is predominant in the environment. Therefore, English input or practice in a country like Japan often depends on classes that do not meet often or long enough to match the results of an ESL environment where, by contrast with EFL, English pervades the environment outside of class as well.

This work was previously published in Handbook of Research on Web 2.0 and Second Language Learning, edited by M. Thomas, pp. 181-201, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 4.19
WEB 2.0, Social Marketing Strategies and Distribution Channels for City Destinations:
Enhancing the Participatory Role of Travelers and Exploiting their Collective Intelligence

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ABSTRACT

During the last decades, the use of Web 2.0 applications for the generation, dissemination, and sharing of user-generated content (UGC) and the creation of new value added services are enormous. Web 2.0 tools have tremendously changed the way people search, find, read, gather, share, develop, and consume information, as well as on the way people communicate with each other and collaboratively create new knowledge. UGC and Web 2.0 are also having a tremendous impact not only on the behaviour and decision-making of Internet users, but also on the e-business model that organizations need to develop and/or adapt in order to conduct business on the Internet. Organizations responsible to market and promote cities on the Internet are not an exception from these developments. This chapter aims to inform city tourism organizations responsible for the development of city portals about (a) the use of the major Web 2.0 tools in tourism and their impact on the tourism demand and supply; and (b) the ways and practices for integrating the use of Web 2.0 into their e-business model and e-marketing practices.

DOI: 10.4018/978-1-60566-134-6.ch011

INTRODUCTION

During the last years, the number and use of numerous Web 2.0 tools, whereby Internet users produce, read and share multimedia content (User Generated Content, UGC), is mushrooming (eMarketer, 2007a). It is estimated (eMarketer, 2007b) that 75.2 million USA Internet users currently use UGC, and this is expected to increase to 101 million by 2011.

eMarketer (2007c) also found that over 25 million USA adults regularly share advice on products or services online.

The Web 2.0 technologies and applications (e.g. tags, RSS, blogs, wikis, podcasts, etc.) are considered as the *tools of mass collaboration*, since they empower Internet users to collaboratively produce, consume and distribute information and knowledge. In other words, Web 2.0 tools do nothing more than realizing and exploiting the full potential of the genuine concept and role of the Internet (i.e. the network of the networks that is created and exists for its users). This has tremendously changed the way people search, find, read, gather, share, develop and consume information, as well as on the way people communicate with each other and collaboratively create new knowledge (Sigala, 2008). UGC and Web 2.0 technologies are also having a tremendous impact not only on the behavior and decision-making of Internet users, but also on the e-business model that organizations need to develop and/or adapt in order to conduct business on the Internet (Bughin, 2007).

The tourism industry is not an exception from such developments. On the contrary, as information is the lifeblood of tourism, the use and diffusion of Web 2.0 technologies have a substantial impact of both tourism demand and supply. Indeed, more than ¼ of Internet users have used a weblog to review information about a destination or travel supplier in the last 12 months (Harteveldt, Johnson, Epps & Tesch, 2006), many new Web 2.0 enabled tourism cyber-intermediaries have risen challenging the e-business model of existing online tourism suppliers and intermediaries who in turn need to transform their e-business model and e-marketing practices in order to survive (Adam, Cobos & Liu, 2007). As the Internet plays an important role for the e-marketing of city destinations (Sigala, 2003; Yuan, Gretzel, & Fesenmaier, 2006), Web 2.0 tools and applications also create both threats and opportunities for organizations developing and maintaining destination management systems and portals. In this vein, this chapter aims to inform city tourism organizations responsible for the development of city portals about: a) the use of the major Web 2.0 tools in tourism and their impact on tourism demand and supply; and b) the ways and practices for integrating the use of Web 2.0 into their e-business model and e-marketing practices.

WEB 2.0 TOOLS IN TOURISM: USE, IMPACT AND APPLICATIONS IN CITY MARKETING

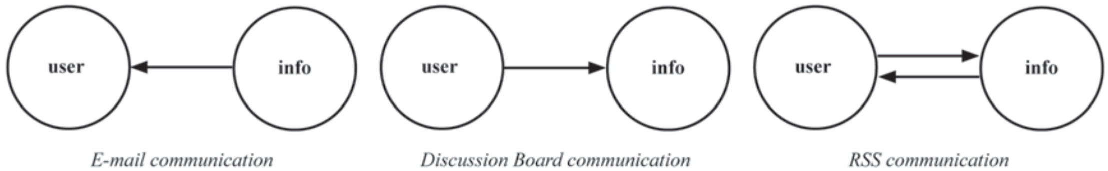
RSS (Really Simple Syndication)

Definition, Features and Use

RSS allow users to subscribe to a webpage for receiving new content, e.g. subscribe to receive online distributions of news, blogs, podcasts etc, and so, RSS allows the creation of links and interactive communication amongst other Web 2.0 applications and users. This is done either through a news aggregator (similar to an email inbox) or a news reader (a web-based environment) (Winer, 2005). By doing so, one does not have to visit each individual website that he/she is interesting to read any new information, but rather the RSS feeds all new updated information to the users' RSS reader. RSS readers enable Internet users to gather and read all new information that is customized to the user's profile within one consolidated message. Many free RSS exist on the Internet, e.g. FeedDemon, NewsGator, Rojo, software on the website of Google™, MyYahoo®, etc.

RSS allows new communication and interaction modes with information (Figure 1) (Farmer, 2004). In e-mail, the control of the communication channel is held entirely by the instigator of the communication. Consequently, e-mail communication is characterized at times by flame wars, antisocial behavior and feelings of intrusion by the participants, while the information artifact is transitory, unfixed and not archived except in indi-

Figure 1. Communication types



vidual instances. In discussion boards, information artifacts are fixed, frequently archived and can be interacted with through threading and comments, but for accessing information, the user must deliberately visit a dedicated online area. In contrast, in RSS, both the communicator and the reader of information have control of the communication process, i.e. the former sends information only to those that users have selected to aggregate the RSS feed, while the later select from where and how (e.g. summaries, titles, or full entries) to receive communication. Further, as most RSS aggregators are either integrated with or stand-alone desktop/web applications, readers need only to check the aggregator for new items.

Impact on Tourism Demand

RSS feeders have a tremendous impact on the way consumers search and read information nowadays. RSS has the following benefits for users:

- saves a lot of time spent on information searching;
- provides users with consolidated personalized information;
- is less obstructive and more personalized to users' interests than other Internet based communication, and so, RSS entice subscribers to visit the related websites, thus helping in building website traffic and visitation;
- RSS boosts viral marketing and online word-of-mouth as users tend to forward items in RSS feeds to their friends, family and co-workers, much like the 'forward this message' feature in eNewsletters.

Business Applications for City Marketing

As RSS is an information distribution technology that is characterized as a demand pull rather than a supply push model, many tourism destination organizations have adopted and incorporated RSS feeds in their websites in order to communicate with their potential and current travelers in a less disrupted and personal way. Some examples of RSS include:

- Keep a communication with their travelers such as sending them Newsletters and/or updates of the programme of cultural events organized in the city.
- RSS helps organizations to enhance their Search Engine Optimization by creating inbound links to a company's website and by informing search engines whenever new content is uploaded on a website, so that they can index it.
- RSS is used for syndicating content to other Websites expanding the original website's readership and reach.

For example, the destination marketing organization of Las Vegas has included an RSS on its website (visitlasvegas.com), whereby users can subscribe to feeds that automatically notify them of current travel specials. Almost all of the information (e.g. events' news, weather updates, special offers, etc.) on the official city website of Dublin created by the city tourism board (visitdublin.com) is available to any traveler and/or other website through RSS. RSS are offered for free for anyone for reading and/or enriching his/her own web site, provided that the latter follows the proper format, terms and conditions and attribution, e.g. attribution such as *"Content provided by Dublin Tourism"*. In such a way, visitdublin.com aims to enhance readership of its content, continuous personal communication with its customers, viral marketing, and search engine optimization through content syndication and incoming links.

Blogs (or Weblogs)

Definition, Features and Use

Weblogs began as personal writing spaces that store and update regularly multimedia content (in reverse chronological order) and links of interest to the author. Thus, blogs are used for recording its author's journey and sharing it with others by using links, RSS, trackbacks, comments, taglines, archives, permanent links, blogrolls, etc. (Blood, 2000). Weblogs are defined as a ''… site consists of dated entries'' (Blood, 2000), whereby entries are episodic or conversational in a diary or ''story telling'' format. Motivated by different reasons (Forrester Research, 2006), such as documenting one's life, providing commentary and opinions, expressing deeply felt emotions, articulating ideas through writing, and forming and maintaining community forum, weblogs (or blogs) are a *''new form of mainstream personal communication''* (Rosenbloom, 2004, p. 31) for millions of people to publish and exchange knowledge/information, and to establish networks or build relationships in the world of all blogs. Indeed, blogging tools enabling between-blog interactivity are building up the ''blogosphere'' whereby social networks among bloggers are created. Du and Wagner (2006) identified the following characteristics of blogs:

- **Personalized:** blogs are designed for individual use and their style is personal and informal. Blogger.com offers a ''team blog'' collaborative feature enabling also multi-person weblog.
- **Web-based:** blogs are easy to access and frequently maintain by simply using a web browser.
- **Community-supported:** Weblogs can link to other weblogs and websites (e.g. photos, videos, web-texts), enabling the synthesis and linkage of ideas from different users, and so, stimulating meta-knowledge, i.e. the generation of new knowledge through sharing.
- **Automated:** Blogging tools are easy to create and maintain without the need of HTML programming skills and knowledge; so, bloggers can solely concentrate on the content.

Du & Wagner (2006) also identified 3 types of blogging tools and features: type I features of blogging (such as text, diary, hyperlinks, user friendly editor) provide easy-to-use and learn tools for editing, presentation, publishing and interlinking of content. Such blogs are heavily used by those that solely seek a channel of self-expression. Type II blogging tools (such as Indexed archive, search, "permalink": a permanent URL for each weblog entry enabling referencing of specific past entries like other web-source. ''Trackback'': a reverse hyperlink tracking the referrer weblogs ''making these formally invisible connections visible'', categorisation & syndication) are used by bloggers who wish to easily share rich media (e.g. videos, pictures etc), to have a sophisticated content management system and to enable between-blog commenting or hyper linking, e.g. through ''permalink'' or trackback (Blood, 2000).

Nowadays, the emerging Type III of blogging tools provide improved content distribution and between-blog connectivity (e.g. “pingback”, alert of other bloggers’ comments or new posts), as well as integrated applications for further enhancing social networking and community building such as the following examples:

- Workflow or project management (e.g. Lycos Circles workflow for a party, from invitation to management of responses and to travel directions),
- Polls, Intrasite messaging (e.g. ModBlog allows users to track friends’ newest entries, or to know who are the most “recent visitors”),
- Web invitation, picture/music sharing (e.g. MSN Space picture/music sharing, and remote posting of updates via email or mobile devices).

Impact on Tourism Demand

Numerous examples of general and-or (content or user) specific blogs have been created in the tourism industry, such as tripadvisor.com, hotelchatter.com, bugbitten.com, placeblogger.com, realtravel.com, travelpod.com, igougo.com, gazetters.com (a B2B blog for travel agents). Many travelers and tourists also develop and maintain their own blogs for sharing their travel experiences with others and distributing their feedback (reviews) of travel suppliers for achieving fun, social recognition, prestige and-or self-expression. Due to the unbiased information shared in blogs based on first-hand authentic travel experiences, many travelers tend to use and trust blogs’ information for searching for travel information, tips and selecting travel suppliers and destinations. Blogs have the power of the impartial information and the electronic word-of-mouth that is diffusing online like a virus. Hence, blogs are becoming a very important information source for international travelers for getting travel advice and suggestions. Moreover, when reading others’ travel experiences through weblogs, this also creates to the reader the willingness to travel and visit the same destination or suppliers. Indeed, research has shown that UGC at blogs has a similar AIDA effect to users as paid advertisements have. The latter is because blog’s content can (Lin & Huang, 2006): 1) **A**ttract the attention, eyeballs of other Internet users and increase traffic on a website, 2) create **I**nterest to users who can now seek more and additional information, 3) develop someone’s **D**esire to also visit a destination and/or buy the product and 4) foster an **A**ction (e.g. book a hotel or organize a trip to a destination). Of course, it should be noted that the power of blogs can also be negative, i.e. spread a bad experience of a tourist to million of online Internet users. Therefore, it is very important that tourism companies authorize a public relations staff as the responsible representative of the company to first scan and read blogs’ content and then respond to formally any positive and negative users’ comments. Guidelines and corporate policies for responding to UGC should also be established. Nowadays, many blogs take the form and are presented in a video format (Vlog, video blog). The first travel website to implement vlogs exclusively is endlesseurope.com. Due to the multimedia features of video content and the intangible nature of the tourism product, it is argued that vlogs are going to have a much greater impact and influence on travelers’ decision making and evaluation of alternative tourism products and suppliers.

Business Applications for City Marketing

Blogs generate and distribute a plethora of UGC related to travelers’ experiences, suppliers’ and destination reviews, travel tips and advices. City destination management organizations can exploit and use such content for:

- monitoring and influencing electronic word-of-mouth;

- conducting an easy, free, timely and reliable market research about travelers' preferences, feedback and profile;
- communicating with current and prospective travelers in a very personal and informal way;
- gathering travelers' feedback and responding to customers' complaints;
- enhancing search engine optimization: blogs are becoming very important tools affecting information search since their links, content and popularity can dictate the position of a company on a search engine search.

There are many search engines that one can use for identifying and locating weblogs. The most popular one is technorati.com, which also provides statistics about the online activity of weblogs, e.g. about the popularity of a blog and its potential influence on search engines results.

Apart from exploiting others' blogs, many tourism suppliers and destination management organizations have also adopted a pro-active strategy by creating and incorporating blogs on their own websites. For example, Marriott has created its own blog on its website (www.blogs.marriott.com), while Starwood has created a blog to communicate with its Preferred Guests and enhance their loyalty through the website www.thelobby.com. Company initiated and moderated blogs can offer the following benefits: solicit and gather feedback from customers; conduct free online market research; become recognized as an expert on a specific topic; communicate and update your customers with latest news; and use others' customers' suggestions for helping customers select and evaluate products such as what amazon.com is doing by allowing users to upload books' reviews on its website. For example, Eurostar has initiated a blog (www.voiceofacity.com) whereby it has commissioned local Parisians to post blogs for creating a travelers' guidebook with a truly ground-roots feel. The destination organization of the city of Los Angeles has created a blog supporting the sharing of bloggers' experiences and insights on their adventures of the diversity of Los Angeles' arts and culture (http://blog.experiencela.com/). The fully Web 2.0 enabled official portal of Holland features a blog capability (i.e. the triplog) enabling Dutch travelers and locals to share and post the experiences they lived in Holland (http://us.holland.com/blog.php?sf=e.pagerank&so=DESC&sel=popular). In this vein, blogs are becoming a useful tool for enabling local communities to get more involved in destination marketing, communicate and blur with tourists. As a result, blogs and web 2.0 tools can support and foster community participation in city tourism development and marketing practices. Community participation can ensure a better blend between locals and tourists reducing any inter-cultural conflicts, creating social relations and respect and understanding amongst different cultures as well as enabling multi-stakeholder understanding and communication in tourism decision making and activities.

Social Networking–Collaborative Networking

Definition, Features and Use

Social networking websites enable users to create their profile and invite others with similar profile to take part in their online community. The most popular websites such as myspace.com and bebo.com reflect the willingness of Internet users to transform websites as a gathering place of people with similar profiles.

Impact on Tourism Demand

Many social networking websites have been created in the tourism industry allowing travelers and prospective travelers to network with one another based on shared interests or attributes, such as tripmates.com, gusto.com, triporama.com, triphub.com, traveltogether.com and wayn.com. Travelers log into websites and create a personal profile detailing their travel experience and interests, then network with others o share travel advice and stories, and even plan trips together. Hence, social networking websites have a tremendous impact on how tourists nowadays create, organize and consume tourism experiences. Many tourists nowadays prefer to have the reassurance of other users sharing similar profile with them that the trip, the travel company, destination and/or the itinerary that they have scheduled is a good one and it matches their preferences and tastes. Many tourists also wish to use the Internet for collaboratively organizing a group trip with their friends. Websites such as tripup.com, traveltogether.com and travelpost.com enable tourists to create an itinerary, e-mail and share it online with others, who in turn can edit, modify and enhance it, post it back to others for further comments and / or invite and read other travelers' comments and advices on the trip they organized in order to finally achieve a consensus and proceed to a group booking.

Business Applications for City Marketing

Since sharing travel experiences in a social website can significantly inspire travel and boosts one's willingness to visit a destination or supplier, several tourism websites are incorporating social networking tools in their e-business models. For example, existing cyberintermediaries, such as Yahoo!® Trip Planner has adopted a collaborative trip organizing and booking tools. The official website of the city of Philadelphia has also features a collaborative trip planning tool (www.planit.pcvb.org), that potential travelers can use for organizing their itinerary in Philadelphia with friends as well as soliciting feedback and comments from other travelers and locals.

Lufthansa created and operates its own social networking website, named as Jetfriends, for enabling its young flyers to share flight experiences and indoctrinate them into the Lufthansa brand and frequent flyers' club (http://www.jetfriends.com/jetfriends/kids/). Sheraton also re-organized and re-designed its website (which is nowadays titled as the Sheraton Belong Neighborhood), whereby Sheraton's guests can subscribe to the website, upload their experiences, stories, pictures, videos and comments for sharing them with other website visitors and users. The social networking of Sheraton's website enables potential travelers to organize and book their holiday and hotel experience at any Sheraton property that matches their profile and preferences by reading and reflecting on the comments and first-hand experiences written by previous Sheraton customers. The impact of social networking features for persuading potential travelers to select a particular hotel and/or destination is very powerful, because through social networking websites, travelers can search website content based on keywords and stories contributed by other travelers that may be more relevant and make more sense to them than keywords and experiences being created and pushed by the website developers themselves. For example, on Sheraton's website one can search an hotel experience based on the comments and tags contributed by a previous guests referring to *"nice walking in beaches nearby Sheraton hotels*" or *"relaxing family holidays in Sheraton properties"* rather than using the Sheraton's search engine to find hotel based on its location, facilities etc.

Nowadays, many city destination organizations have also incorporated social networking features into their e-business model and strategy in order to further enhance their communication with customers and take benefit of the electronic word-of-mouth that they can create. For example, the official website of Los Angeles invites any cultural and art organization-institution to become a partner with experiencela.com in order to share and distribute related content on their website. Experiencela.com has also created a cooperation e-business strategy with the social networking websites clickr.com and myspace.com. Specifically, the destination management organization of LA created a special webpage for LA on flickr.com (http://www.flickr.com/groups/21164279@N00/pool/) and myspace.com (http://www.myspace.com/experiencela) in order to enable the users of the formers that are also funs and travelers of LA to share personal photographs, comments and stories about LA. The city of LA has realized that such UGC can crucially drive traffic to their website, boost their search engine optimization strategy, instil travelers' desire to visit LA and use customer intelligence for providing reliable and timely advice and suggestions for trips to potential travelers to LA.

Tagging (Social Search and Tag clouds)

Definition, Features and Use

Tagging represents a new way for categorizing information. Users tag a piece of content (e.g. an audio, a picture, a word) with a meaning (a word or phrase) and then this information is categorized in categories based on this meaning. Community tagging is a bottom-up, grass-roots phenomenon, in which users classify resources with searchable keywords. The tags are free-form labels chosen by the user, not selected from a controlled vocabulary. Tagging is also known as consumer-generated taxonomy. Forrester (2006) defines tagging as 'the act of categorizing and retrieving Web content using open-ended labels called tags'. Tagging provides customer value, because it allows them to assign their own word or words to mark products and content online in order to categorize content that they find relevant, i.e. such as what bookmarking allows users to do. Words that users choose for categorizing website and content then become a navigation shortcut that a person can use to browse and search content throughout that site.

Tagging is used not only for saving and sorting a user's content but also for sharing content with others. Websites with tagging capabilities can also allow users to share their personal tags and navigation ways with other users. Moreover, some tag enabled websites enable users not only to share their tag navigations, but also their profile. In this way, users can see who has tagged something, and try to search and find information based on the search behavior of users with similar profiles and mental maps with them (personalized social searching). In this vein, tagging has a great effect on how search engines identify and present information results in keyword searches to users.

Flickr.com represents the first wide-spread of tags, whereby users can add their own tags to any photo they wish to share, aggregate pictures into photosets, create public or private groups, search photos by tags and easily add flickr-stored photos to a blog. Nowadays, there are numerous websites enabling tagging and searching based on tags, e.g. del.icio.us, a bookmarking service, Technorati, a blog cataloging site, and digg, a gathering place for tech fans. These sites create clickable "tag clouds" for resources, groupings of tags arranged alphabetically, with the most used or popular keywords shown in a larger font. In this way, these websites present other websites that users think are important or relevant to them. Many such sites make use of RSS to notify interested users of changes and new developments, e.g. in flickr.com, RSS feeds can be attached to individual tags, or to photos and discussions. In addition to RSS, flickr.com and other social networking sites typically offer functions such as search (for users and tags), comments (and comment trails), and APIs (application program interfaces) for posting to or from the tools, that can be used in combination with blogs. An interesting use of RSS that is combined with tagging is the Flashcard exchange, where, one can view or subscribe to all flashcards posted for learning Spanish (or other languages).

Although the tagging process is by no means simply technical—a way of categorizing resources—it has a strong social dimension as users of the website find common interests and create on-line communities. It represents another example of the fuzziness separating consumers and creators on the Web. A contribution to a tagging site, seen by other users, may cause additional tags or comments to be added, automatically building and updating and thus ultimately defining a resource. Instead of one person making a judgment about a blog entry, photo, or other resource, a consensual classification is created. In effect, a text or object identifies itself over time. This creation of "folksonomies" (as the user defines how to sort information which in turn defines how others search and find information) can be seen as a democratic implementation of the Semantic Web. Thus, for some, tagging helps and boosts the creation of the semantic web (Web 3.0), whereby web content and search is directly related to its meaning for the users.

Impact on Tourism Demand

Several websites offer the capability for users to sort, share and categories travel related content based on tagging, e.g. flickr.com (for pictures sorting and sharing), travbuddy.com (for travel experiences sharing), travelistic.com (for tagging video content). However, although more and more users are using collaborative tools for identifying and sorting travel content, tagging is still an emerging technology: only 5% of USA online leisure travelers—slightly more than 5 million of the 114 million USA adults who travel for leisure and go online regularly—tag Web pages or other content on sites like del.icio.us or Flickr™ (Epps, 2007). Moreover, the social capabilities of tagging for community building and social collaboratively construction of concepts' meaning and of travel experiences could have numerous innovative applications in tourism as well. For examples, travelers may be enabled and offered the opportunity to build structural tags in a text using XML for creating word groups or simply finding appropriate keywords to describe a travel experience. This would offer additional options to Internet users to collaboratively develop travel itineraries and search of travel information with others sharing a similar profile with them.

Business Applications for City Marketing

Because of the power of the folsconomy to provide enhanced user-value and influence the results/page ranking of search engines' search, many tourism firms nowadays include and consider tagging when designing their websites and e-business strategy. For example, Thomson's website provides an affiliate link to deli.ci.ous.com (http://www.thomson.co.uk/), so that its users can tag and sort its website content through this technology.

However, tourism firms may adopt different strategies regarding the way they use and incorporate tagging into their websites (Epps et al., 2007). For example, Triporama.com has launched its tagging system, titled "Triporama Bookmarks", which allows its website users to download a free software in their PC for tagging content in their own words from anywhere on the Web to their Triporama group trip plan, which they can then share with their travel companions. Such a solution provides differentiation customer value for Triporama, because as travelers visit many different Websites while planning a trip, Triporama's bookmarking tool lets travelers collect, label, and share the content they have found on the Web with other members of their group. Users also have the option to make their tags publicly available, while Triporama also aims to edit and curate these public tags into features like "top 10" lists to give other users ideas for planning their own group trips. When redesigning its website, Sheraton introduced its "Vacation Ideas" feature whereby guests are invited to write stories about their hotel stay, users give Sheraton their consent for publishing their stories online and the entire story becomes a tag. A tag cloud is created, titled the "Buzz Barometer", whereby word occurring most frequently in stories appear in bigger fonts, while based on the number of stories shared containing different words a "Vacation Ideas page" is created (http://www.starwoodhotels.com/sheraton/index.html). For example, by clicking on the "Beach" guide brings up the five hotels whose stories mention "beach" most frequently (weighted by the number of stories relative to the size of the property). By making storytelling the method by which the tags are created, Sheraton has made tagging so friendly and easy for its guests that they do not even know that they are tagging content. Sheraton benefits from this tagging strategy because:

- It helps first time website users: Vacation Ideas gives travelers, not knowing where they want to go and/or not familiar with the Sheraton brand, a more creative, user friendly and understandable way to search and book hotels than the customary destination-based and company pushed search.
- It helps Sheraton to build long lasting relations with its guests by maintaining a close relationship with the travelers before, during and after the trip. This is because the website provides guests having stayed at a Sheraton's hotel to return to the Sheraton's website in order to contribute, solicit or read other travelers' stories.
- It improves organizational learning, since Sheraton gets insights into Sheraton's hotel properties and customers' experiences. Instead of conducting expensive and time consuming research, Sheraton uses tagging as a simple and reliable way for gathering customer feedback and intelligence about its products and services. Based on the customer knowledge that is gained, operation managers can improve organizational processes, while marketers get to know what and how customers think and talk about the brand, in order to better position the Sheraton brand in the market and enhance the guest experience at the hotels in ways that reinforce guests' perspective of the Sheraton brand.

Yahoo!® Travel introduced new tagging features into its Yahoo!® TripPlanner that enable users to tag their own or others' Trip Plans with suggested or custom tags, which are later analyzed and used by Yahoo! for identifying and feeding recommendations on the Yahoo! Travel home. Users can set their preferred level of privacy at the level of the Trip Plan (private, shared with invited friends, or visible to any user). Users are provided around 30 tags (e.g. ("budget," "luxury", "weekend", "honeymoon") to choose from for labeling trip plans from the style of the trip, however, Yahoo! monitors the tags used most frequently by its users for augmenting its list of proposed tags. By using taxonomy-directed tagging, Yahoo!® eliminates many of the inherent problems of folksonomies created when users label similar things differently using synonyms or different forms of the same word (e.g. lodging, accommodation, hotel etc.). Tagging has helped Yahoo!® to: a) make its content (750,000 Trips Maps, photos, users' comments etc.) more useful, accessible, searchable and understandable to its users; and b) to gather, analyze and use customers' intelligence (where they live, where they have traveled, and what content they have viewed) and further refines that knowledge through the lens of the tags they use to search in order to create targeted, personalized recommendations for destinations and deals sold through its vertical search website Yahoo!® FareChase. In other words, tagging helps to further refine the collaborative filtering process that Yahoo! uses in order to provide personalized recommendations and suggestions to its users. Personalized suggestions for cross and up sales can significantly drive and enhance booking and sales levels as well as provide additional functional and emotional value to website users that in turn enhances customer loyalty.

In the same vein, the official destination portal of Holland uses tagging technology in order to provide travelers an easy way to search the website content and its multimedia information (video, photos etc.) (http://us.holland.com/). Actually, tags are used as an user constructed and defined search engine rather than providing a search engine designed by the website developer that reflects a top down business defined search process. Tag clouds appear on the left with different font sizes to reflect words used more or less frequently, while "Top 10" suggestions for each tag (e.g. restaurant) are also constructed and updated continuously when new content and UGC is shared on the website. The portal also provides users the possibility to comment each others' contributions and comments as well as to tag the Holland's webpage content by using different social booking technology such as Digg and Furl.

Overall, it becomes evident that city tourism organizations should consider including tagging into their websites, as tagging can help them overcome the following issues (Epps, Harteverldt & McGowan, 2007):

- Very frequently websites do not speak the same language and they do not use the same terminology as their users. City destination organizations should consider using tagging in order to make their website content more accessible, understandable and appealing to its users. For example, the marketer of a city might promote as the major value of the destination its easy accessibility by air transportation, however, travelers may perceive as the most valuable feature of the destination the fact that it is "a safe city to walk around".
- Tagging can help and further enhance keyword search by supporting nuanced, adjective-based searches. Tagging also enables social search whereby users can see who has tagged something, how credible or relevant its suggestions are based on his/her profile and his/her evaluation by other users.
- Tagging helps organize and display user-generated content uploaded on websites. As more and more city tourism organizations invite their users to upload and share their UGC (e.g. reviews, itineraries, photos, videos, and podcasts), they later struggle to make this UGC relevant and accessible to their users and tags can help in addressing the latter.
- City tourism organizations can gather reliable and timely customer intelligence and feedback regarding the image of their destination, the mental maps of their travelers and how they view and perceive their destination etc. Such customer knowledge can be later used for marketing campaigns as well as for improving the products and services of the city as a destination.
- Customer information gathered through social tagging can also be used for improving search engine optimization campaigns. For example, words used frequently as tags by travelers can be used as metatags-metadata for building the portal's website as well as for spending money on keyword sensitive search engines such as Google™ AdWords.

However, when deciding whether and how to use tagging, city tourism organizations responsible for the development of the city portal should also decide the process, the policy and the way for developing their tagging system regarding the following issues: a) does the company edit the tags incorporated by users? This is important specifically if tags are uploaded with spelling mistakes or they include anti-social and embarrassing words. In other words, editing and a clear policy may be required in order to protect the consistency, the ethos and the good image of the website; b) are the tags and taggers' profiles made publicly available for everyone? What consent and agreement are required to take from the users and how the privacy policy of the website should be amended to incorporate the former?; c) is a software going to be purchased to manage the tagging process or is this going to be done manually? Are the required and skilled labor sources available? and d) how tags are going to be created? Are the tags going to be provided by the users or are the tags restricted by the website owner? Forrester (2006) recommends that companies use *taxonomy-directed* tagging, as it makes the tagging process more efficient and easier to use and it promotes consistency among tags. This is because when users create a tag, they can choose from existing suggested tags, or they can add their own.

Wikis

Definition, Features and Use

Wiki is a piece of server software permitting users to freely create and edit (hyperlinked) content via any browser and without the need to have access to and know to use any programming language. A wiki is a collaborative website whose content can be edited by anyone who has access to it. Wiki features include easy editing, versioning capabilities, and article discussions. So, wiki technologies enable users to add, delete, and in general edit the content of a website. Wiki users-creators are notified about new content, and they review only new content. As a result, such websites are developed collaboratively through their users, and a wiki becomes a collaboratively expandable collection of interlinked webpages, a hypertext system for storing and modifying information—a database, where each page is easily edited by any user with a forms-capable Web browser client. Neus and Scherf (2005) defined wiki as web content management systems allowing collaborative creation, connection and edition of contents, while Pereira and Soares (2007) defined wiki as a shared information work space that facilitates access to information content, organizational communications, and group collaboration. In other words, wikis represent another way of content publishing and communication as well as for group collaboration. In this vein, wikis and blogs have some similarities but they differ regarding the notification of new content, editing format, and structure. In other words, *'a wiki can be a blog, but a blog does not have to be a wiki'*.

Impact on Tourism Demand

The most popular wiki is the famous online encyclopedia, titled wikipedia.com, that is created and continually updated by its users. In tourism, wikitravel.org represents a wiki based effort of Internet users to collaboratively create and continuously update an online global travel guide including world-wide destinations. The number of readers, creators and content at wikitravel.org are continuously mushrooming. At wikitravel.org, one can find guides for any destination irrespective of its size and/or geographic location, as well as create a guide for any destination that he/she wishes. Wikitravel.com is further enriched with other web 2.0 tools and technologies such as maps, tags, podcasts etc.

Business Applications for City Marketing

Many tourism organizations take the opportunity to promote and create links to their websites through wikitravel.com in order to create and drive traffic to their own websites (http://wikitravel.org/en/London). Many other destination management organizations exploit and incorporate the wiki technology in their website portals in order to enable its users (travelers and locals) to collaboratively create and share their perceptions and mental images and opinions about their destination. For example, the National Library of Australia has included a wiki on its portal (http://wiki.nla.gov.au) inviting users to share their understanding and knowledge of local Australian dances as well as negotiate their meaning and create metaknowledge by synthesizing different views and perspectives. The National Library of Australia has also developed a wiki and social network website (www.pictureaustralia.org) whereby users can share their pictures about Australia and tell their story. In this way, the Library aims to help democratize history and establish a collective memory of places and events around the country. Ancient Times website (http://ancient.arts.ubc.ca/community.html) includes several collaborative tools, such as a wiki, blog and an arts metaverse enabling any user and history student to collaboratively develop and negotiate the meaning and construction of old cities and destinations, such as Giza and Athens. These cultural guides can significantly enhance the appeal and the interpretation of the cultural artifacts of historical cities and destination by providing several edutainment services and benefits to their users/visitors (Sigala, 2005a). Other wiki applications can also be provided on the city portals in order to boost website loyalty, repeat traffic, and travelers' desire to visit the destination. For example, a destination organization can design and incorporate a wiki on its portal for enabling potential travelers and locals to exchange and collaboratively develop recipes of local dishes and food.

Podcasting and Online Video

Definition, Features and Use

Podcasting refers to the uploading of audio and video files by users on websites. The most popular website for sharing such content with others is youtobe.com. Podcasting represents repositories of audio (podcasts) and video (vodcasts) or "video podcasting" materials that can be "pushed" to subscribers, even without user intervention, through RSS aggregate feeds of audio and video content facilitating users to search the latest services. Podcasting-capable aggregators or "podcatchers" are used to download podcasts. These files can also be downloaded to portable media players that can be taken anywhere, providing the potential for "anytime, anywhere" learning experiences (mobile learning). Podcasting's essence is about creating content (audio or video) for an audience that wants to listen when they want, where they want, and how they want. Podcasting differs from webcasting. A podcast has a persistent site, capable of synchronizing with a portable multimedia device, e.g. an MP3 player or iPod, whereas webcasting is streamed from the internet and requires the user to be connected to the internet while playing or viewing the webcast files. Webcasting is closely related to real-time downloading and synchronous broadcasting. Podcasting adds spatial flexibility to the temporal flexibility that webcasting offers and affords itself for creating personally-customizable media environments. Podcasting offers customer value in terms of the flexibility possibilities to hear personalized content whenever and whatever device one wishes, e.g. one can download the "Economist"'s or "CNN"'s personalized news' and press releases to his/her iPod and listen to its favorite news while he/she driving at work. As podcasting does not rely on the visual senses, it allows users to carry out other tasks while listening.

Impact on Tourism Demand

Tourism experiences are intangible. One cannot experience, feel and try a travel experience before he/she buys and before he/she travels to a destination. As a result, the purchase risk of a travel—tourism experience is high and it is difficult to persuade a user for the qualities of a tourism service. Due to its multimedia features, podcasting helps users to better and easier evaluate travel alternatives by experiencing in someway a travel experience before they decide to buy and consume it and/or travel to a destination. This is because audio and video files of hotels, destinations, and other travel products created and uploaded for sharing by other users are considered as more unbiased information and not staged experiences produced by the supplier aiming to promote his/her own product as the best one. Podcasting has also been used as mobile guides for travelers, e.g. Virgin Atlantic provides through its website free podcasts-guides of cities whereby they fly to.

Impact on Tourism Supply

Many tourism suppliers are using Podcasting as a marketing, information and customer communication tool. For example, Jumeirah hotel uploads podcasts on its website for delivering and updating its potential guests about what is happening in its properties at every single day, and-or delivering to website users and potential buyers the experiences of VIPs that have stayed at their property. Tate Gallery enables their visitors that have experienced their paintings and exhibition to record themselves, upload their audio-video on the Tate Gallery website, and which others can later download and use them as a mobile interpretation guide while visiting the gallery. Orbitz.com provides podcasting of many destinations that travelers can download to their MP3 players and use them as guides while visiting the destination. In a similar way, MGM Grand Hotel Las Vegas has lauded online video on its website under the title "Maximum Vegas" in order to better illustrate to its potential guests the experience and services of its hotel and gaming resort. Similarly, city destination organizations should consider enhancing the content and marketing appeal of their website portals by enabling podcasting opportunities, i.e. either allow users to share content or push their own created podcasting content (e.g. http://www.visitlondon.com/maps/podcasts/, Podcasts at the official portal of London). For developing podcasts, city tourism organizations can outsource this function to companies such as soundwalk.com, podtrip.com and heartbeatguides.com that specialize in the development and dissemination of destination podcasts.

METAVERSES: MASSIVELY MULTIPLAYER ONLINE ROLE PLAYING GAME (MMORPG)

Definition, Features and Use

Metaverses are three dimensional virtual worlds whereby Internet users collaboratively play "online MMORPG games" with others. However, these platforms are wrongly perceived as "simple games" and "virtual" worlds, since they frequently represent an extension to our physical day-to-day world to which users add new socio-economic and political situations. MMORPG are games that are played by numerous players (e.g. millions of users) and they could be considered as an intermediate step from 'computer' to 'ambient' era. Some of these games (e.g. World of Warcraft) develop around a theme defining the goals of the game, while other games, such as SecondLife.com, there.com, cokemusic.com, habbohotel.com and http://play.toontown.com/about.php, encourage a free-style of playing, allowing the users to make what they want out of it. Metaverse environments are internet-based 3-D virtual world whereby their users, called residents, can interact with each other through motional avatars (an internet user's representation of him/herself) providing an advanced level of a social network service. Although it is difficult to measure the size and growth of such games, it is estimated that the market for massively multiplayer online games is now worth more than $1bn in the West world (Book, 2003). For example, one can simply consider the size of and growth of Second Life®® itself. Second Life® has more than 5 million users, while about half a billion US$ are being transacted every year on Second Life's® website (as reported on SecondLife.com on April 2007).

Impact on Tourism Demand

Tourists and travelers participate in such games either for fun and-or for ways of expression of oneself and for achieving satisfaction through task—accomplishment, self-actualization and creation—design of something new. For example, many people dream and try to become and excel on a profession that they could not achieve in their real life, others try to design a new product and service hoping that other players will adapt and pay for it and so they can gain money and/or head hunters would spot their talents and recruit them in their real or virtual companies.

Business Applications for City Marketing

Many tourism and travel related companies have already created their representative offices and headquarters in metaverse environments such as SecondLife.com. Embassies (e.g. that of Sweden), Tourism Authorities (e.g. that of Maldives) of many countries and many tourism companies (e.g. TUI, Burj Al Arab Hotel, Marriott, Costa Cruises) have created their offices and companies on islands of SecondLife.com for boosting their marketing practices such as enhancing customer communication and education about their products/services, building brand reputation and user communities, and achieving word of mouth (WOM) and advertising. Hyatt used residents of Second Life® and exploited their intelligence and knowledge for designing a new hotel concept, named as Aloft; architects and guests were involved in designing the hotel providing their feedback, preferences and specialist knowledge (read the related blog at http://www.virtualaloft.com/). As a result of the popularity of the new hotel, the first Aloft hotel will open and operate in real life in New York in January 2008. Apart from collaborative new product development, a firm can further exploit the social intelligence gathered and generated at SecondLife.com and other metaverse environments in order to conduct market research and to test new product ideas and new advertising campaigns, e.g. Toyota first tested the campaign of its new brand Scion on SecondLife® and then, widely broadcasted the new campaign in real life. Other companies, use SecondLife® for recruiting and identifying new talents e.g. CNN does head hunting of new journalists online.

Many destinations are also moving into the futuristic world of virtual reality and metaverse, as many city and country destination organizations create their virtual destinations. Netherlands Tourism Board recently opened a national tourism board in SecondLife® (http://us.holland.com/secondlife.php), the city of Galveston launched a virtual replica of itself in SecondLife® (http://www.galveston.com/secondlife/), providing their visitors with the chance to become part of an interactive community (Figure 10 and 11). The aim is to provide digital travelers the chance to take guided virtual tours, learn about the history, culture and daily life of the destination, and interact with new virtual friends from around the world. Tourism Ireland has also launched the world's first tourism marketing campaign in SecondLife® (http://dublinsl.com/index.php) including the sponsorship of a range of events and activities, including concerts, fashion shows, and photographic exhibitions, in Second Life's® replica city of Dublin. Dublin's representation in SecondLife.com is the first place-location in Ireland that the Tourism Board created its representation in Second Life®. Similiar to the Dublin creation, Amsterdam in Second Life® comes complete with Dutch signs, canals, trams and a lot of attention to detail. Overall, when investigating the impact of SecondLife.com on its residents' behavior, it becomes evident that historical landmarks and buildings such as Tour Eiffel, London Bridge, Ajax Football stadium etc., have a great effect in building virtual communities of people spending a lot of time on dwelling them. Since it is apparent that real world modern-day cities and their landmark attraction are probably the most effective at driving and retaining visitor traffic, city tourism organizations should exploit this inherent advantage and exploit their cultural and heritage assets in metaverse environments for boosting their city brand name, recognition and promotion.

Mash-Ups

Definition, Features and Use

Mash-ups describe the seamlessly combination of two or more different sources of content and-or software for creating a new value added service to users. Many mash-ups enrich their services with some geographical content such as Google™ Maps; e.g. *The New York Times Travel Section's "36 Hours In…"* mash-up, which allows users to search the *"36 Hours in …"* story archive from a Google™ Map. For example, when visiting the website traintimes.org.uk, one can see on real time where trains are located and when they will arrive at destinations, since the website combines information from Google™ maps, and information from the British rail website about train time tables, delays etc.

There are several mash-up applications in tourism such as new cyberintermediaries including mapping services (e.g. earthbooker.com, tripmojo.com, reservemy.com) and meta-search engines such as farecompare.com. Other examples include: www.43places.com that combines Flickr photos, RSS feeds and Google™ Maps with tagging and user-generated content, allowing users to share their favorite destinations; www.randomdayout.co.uk combines a number of data sources to create a mapped itinerary, using Virtual Earth (Microsoft's equivalent of Google™ Maps). An innovate example related to destination marketing management is the case of the city of Pennsylvania (http://www.visitpa.com): based on a project amongst Google™ Earth, Carnegie Mellon University, NASA, the Pennsylvania Tourism Office and the National Civil War Museum, virtual tourists would have the chance to view Pennsylvania's Civil War trails online. More sophisticated examples of mash-ups are the "Marco Polo" function on triptie.com and the "Trip Planner" function on Yahoo!® Travel, which allow users to integrate content from other websites into the user's own itinerary planning toolkit on the host website.

Impact on Tourism Demand

Travel decisions are complex and involve the searching, comparison and combination of several information located in many different websites. For example, a decision to travel to a destination requires various and a plethora of information about weather conditions, exchange rates, travel and accommodation alternatives and prices, attractions etc. As a result, tourists increasingly demand and expect to combine and cross-check information from different sources, so that they can better and easier make a holistic decision. For example, tourists may not be able to clearly understand where a hotel may be located when the description of the hotel websites states that the hotel is located on the beach, near the beach etc. Tourists easily get confused from different descriptions found in different websites. On the contrary, mash-up websites empowered with maps (e.g. earthbooker.com) enable users to see where exactly a hotel or other attraction is located (sometimes even locate the exact orientation and view of a hotel room and then decide whether to book this room at this hotel).

Business Implications for City Marketing

Mash-up applications have empowered the rise of new cyber- and info- intermediaries offering new sophisticated information services (e.g. flightcompare.com search and compare all flight information from different websites in order to provide comparable flight information within one webpage to its users). Moreover, many tourism suppliers and organizations also enrich their website content with maps in order to make it more user friendly and useful to their visitors, e.g. the official website of London and Dublin use Google™ Maps with geotags for enabling tourists to identify points of interest, hotels etc. Moreover, many companies leave their software as an Open Application Programme Interface (API), so that users can create limitless combinations of their services. For example, backstage.bbc.co.uk represents BCC's services and opportunities offered to its users, who are enabled to take content from the BBC, re-structure it and present it the way they prefer. Enabling user innovation is another way that companies aim to exploit on users' creativity and intelligence instead of investigating solely on company's R&D efforts.

FUTURE TRENDS

It has become evident from the above mentioned analysis that the two major impacts of web 2.0 and its UGC on consumer behavior and marketing practices are: 1) the electronic word-of-mouth that is created; and b) the opportunities to build and maintain customer communities for enhancing the practices of Customer relationship Management and social marketing. Exploiting web 2.0 for city marketing can have a tremendous effect on the marketing effectiveness, since, as the following analysis and discussion illustrates, both previous issues significantly affect consumer loyalty and purchasing behavior.

Web 2.0 and Electronic Word-of-Mouth (WOM)

Word-of-mouth (WOM) is very important in tourism and in services in general, since objective information about a service experience cannot be easily provided before one buys and consumes the services themselves. Services are intangible and so they are difficult to be tested, tried and evaluated before buying them. Consumers also tend to rely more on consumer reviews when purchasing high involvement products (Park, Lee & Han, 2007), such as several travel products e.g. a honeymoon trip, an adventure travel etc. In this vein, tourism decisions are very complex and risky. Indeed, the literature about information search in the tourism field has recognized the important role of WOM in travel planning and decision making (Hwang, Gretzell, Xiang & Fesenmaier, 2006; Murphy, Moscardo & Benckendorff, 2007). WOM has been found to be one of the most influential information sources for travel (Morrison, 2002). Research has also shown that those with past experience with a specific travel destination and that engage in digital word-of-mouth communication are most likely to be the most preferred and the most influential source of information in the pre-trip stage of travel decision making (Crotts, 1999).

To make travel decisions easier, travelers need to reduce the inherent information complexity of travel decisions as well as the risk related to the service firm (i.e. is that a good and reliable company), the service risk (i.e. is that a service that fits my preferences and needs?) and the purchasing risk (i.e. is that a trustworthy booking and buying channel to use for buying a travel service?). To achieve that, consumers use recommendation-based heuristics and other users' feedback to reduce uncertainty, eliminate the related risks as well as filter and process the plethora of information that must be processed when making decisions (Olshavsky & Granbois, 1979). WOM-based information is heavily used and trusted by consumers for taking travel decisions, because it is seen as more vivid, easier to use, and more trustworthy as it is based on actual experience and typically provided without direct benefits (Smith, Menon & Sivakumar, 2005).

As demonstrated in the above mentioned analysis of UGC in Web 2.0 websites, electronic WOM can take different names and forms such as virtual opinion platforms, consumer portals, social networking, blogs' comments, tag words, podcasting, virtual communities and online feedback mechanisms (Armstrong & Hagel, 1997; Bellman, 2006; Sigala, 2008). Users of Web 2.0 websites and tools may post their own experiences, videos, share their opinion, give advice, or look for answers to their questions. Consumers also perceive electronic WOM to be a reliable source of information (Gruen, Osmonbekov & Czaplewski, 2006). Dellarocas (2003) identified three different characteristics of online WOM relative to traditional WOM: 1) electronic WOM is larger in scale (both in terms of quantity and people impact) due to the Internet's low-cost and networking features; 2) electronic WOM is a powerful and reliable market research tool giving organizations the ability to monitor on real time their operations; and 3) it is difficult to convey contextual cues (e.g. facial expression) through the Internet and peer review websites for example, and so not knowing or seeing who the information provider is makes, it is harder to interpret the subjective information in online interaction. To address this problem, websites often display demographic or other data about reviewers (for example, the length of membership, their location, etc.) in order to help build credibility and trust. Websites may even provide the possibility to users to upload and share their own feedback and evaluation (by incorporating each review into a rating of the reviewer) about the quality of the reviews written by other members. Moreover, because Web 2.0 enables users to identify and use personalized and contextual information (e.g. look at what others' with similar profiles are saying), electronic WOM is considered as both more relevant and unbiased than traditional WOM, whereby one cannot easily track and relate the content with the profile of its original messenger.

Smith, Menon and Sivakumar (2005) claim that consumers prefer such peer recommendations over other forms of input, while Amis (2007) advocated that social network sites have as much influence on consumers as television and more than newspapers. Statistics actually provide evidence of consumers' reliance on electronic word-of-mouth. More than 80% of web shoppers said they use other consumers' reviews when making purchasing decisions (Forrester, 2006). eMarketer (2007d) reports that nearly 6/10 consumers prefer websites with peer-written reviews, and that websites with reviews experience greater conversion rates.

Overall, Dellarocas (2003) summarized organizations' benefits of electronic WOM in the following: brand building; customer relationship management; customer acquisition; addressing customer complaints; market research; product development; quality control and supply chain quality assurance activities.

Web 2.0, Customer Relationship Management (CRM) and Social Marketing

The major aim of CRM is to personalize business services and products as well as develop a 1:1 communications and long lasting relation with profitable customers (Sigala, 2005b). eCRM also requires the development of customers' communities for providing loyal customers with functional, emotional and social benefits and value (Sigala, 2006). The previous section provided practical examples illustrating the way in which web 2.0 applications and tools enable the formation and development of customer virtual communities. By identifying and reviewing the limited related studies that have been conducted so far, the following analysis further supports the capability of web 2.0 to build virtual communities of users and enhance the community benefits (functional and emotional/social) to its users.

Ying and Davis (2007) and, Lento, Welser, Gu and Smith (2006) illustrated how blogs create and maintain strong online communities through their social ties tools such as blogrolls, permalinks, comments and trackbacks. Indeed, many authors (e.g. Lin, Su & Chien, 2006; Ying & Davis, 2007) have started to apply social network analysis for measuring and illustrating the social bonds, networking and communication structures created within the blogsphere. Li and Stronberg (2007) summarized blogs' benefits for firms as follows: search engine optimization; e-word-of-mouth (eWOW); improved brand perception and visibility; instantaneous client feedback; market research and insight; increased sales efficiency; and reduced impact from negative user-generated content. Damianos et al. (2007) advocated that social bookmarking generates social influence and bonds as well as creates value by: enabling resource management, information sharing and discovery, expert finding, and social networking; providing teams with a place to share resources; forming and supporting social networks around interest areas; and feeding expertise finding and user profiling. Awad and Zhang (2007) discussed the marketing benefits of eWOW generated in online review communities and debated firms' efforts and strategies addressing it. By examining the communication tools and social cues of myspace.com, Dwyer (2007) demonstrated the impact of social networking sites on developing customer interrelations and communities. In their study of videos' tags on Del.ici.ous, Paolillo and Penumarthy (2007) found that social tagging can generate community benefits such as: easy retrieval (as users use words they can remember and have useful meaning to them); contribution and sharing; attract attention; opinion expression; play; and self-presentation. Thus, since tagging can be used for providing functional services, creating social ties, market research on users' opinions and interests, and WOW, social tagging's ability in creating user communities is evident. Forrester (2006) demonstrated web 2.0's ability to generate customer and business value in different processes: customer service (e.g. community self-service savings); sales (e.g. community loyalty and sales reduces commissions and price competitions); marketing (e.g. credibility of eWOW); production (e.g. co-design reduces waste); and R&D (e.g. community input raises success rate).

A significant amount of literature also highlights the business benefits from developing virtual communities particularly in the area of CRM and social marketing. Analytically, Wang and Fesenmaier (2004) illustrated that virtual tourist communities are useful for managing customer relations by: attracting customers through in-depth, focused and member-generated content; engaging customers through social interactions; and retaining customers through relation building with other members. Online communities also build customer value (Wang & Fesenmaier, 2004) by generating users with all types of relational benefits namely functional, social, hedonic and psychological (Gwinner, Gremmler & Bitner, 1998). Kim, Lee and Hiemstra (2004) provided evidence of the impact of virtual communities on travelers' loyalty and product purchase decision making. Andersen (2005) explored the use of on-line brand communities for developing interactive communication channels and establishing social and structural bonds with devoted users. Jang, Ko and Koh (2007) showed that online brand communities posses and develop features - such as, quality and credibility of information, service quality, member interaction and leadership, brand reputation and (intrinsic and extrinsic) rewards for members' activities- that in turn, contribute to increased users' brand loyalty, commitment and sales. Erat, Desouza, Schafer-Juger and Kurzawa (2006) discussed how different types of communities of practice (e.g. B2C, C2C) can be used for acquiring and sharing customer knowledge in order to improve business processes and performance. Beyond collecting customer knowledge, online communities can also be used for co-operating with customers for New Product Development (NPD) and innovation (Rowley, Teahan & Leeming, 2007). A plethora of cases and research studies (e.g. in Lagrosen, 2005; Pitta & Fowler, 2006) reflects the possibility to use virtual communities for NPD as well.

Proposed Models for Exploiting Web 2.0 in Enhancing Marketing Communication and CRM

The previous analysis and industry examples illustrate that web 2.0 tools and applications have a twofold impact on the way CRM is implemented: 1) web 2.0's networking and connectivity capabilities provide enormous opportunities to communicate and co-operate with customers and industry

Table 1. Web 2.0 extended CRM implementation

	Low market integration	High market integration
High customer integration	**Many-to-one** Target: clients' networks Active customers' involvement *e.g. Lonelyplanet.com, Sheraton.com*	**Many-to-many** Co-exploitation of customers' profiles with other network partners *e.g. mash-ups, earthbooker.com, flightcompare.com*
Low customer integration	**One-to-one** Target: individual customers	**One-to-many** Ecosystems of partners offering a seamless experience to individual clients (cross-selling, products' bundling) *e.g. travelocity.com*

partners in many different directions (e.g. many-to-one, many-to-many) (Table 1) the social intelligence and knowledge created collaboratively in web 2.0 platforms (i.e. the user-generated content) can be exploited in different ways for identifying, developing, enhancing and maintaining relations with profitable customers (Table 2).

In other words, CRM cannot anymore be considered as synonymous to one-to-one communication and personalized service at an individual basis. Web 2.0 augment CRM practices and implementation to include various forms of communications with clients and business partners. Following Gibbert, Leibold and Probst (2002), Table 3 reflects

Table 2. Exploiting social intelligence for managing and enhancing customer relationships through their lifecycle

Phase	**Type of customer information/intelligence**	**CRM implementation activities**
Acquisition	Of the customer information: transaction and personal data	Create brand awareness and recognition amongst customers and virtual communities by building and supporting electronic word-of-mouth
		Develop brand reinforcement and trust by educating and informing customers about the brand, its services, functionalities etc
		Use customer intelligence in order to identify and target new customers, e.g. clone the profile of existing product-service users, use the connections and recommendations of existing customers etc.
		Use customer intelligence to understand how customers use the service, what functionalities they prefer or not
		Use customer intelligence for profiling customers
Retention	For the customer information: relationship and product data	Use customer intelligence for enhancing customer service and transactions
		Use customer intelligence for personalizing services and products
		Build and develop community of customers-users
		Use customer intelligence for innovation & NPD
Expansion	For the customer information: relationship and product data	Use customer intelligence for cross selling, e.g. suggest compatible products based on other users' purchases
		Use customer intelligence for up-selling
		Use customer intelligence for developing affiliation and loyalty programmes
Win back	By the customer information: feedback and monitoring data	Use customer intelligence (feedback, reviews etc) for identifying pitfalls and faults
		Use customer intelligence and communities for handling customers' complaints
		Use customer intelligence and communities for monitoring and managing the firm's reputation, status and prestige

a two dimensional matrix, whereby the vertical axis represents how firms integrate customers into their value chains and the horizontal axis represents the integration of business partners into the firm's value chain. Companies can use web 2.0 technologies to communicate and enable dialogues and interactions not only between them and their customers, but also between customers themselves (C2C), between business partners, among all of them etc. When engaged in two directional communication both customers and partners, firms can involve the former in their value chain in order to create customer value and benefits. For example, as explained earlier, when customers communicate with other customers in virtual communities, customers provide social and emotional support to others as well as functional benefits (e.g. free consultancy in trip planning). Also, when co-operating and sharing content and applications with other businesses (e.g. in mash-up websites), firms can collaborate with and integrate other partners in their value chain in order to provide additional services to their clients, e.g. a holistic tourism product-services such as a dynamic packaging.

Moreover, in developing successful relationships with profitable clients, firms need to understand and manage all phases through which relations are evolved, as each phase is characterized by differences in behaviors and orientations and so, it requires different CRM approaches. Theory and practical evidence has shown that customer relations evolve over three major distinct phases related to the customer lifecycle (see Sigala, 2008): initiation, maintenance and retention or termination. Hence, all CRM implementation models reflect practices that collect and use three forms of customer information / intelligence in order to manage each relational phase. "Of-the-customer" information includes customers' personal and transaction data for understanding and measuring their profile, e.g. sales, profitability, purchasing patterns, preferences. "For-the-customer" information refers to product, service and firm information perceived as useful by clients for making more informed decisions. "By-the-customer" information reflects customer feedback (e.g. customer complaints, suggestions, reviews) used for new product development or business improvement. As illustrated previously, Web 2.0's user-generated content mushrooms these three types of customer information and provides firms with several opportunities not only to collect, but also to get access to such types of customer intelligence. In other words, Web 2.0 platforms can be exploited as a free and real time market research and intelligence tool. Table 2 summarizes how firms can exploit web 2.0 tools and platforms for collecting and analyzing this customer intelligence for augmenting and supporting their CRM practices.

Overall, it becomes evident that web 2.0 enabled CRM reflects a cultural shift from product *'designing for customers'* to *'designing with'* and *'design by'* customers. For firms to achieve such a cultural shift, crucial organizational changes should also take place. Importantly, the role of marketers should be changed from being sales people to becoming community builders and perceiving customers not as targets to identify and sell, but as partners to collaborate with. Firms should also realize that they should use customer intelligence not only for learning about their customers and identifying new target markets (opportunistic behavior), that they should also use customer intelligence for learning and improving processes and products with their customers as well as with different business partners (partnership relation). In other words, firms derive and realize maximum benefits when they exploit web 2.0 tools for establishing and maintaining co-creation and co-learning adaptable and flexible ecosystems with their customers and business partners (Table 3).

CONCLUSION

Internet users and travelers are nowadays empowered to create and synthesize in their own way the travel content that they also wish to distribute and share it with others through users' controlled distribution channels. In this vein, Web 2.0 technologies enable Internet users to become the co-producers, the co-designers, the co-marketers and the co-distributors of tourism experiences and services as well as the co-entrepreneurs of new tourism products and new e-business models. As the diffusion of Web 2.0 applications becomes wide and consumers incorporate them within their daily and professional life, travelers expect tourism firms and organizations to provide similar Web 2.0 enabled services. The previous analysis aimed at identifying and illustrating the business implications created for tourism and hospitality enterprises as well as strategies and tactics that they can adopt for eliminating threats while exploiting the arising opportunities. Therefore, as Web 2.0 is here to stay, it is evident that unless a city tourism organization adopts and incorporates Web 2.0 tools into its e-business model and strategies for marketing and managing its destination, the competitiveness of the latter is threaten. Nevertheless, in order to be successful, the adoption and use of any web 2.0 tools should be accompanied with appropriate organizational and cultural changes within the firm regarding the roles, job descriptions and tasks of its staff, users and business partners. Further research is required in order to understand and examine how firms are achieving and trying to implement such organizational changes when incorporating web 2.0 into their e-business model.

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This work was previously published in Information Communication Technologies and City Marketing: Digital Opportunities for Cities Around the World, edited by M. Gasco-Hernandez; T. Torres-Coronas, pp. 221-245, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 4.20

Marketing for Children Using Social Interaction Technologies

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ABSTRACT

Children are spending more time online and, in most cases, this means they are using social interaction technologies. Beyond the concern for safety, another issue is gathering strength: namely, interactive marketing to children. This chapter looks at the immersive nature of interactive marketing, which can be found in blogs, chat rooms, virtual worlds, advergaming, and other forms of advertainment. The chapter also examines: the ages of targetable audiences (some of whom cannot yet read the "advertisement" label), websites for children that use interactive marketing, where and how ads are displayed, the effects of interactive marketing, the potential for data collection through interactive marketing, the lack of regulation in interactive marketing, and the future trends of interactive marketing to children.

INTRODUCTION

Early use of social interaction technologies by young people seemed to elicit one primary concern from adults. That concern was safety, because children and teens often reveal too much private information online in blogs, chat rooms, and such social networking sites as MySpace. However, a related issue is gaining momentum. It is the power of interactive marketing on social networking sites and similarly interactive websites for children. The concerns are that (1) young children are unable to discern marketing messages, and (2) even for older children, much of the advertising on social networking sites is so closely tied to the environment that it may be seen more for its participatory nature rather than for its marketing purpose. This chapter will look briefly at the safety issue and then move to explanation and discussion of the growing concern over marketing branded products to children through immersive interactive environments of the Internet.

DOI: 10.4018/978-1-60566-368-5.ch041

BACKGROUND

The proportion of children with access to computers and the Internet at home is steadily increasing. A 2005 Kaiser Family Foundation report stated that 86 percent of eight-year-olds to eighteen-year-olds had computers in their homes compared to 73 percent in 1999, and 74 percent had Internet access compared to 47 percent in 1999. Time spent by eight-year-olds to eighteen-year-olds on the computer for recreational purposes alone averaged a little over an hour each day in 2005. Eight-year-olds to ten-year-olds clocked in at thirty-seven minutes, eleven-year-olds to fourteen-year-olds at an hour and two minutes, and fifteen-year-olds to eighteen-year-olds at one hour and twenty-two minutes (Roberts, Foehr, & Rideout, 2005). Those numbers are expected to be higher today with the popularity of social networking sites, such as MySpace and Facebook, plus the many online communities for children.

About 55 percent of American youths ages twelve to seventeen use an online social networking site, according to a national survey of teenagers conducted by Pew Internet & American Life Project (Lenhart & Madden, 2007). The number of children and youth who use social networking sites and create online profiles is growing daily. Although some participants choose to make their profiles available only to those in their network, much information is still available to all. A study by Huffaker & Calvert (2005) of teenagers' blogs found that the teens volunteered far too much private information. Two-thirds provided their ages and at least their first names, while 60 percent gave their locations and contact information. One in five told their full names.

MySpace.com has a policy that does not allow children under age sixteen to become members. Spokesman Bennet Ratcliff said the firm immediately removes members' sites that are in violation of the terms of service, including those with too much personal information. However, participants can get around the rule by lying about their age, according to Sullivan (2005), who browsed the site and quickly turned up several pages on which children stated they were sixteen, but in their personal descriptions provided information that they were actually younger.

Parry Aftab, who runs the WiredSafety.org program, stressed that she does not think any blogs or community sites are safe for children. Her organization receives complaints every day: "There are underage kids on every social networking site on the Net. They are engaging in highly provocative conversations and doing things they would never do offline" (cited in Sullivan, 2005, p. 2). Now add to this issue the fact that marketers have found social networking sites and are trying to establish their brands in the minds of youthful consumers.

INTERACTIVE MARKETING TARGETS CHILDREN

Marketers have already created MySpace profile pages for characters from their advertisements and have invited users to add those characters to their list of friends. On Facebook, marketers have created groups around branded products and are trying to use those groups to increase word-of-mouth advertising about their product. Marketer sites often include video clips and quizzes to increase engagement, as well as free downloadable ring tones and other promotions to increase traffic. Some of these promotions utilize viral marketing, offering incentives for users to send information to friends. Chase financial services had a promotion on Facebook that rewarded site visitors for getting friends to sign up for credit cards (Hansell, 2006). Of course marketers' social networking sites all have links to their brands' websites, which have more games and activities for a variety of ages.

Younger children are not left out of the interactive social networking strategy of marketers. Virtual worlds are three-dimensional environments where preteens and children can go to play and to interact with others from around the world. Unlike television ads that children view for thirty seconds to a minute, marketers' virtual worlds often create a video game-like atmosphere in which children may be immersed for thirty minutes or more. Some of these virtual worlds were created by brands (such as Barbie, Bratz, Disney, Nabisco, and Nickelodeon). These worlds are loaded with "advergaming" and other "advertainment" that use the brand's own products. Children as young as preschoolers are playing games that involve some of these branded products. In addition, the sites sell products, such as toys, clothes, and DVDs.

Other virtual worlds (such as Whyville, Gaia Online, and Stardoll) were not created by and for brands to push their products. Whyville was created as a safe social networking site with an educational platform. However, that does not exclude Whyville or similar sites from marketing influence. Children are driving virtual Toyota Scions at Whyville.net and Gaia Online, and they are wearing the latest digital fashions from DKNY at Stardoll.com. In these virtual worlds, children can craft their own "avatars" (representations of themselves), customize a car, play games and socialize.

Marketing of this nature is designed to function at a subconscious level, according to Kathryn Montgomery, author of *Generation Digital: Politics, Commerce and Childhood in the Age of the Internet* (Olsen, 2007). She noted the purpose of ads and product placements in three-dimensional worlds is often to blur the line between content and advertising. What makes virtual worlds and their interactive games such powerful delivery tools is that a child's emotional engagement is so high: "With their engaging, interactive properties, the new digital media are likely to have a more profound impact on how children grow and learn, what they value, and ultimately who they become than any medium that has come before" (Montgomery, 2001, pp. 635-6).

SOME VIRTUAL WORLDS REQUIRE PURCHASE

Webkinz was the first company that required purchase of a toy for children to enter its virtual world online. The Webkinz plush animals are sold with special codes that permit children to access the website where they can play games, chat, participate in other activities, or "work" to earn KinzCash to purchase virtual things for their virtual rooms or their virtual pets. More recently, Barbie began selling a bundle that includes a fashion doll, a pink portable MP3 player, and a USB key that provides access to BarbieGirls.ca where children can play games, chat, and buy other Barbie things. Similarly, a Bratz doll can be purchased with a necklace that has a special "key" to provide access to Be-Bratz.com where children can play games, decorate their virtual rooms, communicate with each other, and buy more Bratz products.

Time spent with a brand generally translates to brand preference and purchase intent. However, for children who are not old enough to purchase these products on their own, some marketers may value their engagement more for its "nag factor" – that is, children's ability to influence their parents – and for the positive impression it is making as a foundation for children's future interaction with the brand. When a child creates a character in a virtual world or when the child plays a game online, the child is using a first-person perspective, so interaction with a brand will likely form, revise, or challenge the child's association, emotions, and attitudes toward that brand (Nelson, 2005).

Toyota is hoping that the youthful car enthusiasts at Whyville and Gaia will influence their parents' car purchases and that the children will grow up with some Toyota brand loyalty. According to the *New York Times*, Toyota believes the product placement in Whyville is working. After only ten days, the word "Scion" had been used in chats on the Whyville website more than

78,000 times; hundreds of virtual Scions were purchased by children using "clams," the currency of Whyville; and the community meeting place, Club Scion, was visited 33,741 times. These new virtual Scion owners customized their cars online, drove around the website, and picked up their non-car-owning friends for a ride around Whyville (Bosman, 2006).

Toyota may well be experimenting with "cradle-to-grave marketing" which emerged in the mid-1990s and refers to attracting a customer early in life and keeping that customer through adulthood and into old age: "It has been estimated that corporations whose marketing campaigns appeal to a toddler can expect to collect as much as $100,000 from her over the course of her lifetime – starting with the money spent on her as a child and, later, the money she spends on her own children and grandchildren" (Thomas, 2007, p. 125).

Targeting young people before they can buy the product is a tactic being utilized by more and more marketers. "It's early branding," said Matthew Diamond, the chief executive of Alloy Media and Marketing, a consultancy in New York that specializes in youth marketing. "You are branding your product at a relevant time to the young person. You're establishing that brand presence and positive association, since important buying decisions are forthcoming" (Bosman, 2006, p. 2). Capture them before they have any opinions on brands. Talk to young people in their environments in a relevant way: "Too often advertisers wait to convert them later, and then it's too late" (Bosman, 2006, p. 2).

CHILDREN'S VIRTUAL WORLDS MULTIPLYING

Virtual worlds targeting children are a relatively new market, but one that seems to be growing quickly. It is anticipated that more than half of the young people online will belong to a virtual world by 2011 (Olsen, 2007). Ad spending in these environments is expected to increase tenfold, and that "excludes marketers spending on their own virtual worlds, like BarbieGirls.com" (Olsen, 2007). The anticipated increased ad spending is one reason that Montgomery (2001), who helped found the Center for Digital Democracy advocacy group, emphasized that advertisements need to be labeled as such.

Nickelodeon labeled ads in its Nicktropolis three-dimensional environment for kids ages seven to fourteen. Other sites are also labeling ads, but the labels are small and the ads look flashy and exciting. Color, movement and sound are just some of the features that draw in children. Identifiable characters, such as Mickey Mouse or Barbie, are also heavily used. Disney has a special section on its website for preschoolers who can be enrolled by a parent in Club Mickey. These preschoolers probably can neither read nor understand the meaning of the label, "Advertisement." Premiums are yet another method used to draw children's attention to a product and move them to action (Comstock, Scharrer, 2007). In addition, many ads online and off that target young children use symbols (such as flowers, butterflies, cars, or soccer balls) to attract children and help them identify with the message being sent.

Although most children's virtual worlds are now targeted for those ages seven to fourteen or eight to fifteen, some are being created for even younger children. MGA Entertainment, the toy company that makes Bratz dolls, launched MyePets.com in 2007. It targets five-year-olds to seven-year-olds, using plush animal toys that need to be "rescued" (purchased). Similar to Webkinz, the site is closed to all except those who have purchased a pet, which provides a password that allows access to the website (York, 2007).

Kurnit (2000), founder and president of KidShop youth marketing company, said there are now five different age groups that are considered addressable targets for marketing to children. They are as follows:

- toddlers, considered children from birth to age three
- preschoolers ages two to five
- kids ages six to eight
- tweens ages nine to twelve
- teens ages thirteen to fifteen.

This presents a dilemma since television research shows that most children who are ages eight years and under do not understand the persuasive intent of marketing, and most children ages four and under cannot consistently determine the difference between advertising and programming on television, much less on the Internet (McGinnis, Gootman, & Kraak, 2006).

To learn more about computer use by children, Kurnit (2000) surveyed sixty-two mothers with children ages two to five. Nearly all acknowledged their children used a computer, most started at the age of two, and they spend between one and three hours a week on computer activities. Special software, dubbed "lapware," is available for parents to purchase so that infants and toddlers, sitting on a grownup's lap, can learn to use the keyboard for the reward of seeing stars or shapes fly across the monitor (Thomas, 2007). "Moms unanimously agree that what they like best about their child's computer interaction is the educational benefit their kids derive from it" (Kurnit, 2000, p.5). The computer "enjoys a special halo effect because it is seen as an educational tool that replaces television" (p. 5). A study by the Kaiser Family Foundation confirmed that finding. The 1,000 parents of children ages six months through six years who were studied were more enthusiastic about computers than any other electronic media, with 72 percent saying that it "mostly helps" children's learning (Rideout, Vandewater, & Wartella, 2003).

'KIDS GETTING OLDER YOUNGER'

Although computers have this halo effect, Kurnit (2000) argued that they contribute to a phenomenon referred to as "kids growing older younger." Computers and the Internet give children access to learning and experiences that previously would have occurred much later in life, probably with more parental supervision. Two-thirds of Kurnit's sample of mothers confirmed that their children are brand aware. Most thought that brand awareness began around age two or three, but about a quarter of the sample said their children began to recognize brands as early as twelve to eighteen months (Kurnit, 2000). Thomas (2007) noted other marketing studies found that children can distinguish brands as early as eighteen months and are asking for branded products, such as Cheerios, Pop-Tarts, Coke, and McDonald's, by age two. She added that since the 1980s, marketers have been refining ways of mining the tween market, which has always been brand conscious, but now this brand consciousness is dribbling down to even younger ages.

In the past, marketers that wanted to reach children did so with campaigns targeting both mothers and children, but today's marketers are able to send their messages directly to the children, primarily because of heavy media use by the children and knowledge of children's preferences. According to Schor (2004), marketers create direct connections with children in isolation from parents and are sometimes allied with children against parents. Furthermore, marketers reach children in parent-free environments, such as school and the Internet, and while children are watching television alone. There the marketers can speak directly to the children. Sometimes this leads to conflict with parents as children make their wants known and parents attempt to defend their ground, often unsuccessfully.

The estimated $2 billion of advertising funds directed specifically at children – a larger proportion of which are going to the Internet each day – are believed to be creating a consumer culture among many children (Sheehan, 2007). Seventy-five percent of tweens in the United States want to be rich when they grow up, and more children in the U.S. than anywhere else in the world believe that the brands they wear define who they are and identify their social status (Schor, 2004). Two-thirds of parents say that their children describe their self-worth in terms of possessions, and half of the parents say their children would rather be at the mall than at other activities or with family (Gibbs, et. al., 2001). Critics are concerned that children are developing a consumer-based value system in which problems can be solved and happiness attained by buying things. "Contemporary American 'tweens and teens have emerged as the most brand-oriented, consumer-involved, and materialistic generations in history. And they top the list globally" (Schor, 2004, p. 13). Experts increasingly describe them as "bonded to brands."

Schor (2004) claimed her research shows that, in addition to obesity, involvement in consumer culture appears to be at least partly responsible for dysfunction in the form of depression, anxiety, low self-esteem, and psychosomatic complaints. Additionally, reports of addiction to web surfing and online games are beginning to surface.

DATA MINING AND LAWS

As if the explosion of marketing material disguised as content on websites for children were not enough, there is yet another concern – data mining. Children play games, take quizzes and fill out surveys to earn the currency of the social networking site in order to purchase items from the website store for their virtual environments. While they are doing this, their actions are being monitored, and data is being collected. Data mining technology can create detailed profiles of children online which can then be used to document trends in youth markets. Sometimes the information is used only by that website, but sometimes it is sold in the aggregate to other marketers (Chung & Grimes, 2005). One site that was found selling its information was Neopets.com, an online community launched in 1999, where children can care for virtual pets, play games, participate in contests, and purchase items for their pets using online currency. Neopets collected and processed its users' data, then sold it in the aggregate as Youth Pulse reports (Grimes & Shade, 2005). This demographic and behavioral data is valuable to marketers who want to construct highly targeted marketing campaigns.

As yet, there are no laws that deal with privacy regarding aggregate data. The only law that has been enacted in the United States to protect children on the Internet is the Children's Online Privacy Protection Act (COPPA), which became effective April 21, 2000. Regulated by the Federal Trade Commission, the law prohibits online sites from collecting personal information from children under the age of 13. This includes full name, address, email address, telephone number, information on hobbies and interests, as well as information gleaned through cookies or other types of tracking mechanisms "when they are tied to individually identifiable information" (COPPA, 2000, p. 1). The COPPA law has helped control websites' harvesting information from children but has left teenagers open to websites' innovative methods of gathering names, addresses, and product preferences through memberships, surveys, polls, games, newsletters, premiums, and the like. Further, no law addresses the commercialization of children of any age through immersive interaction made possible by the Internet and social interaction technology.

The Children's Television Act (CTA), passed by Congress in 1990, limited advertising in programming aimed primarily at children twelve years old and younger to ten and a half minutes an hour on weekends and twelve minutes an hour on weekdays. In addition, the CTA banned host selling which was defined as any product endorsement by a character in the program being viewed that confused a child viewer so that the child had difficulty distinguishing between the program and the advertisement (Federal

Communications Commission, 1990). However, neither of these limitations affects the Internet where marketing messages are likely to be more immersive, of longer duration, and processed with less skepticism.

Moore and Rideout (2007) studied online marketing directed at children and identified six issues that they thought were significant in terms of public policy relevance. They are as follows:

- Questionable nutritional profiles of promoted brands; an overwhelming majority of the products promoted to children online were of poor nutritional quality.
- Tacit persuasion that occurs through games; the simple enjoyment of an advergame can influence children.
- Absence of limits on total time exposed to ads; children can participate in advertainment for as long as they want and can return as often as they want.
- Use of viral marketing; children are asked to e-mail their friends with brand-related information, which is often influential because it comes from a peer.
- Lack of breaks between ads; children need to be reminded that they are watching or participating in an advertisement and so should be vigilant.
- Direct inducements to purchase through special rewards offered; for example, purchase product X for access to game tips, or for access to a secret site, or to save your game score in the Hall of Fame.

FUTURE TRENDS

The future may bring even more personal interaction. Technology is now able to put talking heads on websites so that visitors can interact with them. The idea is that visitors will spend more time on a site that has interactive characters, explore it further, remember it more easily, and return to it more often. How long will it be before these talking heads are brand-related icons that interact with children, using data mined from the child's previous visits, to build a trusting relationship and instill loyalty? As technology advances to offer more bells and whistles on the web, more ways of collecting data, and more opportunities for marketers to connect with children, it behooves the players involved to step back and assess the pros and cons of this technology, of the opportunities that it enables, and to look with the concern of a parent at the long-term consequences that could result.

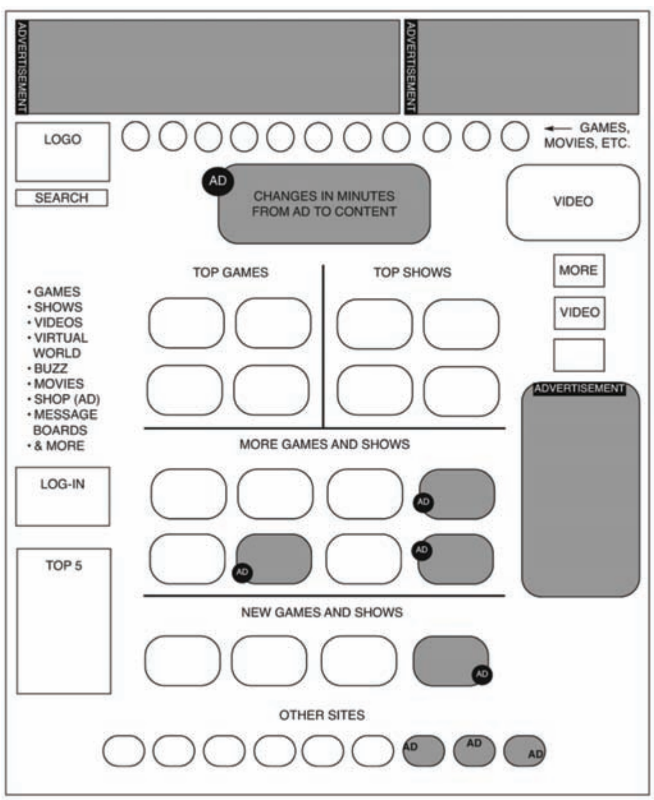
Schor (2004) quoted a critic who pointed out that parents are put in the position of "playing David to the corporate Goliaths" (p. 184). Schor stressed that parents blame the advertising industry, and the industry blames parents, when both bear responsibility. Advertising agencies, clients, and media should recognize that children are vulnerable subjects and place the "need to do well by kids" over and above the pressure to make money. This could mean eliminating the "nag factor," providing shorter and less immersive games, or including less product placement and branding in them. It also might mean that online sites determine uniform style and placement of ads. Parents should not shrug off the consumptive society as inevitable but should take proactive measures to assure the well being of their children. This might mean limiting their children's time on the computer, spending time with their children on the computer, or teaching them about the nature and intent of advertising.

The concept of advertising is a complex one for children to understand. Very young children see television ads simply as sound and visuals presented in a brief, entertaining format. By age four, most preschoolers recognize commercials as being distinct from television programming. Also, these children can match characters shown in a commercial with the products that they promote. However, it is between the ages of seven-and-a-half and eight-and-a-half that the selling nature of a commercial is understood by a majority of the children (Comstock & Sharrer). No research has yet been done on children's comprehension of Internet advertising which, it seems, would be much more difficult to differentiate and for which it would be more difficult to recognize the selling intent. Websites are available to help educate children, teens, and even parents and law enforcement officers regarding Internet use. One such site is NetSmartz.org; yet even it includes Opinion Polls clearly, although inconspicuously, labeled "Marketing Research."

The advertising industry has addressed concerns regarding online marketing to children through self-regulatory guidelines established by the Children's Advertising Review Unit (2006), which is a branch of the National Advertising Review Council. The guidelines apply to children under age twelve and address blurring of advertising and editorial content online, use of program personalities, premiums, kids' clubs, sweepstakes and contests both online and off. For example, the guidelines state that when an advertiser integrates an ad into a game or activity, the advertiser should make clear, "in a manner that is easily understood by the intended audience," that it is an ad (p. 7). This is easier said than done. Simply labeling it may not be enough.

Take a look at a map of the Nickelodeon website (Figure 1), and you will see the word "Advertisement" reversed with white type on black. It is run horizontally in some places, rotated so that it is vertical in other places, and shortened to "Ad" in still other places. Sometimes the word "Ad" is not

Figure 1. The Nickelodeon website has ads that are scattered throughout. It demonstrates that merely labeling an ad is not enough. The ads should be placed together in an area clearly designated and easily understood by the intended audience.



reversed (white on black) and is, therefore, even more difficult to find. On the left side of the page are buttons to click for more games and movies plus podcasts, a virtual world, blogs, message boards, and shopping. When a child selects something from this list, ads appear on the new page, sometimes as a window that has to be closed. Because the ads are sprinkled throughout, the site is a virtual minefield of commercial messages for children attempting to navigate it. Simply placing all of the ads in a clearly designated area would help children differentiate ads from page content, but that will not solve all of the related issues.

CONCLUSION

Children fall into three general categories as consumers of marketing communication. They are viewed as the primary target for some goods, such as cereals and toys. Other marketers see them as an influence market, one that is sought after for its ability to affect purchases made by parents and other caregivers. Still other marketers see children as a future market that must be courted so that brand preference is instilled long before the need for the branded product arises (Comstock & Sharrer, 2004). All of these marketers are sending their messages to younger and younger audiences, and the messages are coming in more interactive and immersive media with little regulation. Children, some of whom do not yet understand what advertising is, are encountering it on a regular basis.

Although the self-regulatory guidelines adopted by the Children's Advertising Review Unit are an excellent start, they must be enforced through attentive monitoring. The websites themselves need to find better ways to arrange and display ads so children can more easily and knowledgeably choose whether or not to participate in their many enticements. Close parental supervision is, of course, a deterrent, but parents first must understand that Disney, Barbie, and even Whyville are commercial enterprises with marketing messages, both apparent and discreet, and often undeserving of a halo effect. Parental vigilance is needed, and explanations are necessary to prepare children for the marketing messages aimed at them. Advertising agencies and clients should place themselves in the parental role and find ways to connect with their vulnerable subjects in ways that are ethically acceptable so that government is not called to step in.

Thus, as online interactive marketing becomes progressively more common for increasingly younger online audiences, it requires increasingly more attention from those who need to be aware of its dynamic and immersive nature, moderate its effects, and from those in positions to control its use – be they industry watchdogs, advertising agencies, clients, media, parents, or government officials.

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KEY TERMS AND DEFINITIONS

Advergaming: Advertising a product through a game. Originally coined in reference to video games, the term is now also used for online games.

Advertainment: Entertainment that incorporates brand advertising.

Children's Online Privacy Protection Act (COPPA): Children's Online Privacy Protection Act, which became effective April 21, 2000. It prohibits websites from collecting personal information from children under the age of thirteen.

Children's Television Act (CTA): Children's Television Act of 1990 that limited commercial advertising in children's TV programming for twelve-year old children and younger to ten and a half minutes an hour on weekends and twelve minutes an hour on weekdays.

Host Selling: Product endorsement by a TV character.

Interactive Marketing: Conversation-based form of marketing enhanced by technology.

Viral Marketing: Self-replicating marketing messages ranging from text to video that are spread by the word of mouth through social networks.

Virtual World: Computer-simulated environment in which individuals interact with others through avatars.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 462-472, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Section V
Organizational and Social Implications

This section includes a wide range of research pertaining to the individual and organizational impact of social computing tools and technologies. Chapters included in this section analyze the usability of social software, the creation of social relationships in virtual communities, and social networking in educational settings. The inquiries and methods presented in this section offer insight into the implications of ubiquitous and pervasive computing at both an individual and organizational level, while also emphasizing potential areas of study within the discipline.

Chapter 5.1
Managing Organizational Knowledge in the Age of Social Computing

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INTRODUCTION

Technology, since the days of the Industrial Revolution, has been used by large corporations, such as factories and the railways, to great advantage. Starting around the end of the 19th century, technology began to be used directly by the consumer, but remained essentially a means of satisfying a *personal* need, such as lighting or listening to music. In the past decade, as technologies such as e-mail, Web, Weblogs (blogs), Wikis, and instant messaging have become pervasive, the way technology is used by individuals has changed—it has increasingly been put to use to meet *social* needs, such as interaction, sharing, and networking. This new paradigm of technology use, and the technologies that have enabled it, may be termed social computing.

By its very nature, social computing facilitates the sharing and leveraging of knowledge residing within a community of people. In this article, we discuss how social computing can act as the primary mechanism that enables the management of knowledge within an organization.

BACKGROUND: THE DISCIPLINE OF KNOWLEDGE MANAGEMENT

There are several ingredients that go into organizational success, and leveraging assets well is one of these. As intangible assets represent a rising proportion of total assets, they have come to represent an important area of management focus. The discipline of *knowledge management* (KM) thus encompasses the organizational activities directed toward the assimilation, dissemination, harvest, and reuse of knowledge. In simpler terms, KM is the answer to the question, "How can the organization update and use its knowledge more effectively?" (Kochikar, 2000).

Some of the world's most successful organizations, be they corporate, academic, or government, invest considerably in KM, and substantial benefits have been reported across industries (Berkman, 2001; Frappaolo, 2006; Kochikar & Suresh, 2005).

Knowledge Management Review magazine's survey of 400 global corporations revealed that the following are key objectives of KM programs (KM Review, 2002):

a. Increasing organizational communication
b. Gaining competitive advantage
c. Increasing collaboration among employees
d. Improving customer relationships
e. Raising efficiency
f. Innovating
g. Learning from mistakes and successes
h. Capturing and retaining tacit knowledge

Using the framework of Nahapiet and Ghoshal (1998), these objectives can be classified as improving *financial capital* (b, e); improving *social capital* (a, c, d); and improving *intellectual capital* (f, g, h).

Each organization must fashion a KM strategy that takes cognizance of its unique competencies, aspirations, and business context. Mechanisms for organizational KM typically take the form of setting up strongly engineered governance mechanisms, focusing on four key aspects: people, processes, technology, and content (see, e.g., Kochikar, Mahesh, and Mahind, 2002).

As an exemplar, Infosys Technologies (*NASDAQ: INFY*) has had a KM program since 1999, which aims to *empower every employee with the knowledge of every other employee.* Key elements of the KM architecture include the *Knowledge Currency Unit* scheme, a comprehensive mechanism for reward, recognition, and measurement of KM benefits; *KShop*, the corporate knowledge portal built in-house; and the *knowledge hierarchy*, a four-level taxonomy of over 2000 subject areas that constitute knowledge in the Infosys context (Kochikar et al., 2002).

For more on KM and its organizational uses, see work by Davenport and Prusak (1998), Drucker, Garvin, andLeonard (1998), Nonaka and Ichijo (2006), and Nonaka and Takeuchi (1995).

BACKGROUND: SOCIAL COMPUTING COMES OF AGE

Social computing is the name given to a slew of technologies that collectively allow people to pool their knowledge, keep in touch with, and interact better with others who belong to their community.

The stellar rise in the popularity of e-mail in the 1990s (the number of users skyrocketed from a few thousand at the beginning of that decade, to several hundred million at the end of it) clearly provides a pointer to the potential that social computing has—people are eager to take up technologies that will help them meet their social needs better. For example, there are as of May 2006 a total of 39 million blogs worldwide, with 75,000 being added each day (Klein, 2006). In an academic/research sense, social computing is a relatively new field—a fact reflected in the relative paucity of books and research papers in the reference section of this article.

What has spurred this gain in the importance of social computing? While there are several reasons, two in particular stand out:

- The steady march of advances in computing that have put more computing power in the hands of the users, allowing them to use it to achieve ends that they truly consider useful;
- Network effects as encapsulated in Metcalfe's Law: As the number of users of a particular technology that supports interaction or networking increases, the benefits perceived by all users accelerate significantly, causing even more users to adopt the technology.

Technologies that commonly go by the name of social computing include e-mail,instant messaging (IM), blogs, wikis, podcasting, and really simple syndication (RSS). They also include Web sites or portals supporting a variety of social interactions (examples include Yahoo!, Myspace, Flickr, del.icio.us).

A key sign of the coming of age of a new technology bubbling up from the masses is large corporations taking note of that technology. In the common view, technology diffuses by a "trickle-down effect," that is, a new technology first finds use within large corporations and then, as it becomes more affordable, trickles down to smaller businesses and finally becomes inexpensive enough to be used by the individual consumer. While such a top-down view is valid, it hardly represents the sole mechanism of technological diffusion. Equally, technology diffuses bottom-up too (Kochikar, 2006). The Internet was for decades used almost exclusively by researchers, then by academics, and subsequently (in the early 1990s) by individuals for publishing information using personal Web sites and so forth. Even when business uses were discovered for the Internet, it was small startups such as Amazon that leveraged it best—large corporations were in many ways the last to embrace the Internet. The same pattern can be seen with e-mail, instant messaging, gaming (which began with children and teenagers and is now finding uses in business such as for strategy formulation), and several other technologies. Other examples can be found in Kochikar (2006), which enumerates a few simple pointers for foreseeing emerging technologies that are "below-the-radar." Thus, large corporations must routinely monitor technologies that have not yet become visible on the corporate radar—that is, in use with small businesses, researchers, or individuals—or else they may miss an important source from where new technologies emerge. Social computing represents precisely such a "below-the-radar" technology.

Social computing is now beginning to find uses within large corporations and has elicited considerable enthusiasm from early adopters (BusinessWeek, 2006; McAfee, 2006).

SOCIAL COMPUTING: A NEW BACKBONE FOR ORGANIZATIONAL KM

Two key principles of social computing (or social software) are that

- It is highly participatory, or allows rich interaction between diverse and possibly dispersed members of a community, and
- It is evolutionary, or supports means for constant updating by the members of the community.

Together, these two characteristics indicate a mechanism for the collaborative creation and updating of content that constantly moves in such a direction as to better reflect the knowledge, beliefs, opinions, and/or aspirations of the community. This is precisely the goal of organizational KM—leveraging the combined knowledge of the organizational community.

To wit, a great deal of what has been learned and practiced by KM thinkers and practitioners over the past few years is finding expression now in the traction that social computing is getting. There has been recognition that social computing technologies can facilitate a new approach to KM. Say Caldwell and Linden (2004, p. 1):

Personal knowledge networking and social networks give individual knowledge workers direct control over the enterprise's intellectual capital and enable a new 'grass-roots' approach to knowledge management. KM can happen without a lot of explicit governance.

While conventional KM systems often act as an additional "layer" on top of existing business processes and require people to devote time specifically for creating shareable content, or making existing content shareable, social computing technologies are more organic and integrate naturally into people's work habits or social needs. Harvard Professor Andrew McAfee writes (McAfee, 2006, p. 21):

There is a new wave of business communication tools including blogs, wikis and group messaging software—which may be dubbed, collectively, Enterprise 2.0 — that allow for more spontaneous, knowledge-based collaboration. These new tools may well supplant other communication and knowledge management systems with their superior ability to capture tacit knowledge, best practices and relevant experiences from throughout a company and make them readily available to more users.

Social computing technologies can help in a variety of organizational knowledge-sharing needs, such as

- Sharing useful materials, viz., documents, presentations, plans, and best practices
- Expressing opinions, reaching out, and getting feedback
- Finding experts in a specific domain
- Learning—sharing lessons learned, tips, and tricks
- Forming communities of like-minded individuals interested in a common activity, or sharing a common area of expertise; for example, a community dedicated to innovative product design may be formed
- Pooling knowledge about a product's market potential
- Finding products and services by means such as collaborative filtering

We illustrate with two or three sample technologies.

Wikis, which are one major component of social computing technologies, can find the following uses in the corporate activity of managing knowledge:

1. **Collaborative Publishing:** Creating documents that need input from multiple authors and reviewers, for example, user documentation for a product.
2. **Capturing Evolutionary Learning:** Creating and maintaining documents or reference material that change often and need to reflect knowledge being acquired on an ongoing basis. Examples include
   - Capturing tips and tricks on how to use a particular technology product or platform
   - Recording experiences of working in, or selling to, a new country
3. **Communication on Shared Concerns, Issues:** Providing a single location where a group of people can pool their views, opinions, and ideas on a concern that is common across the group, for example, how a new initiative can be designed to deliver results efficiently.

Blogging, another archetypal social computing technology, is essentially a "one-to-many" means of communication, while wikis are "many-to-many." Thus, while blogging can fulfill to a degree the three classes of use outlined previously, the quintessential nature of wikis, viz., the ability to capture multiple voices and multiple experiences easily and effectively, is absent. On the other hand, the ability to achieve more personal and individualistic ends, such as projecting one's expertise in a particular area, or enhancing one's credibility as an authoritative commentator on a specific topic or subject, is strongly supported by blogging.

A technology not commonly included in the list of social computing technologies is that of prediction markets. Since these are a mechanism for collecting and aggregating the opinions of a large number of people and making the output useful to the entire community, they can be seen as a form of social computing technology. And since diverse people form their opinions of the outcome based on the knowledge/expertise available to them, these markets, at a fundamental level, form a mechanism to bring together knowledge from across the organization—a goal fully consonant with that of KM. Sure enough, these are used at, for example, Microsoft (Kaihla, 2006) and Google (Google, 2005) to predict product launch dates by aggregating opinions of a large community of developers. Employees from across the company contribute knowledge and opinions, which are aggregated into a forecast by the market (Google, 2005). Eli Lilly Co. uses prediction markets to forecast the success of candidate drugs in the research pipeline (Giles, 2005). Interestingly, prediction markets have been found to be enormously accurate—often more so than conventional forecasting methods (Wolpers & Zitzevitz, 2006).

Can a social computing-based KM approach support KM programs at high maturity? Perhaps what social computing technologies do best within the organizational context is to allow content and human interaction to come together judiciously in carrying out organizational tasks. Referring to the five-level knowledge management maturity model (KMM) (Kochikar, 2000), one finds that two key result areas (KRAs or building blocks) at the highest levels of KM maturity—level 4 (Convinced) and level 5 (Sharing)—are *Content Enlivenment*, where content can be said to be truly "enlivened" with human expertise, and *Expertise Integration*, the notion that appropriate expertise is available to help understand content and tailor it to specific need. Kochikar (2000) states that,

Expertise integration represents the highest level of maturity of the sharing process, as true sharing requires a judicious mix of synchronous and asynchronous mechanisms, to achieve significant gains with optimal utilization of experts' time.

Social computing technologies, by acting as a mechanism to stitch together content and human interaction, facilitate both content enlivenment and expertise integration admirably, and are thus fully capable of supporting KM programs at high maturity.

CAVEATS

Most social computing technologies, by their very nature, involve the members of a community directly accessing and modifying content. Thus, they assume a certain degree of access to, and comfort with, computers, and so organizations/groups where the members do not meet this requirement may not find this technology very productive.

Accountability for content is an issue to be addressed. Accountability is direct in the case of some technologies such as blogging, as a blog typically is written by one person. However, with the appropriate security and auditing mechanisms, accountability can be very high with technologies that allow collaborative content creation, such as wikis, too.

Social computing also takes away a significant degree of responsibility, and hence control, from centralized corporate groups and puts it in the hands of a broader community. It thus engenders a mindset change in organizational governance, without which it may be difficult to absorb effectively.

Also, since a key tenet of social computing is trust, a culture of transparency is important.

FUTURE TRENDS

Considerable work is going into getting social computing technologies to better support various aspects of organizational knowledge sharing. One key area of focus is studying how groups and organizations "remember," and attempting to build systems to support various types of structured online activity such as design. The socially translucent system approach to KM, predicated on the notion that knowledge is discovered, shared, and used in a social context, is perhaps representative of the direction in which organizational KM systems will evolve (IBM, 2006).

Projects such as Cyc (http://www.cyc.com/) and MIT's Open Mind Project (MIT, 2006) also typify approaches for better organizing human knowledge and making machines more "aware," albeit in a societal rather than organizational context. However, the principles are valid in the organizational context, and likely to gain acceptance for managing organizational knowledge.

The Economist Intelligence Unit (Economist, 2006) identifies knowledge management as one of the five trends that will shape business and economy in the coming 15 years. However, in the era of social computing, corporate knowledge management systems will grow "lighter," ceding some of the hitherto centralized responsibility to the community.

CONCLUSION

In the final analysis, social computing is emblematic of the steady power shift that technology itself embodies—from governments, large institutions, and organizations to communities and the individual. Nobody decides on behalf of the user—the user decides what works. This stunningly simple principle is what has made social computing a phenomenon so powerful that it can be termed a profound social mega trend.

As this article illustrates, social computing is increasingly finding use in corporate environments, and is in the process of gaining traction as a mechanism for KM. This can only be a positive development, as ultimately the most effective way of ensuring that content represents what users want is to put the users in charge of managing it.

NOTE

Opinions and views expressed are personal and should not be taken to reflect those of the employer.

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KEY TERMS

Collaborative Filtering: A technique for producing recommendations that are likely to meet an individual's taste, by looking at the preferences of "like-minded" other people.

Intangible Assets: Organizational assets that do not have any physical manifestation, or whose physical measures have no bearing on their value. The following is a typical list of intangible assets:

- fragmented knowledge residing with individuals, or encapsulated in artifacts such as documentation and software code;
- codified and classified knowledge residing in repositories;
- unique systems, processes, methodologies, and frameworks that the organization follows;
- "formalized" intellectual property such as patents, trademarks, and brands; and
- relationships and alliances that the organization may have shaped (Kochikar, 2002).

Intellectual Capital (IC): The "stock" of knowledge that exists in an organization, that can be used for generating value for stakeholders (Bontis, Crossan, & Hulland 2002).

Knowledge Currency Units (KCU): A mechanism defined at Infosys Technologies to convert all knowledge-sharing activities to a common denominator, in order to enable their measurement in quantitative terms.

Knowledge Management (KM): The gamut of organizational processes, responsibilities, and systems directed toward the assimilation, dissemination, harvest, and reuse of knowledge (Kochikar, 2000).

Metcalfe's Law: The utility of a network rises in proportion to the square of the number of its users. This means that as more users get connected into a network, the marginal utility perceived by new users increases dramatically (Metcalfe, 1996).

Prediction Markets: Speculative markets that can aggregate the opinions of a large number of users regarding the outcome of a particular event (Wikipedia, 2006).

Social Capital: The resources available through and derived from the network of relationships possessed by an individual or social unit within an organization (Nahapiet & Ghoshal, 1998).

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Chapter 5.2
Social Software for Bottom-Up Knowledge Networking and Community Building

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ABSTRACT

Recognizing that knowledge is a key asset for better performance and that knowledge is a human and social activity, building ecologies that foster knowledge networking and community building becomes crucial. Over the past few years, social software has become an important medium to connect people, bridge communities, and leverage collaborative knowledge creation and sharing. In this chapter we explore how social software can support the building and maintaining of knowledge ecologies and discuss the social landscape within different social software mediated communities and networks.

INTRODUCTION

Peter Drucker, among others, argues that in the emerging economy, knowledge is the primary resource for individuals and for the economy overall; land, labour, and capital. He further argues that improving front-line worker productivity is the greatest challenge of the 21st century (Drucker, 1999). Knowledge management has become an important topic for the CSCW community within the last couple of years (Davenport and Prusak 1998). A specific contribution of CSCW to the knowledge management field has been to draw attention to the social aspect of knowledge. Within the CSCW community, some important research emphasises the social properties of knowledge and how it is shared among and between communities and networks (Wenger, 1998a; Engeström et al., 1999; Zager, 2002; Nardi et al., 2002; Stahl, 2005). Over the past few years, social software has become a crucial means to connect people not only to digital knowledge repositories but also to other people, in order to share knowledge and create new forms of social networks and communities. In this chapter, we explore how the emerging social software technologies can support collaborative knowledge creation and

DOI: 10.4018/978-1-59904-976-2.ch002

sharing and discuss the social landscape within different social software mediated communities and networks.

KNOWLEDGE, COMMUNITIES, AND NETWORKS

The Social Aspect of Knowledge

Many researchers have provided different definitions for the term knowledge. Nonaka and Takeuchi (1995) define knowledge as justified true belief. Davenport and Prusak (1998) view knowledge as a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms. Drucker (1989) states that Knowledge is information that changes something or somebody, either by becoming grounds for actions, or by making an individual (or an institution) capable of different or more effective action. Drucker further distinguishes between data, information and knowledge and stresses that information is data endowed with relevance and purpose. Converting data into information thus requires knowledge. And knowledge, by definition, is specialized. Naeve (2005) defines knowledge as "efficient fantasies", with a context, a purpose and a target group, with respect to all of which their efficiency should be evaluated. Recently, Siemens (2006) points out that due to the nature of knowledge, it is very difficult to find a common definition and states that knowledge can be described in many ways; an entity and a process, a sequence of continuums: type, level, and application, implicit, explicit, tacit, procedural, declarative, inductive, deductive, qualitative, and quantitative.

Different views of knowledge exist and many researchers have developed classifications of knowledge, most of them in form of opposites (Hildreth and Kimble, 2002). A distinction that is often cited in the literature is made between explicit and tacit knowledge. Explicit knowledge is systematic knowledge that is easily codified in formal language and objective. In contrast, tacit knowledge is not easily codified, difficult to express and subjective. Examples of tacit knowledge are know how, expertise, understandings, experiences and skills resulting from previous activities (Nonaka and Takeuchi, 1995; Nonaka and Konno, 1998). Similarly, Davenport and Prusak (1998) differentiate between structured and less structured knowledge. Seely Brown and Duguid (1998) adopt the terms know what and know how, while Hildreth and Kimble (2002) distinguish between hard and soft knowledge.

Although there is no common definition of the term knowledge, there is a wide agreement that knowledge is social in nature. Many researchers emphasise the social, collective and distributed aspect of knowledge. Polanyi (1967) places a strong emphasis on dialogue and conversation within an open community to leverage tacit knowledge and one of his three main theses is that knowledge is socially constructed. Nonaka and Takeuchi (1995) state that the dynamic model of knowledge creation is anchored to a critical assumption that human knowledge is created and expanded through social interaction between tacit knowledge and explicit knowledge. They further note that this conversion is a socialprocess between individuals and not confined within an individual. Wenger (1998a) points out that knowledge does not exist either in a world of its own or in individual minds but is an aspect of participation in cultural practices. He uses the term participation to describe the social experience of living in the world in terms of membership in social communities and active involvement in social enterprises. Participation in this sense is both personal and social. It is a complex process that combines doing, talking, thinking, feeling, and belonging. It involves our whole person, including our bodies, minds, emotions, and social relations. Wenger stresses that participation is not tantamount to collaboration. It can involve all kinds of relations, conflictual as well as harmonious, intimate as well as political, competitive as well as cooperative. Paavola et al. (2002) propose the metaphor of collective knowledge creation. They discuss three models of innovative knowledge communities; Nonaka and Takeuchi's model of knowledge-creating organization, Engeström's expansive learning model, and Bereiter's theory of knowledge building and point out that all of these models agree that knowledge creation is a fundamentally social process in nature. More recently, Stahl (2005) points out that beliefs become knowledge through social interaction, communication, discussion, clarification and negotiation and that knowledge is a socially mediated product. Siemens (2006) stresses that the challenge today is not what you know but who you know and states that knowledge rests in an individual and resides in the collective. Recognizing that knowledge is a key asset for better performance and that knowledge is a human and social activity, building and maintaining communities and networks that support collaborative knowledge creation and sharing become crucial.

Communities and Networks

Siemens (2006) defines a community as the clustering of similar areas of interest that allows for interaction, sharing, dialoguing, and thinking together.Lave and Wenger (1991) point out that community does not imply necessarily co- presence, a well-defined, identifiable group or socially visible boundaries. It does imply participation in an activity system about which participants share understanding concerning what they are doing and what that means in their lives and for their communities. Quoting Packwood (2004), White (2005) states that a community is present when individual and collective identity begins to be expressed; when we care about who said what, not just the what; when relationship is part of the dynamic and links are no longer the only currency of exchange. The concept of community is very close to the concept of social network. Siemens (2006) defines a network as connections between entities to create an integrated whole. The power of networks rests in their ability to expand, grow, react, and adapt. A network grows in diversity and value through the process of connecting to other nodes or networks. A node in a network can consist of a person, a content resource, or other networks. Nardi et al. (2002) stress that a network is not a collective subject. A network is an important source of labour for the formation of a collective subject. The authors further define a social network as a complex, dynamic system in which, at any given time, various versions of the network exist in different instantiations. Part of the network may be actively embodied through intense communications as a major project is underway. Other parts of the network are instantiated differently, through less intense communications as well as acts of remembering.

Social networks and communities have been viewed from different perspectives and diverse social forms have been introduced in the CSCW literature. These include "communities of practice" (Wenger, 1998a), "knots" (Engeström et al., 1999), "coalitions" (Zager, 2000), and "intensional networks" (Nardi et al., 2002). As a special type of community, Wenger (1998a) introduces the concept of **communities of practice** (CoP). Wenger defines CoP as groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly. According to Wenger, a CoP is characterised by: (a) The domain; a CoP has an identity defined by a shared domain of interest. Membership therefore implies a commitment to the domain, and therefore a shared competence that distinguishes members from other people. (b) The community; in pursuing their interest in their domain, members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other. A website in itself is not a community of practice. (c) The practice; members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems, in short a shared practice. This takes time and sustained interaction. To differentiate between CoP and network, Wenger (1998b) states that a CoP is different from a network in the sense that it is about something; it is not just a set of relationships. It has an identity as a community, and thus shapes the identities of its members. A CoP exists because it produces a shared practice as members engage in a collective process of learning.

Within an activity theory framework, Engeström et al. (1999) note that a great deal of work in today's workplace is not taking place in teams with predetermined rules or central authority but in work communities in which combinations of people, tasks and tools are unique, of relatively short duration. The authors introduce the concept of **knotworking** to describe temporal situation-driven combinations of people, tasks, and tools, emerging within or between activity systems. According to the authors, the notion of **knot** refers to rapidly pulsating, distributed, and partially improvised orchestration of collaborative performance between otherwise loosely connected actors and organizational units. Knotworking is characterized by a movement of tying, untying, and retying together seemingly separate threads of activity. In knotworking the centre does not hold, meaning that the tying and dissolution of a knot of collaborative work is not reducible to any specific individual or fixed organizational entity as the centre of control or authority. The authors contrast knots to communities of practice, noting the differences between the two in terms of knots' loose connections, short duration of relationships, and lack of shared lore. They also contrast knots to networks, stating that a network is commonly understood as a relatively stable web of links or connections between organizational units, often materially anchored in shared information systems. Knotworking, on the other hand, is a much more elusive and improvised phenomenon.

Zager (2002) explores a collaboration configuration called a **coalition** and notes that coalitions are temporary collaborative groups where shared concerns and interests connect constituent individuals and teams. Constituents are part-time members of the coalition, making the coalition loosely bound. At any moment, the coalition's membership is fluid and diffuse, and communications among constituents may be non-existent, hindering coordination of the coalition. The organization of the coalition is bottom-up, comprising independent participants acting on their own, with little or no reference to the other participants. Nardi et al. (2002) point out that coalitions share many of the characteristics of knots in being temporary, loosely bound, and fluid. The authors further note that while knots and coalitions are similar, it is worth making a distinction between smaller, more discrete knots where certain kind of interactions are possible, and more distributed coalitions. Coalitions differ from knots in that they occur in large distributed organizations where people involved in the knot are in separate parts of the organization and often out of communication with one another.

Nardi et al. (2002) note that the most fundamental unit of analysis for computer supported cooperative work is not at the group level for many tasks and settings, but at the individual level as personal social networks come to be more and more important. The authors develop the concept of **intensional networks** to describe the personal social networks workers draw from and collaborate with to get their work done. The authors further use the term **NetWORK** to refer to the ongoing process of keeping a personal network in good repair. Key netWORK tasks include (1) building a network, i.e. adding new contacts to the network so that there are available resources when it is time to conduct joint work; (2) maintaining the network, where a central task is keeping in touch with extant contacts; (3) activating selected contacts at the time the work is to be done. Nardi et al. compare intensional networks to communities of practice, knots, and coalitions. The authors note that intensional networks differ considerably from communities of practice stating that Intensional networks are personal, more heterogeneous, and more distributed than communities of practices. According to the authors, intensional networks also differ from knots in several ways. First, intensional networks often involve long- term relationships. Second, the joint work may last for long or short periods of time. Third, the knotworking that occurs within established institutions is more structured in terms of the roles it draws upon. In contrast, work that is mediated by intensional networks results in more flexible and less predictable configurations of workers. Fourth, in intensional networks, workers are not thrown together in situation dependent ways or assembled through outside forces. Instead, work activities are accomplished through the deliberate activation of workers' personal networks. Nardi et al. further point out that intensional networks differ from coalitions on the dimension of intentionality. An intensional network is a deliberately configured and persistent personal network created for joint work, whereas a coalition is highly emergent, fluid, and responsive to state changes in a large system.

SOCIAL SOFTWARE: TECHNOLOGY FOR COMMUNITIES

Web 2.0 and Social Software

Over the past few years, the Web was shifting from being a medium into being a platform that has a social dimension. We are entering a new phase of Web evolution: The read-write Web (also called **Web 2.0**) where everyone can be a consumer as well as a producer of knowledge in new settings that place a significant value on collaboration. Web 2.0 is a new generation of user-centric, open, dynamic Web, with peer production, sharing, collaboration, distributed content and decentralized authority in the foreground. **Harnessing collective intelligence** has become the driving force behind Web 2.0. Jenkins et al. (2006) define collective intelligence as the ability to pool knowledge and compare notes with others towards a common goal. Levy (1999) sees collective intelligence as an important source of power in knowledge communities to confront problems of greater scale and complexity than any single person might be able to handle.He argues that everyone knows something, nobody knows everything, and what any one person knows can be tapped by the group as a whole.Collective intelligence is similar to the concept of the **wisdom of crowds** introduced by James Surowiecki in his book with the same name. Surowiecki (2004) explores the idea that large groups of people are smarter than an elite few, no matter how brilliant. He argues that the many are better at solving problems, fostering innovation, coming to wise decisions, and predicting the future than the few.

Social software, also called **social media**, has emerged as the leading edge of Web 2.0 and has become a crucial medium to connect people not only to digital knowledge repositories but also to other people, in order to share and collaboratively create new forms of dynamic knowledge. Rapidly evolving examples of social software include wikis, blogs, Web feeds, media sharing, social tagging, and pod/vodcasting. Social software is however not restricted to these technologies. Below we provide a brief outline of characteristics of each social software technology.

Recently, wikis have seen a growing mainstream interest. A wiki is a collaborative Web site which can be constantly edited online through the web browser by anyone who cares to contribute. Once created, a wiki can be revised collaboratively, items can be added or deleted easily, and changes can be made quickly, thereby building a shared knowledge repository.

Another form of Web publishing, which has seen an increase in popularityover the past few years, is blogging. Blog creation is rapidly growing. In contradiction to wikis, where anyone can add and edit items, a blog can only be edited by one individual (personal blog) or a small number of persons (group blog or organizational/business blog). A blog is a frequently updated Web site made up of dated entries presented in reverse chronological order, addressed as posts. The posts normally consist of texts, often accompanied by pictures or other media, generally containing links to other blog entries recommended or commented by the author. Each post can be assigned one or multiple tags/keywords as well as a permanent pointer (permalink) through which it can be addressed later. Older posts are moved to a searchable tag-based archive. Additionally, displayed on the sidebar of a blog, there often is available a list of other blogs that the author reads on a regular basis, called blogrolls. Readers can attach comments to a particular blog post. Trackbacks enable to track citations and references to a blog post from other posts in other blogs and automatically link back to these references. New variants of blogs are gaining more popularity each day. Examples include photoblogs (phlogs) which have photographs as primary content, video blogs (vlogs) which focus on videos and mobile blogs (moblogs) which offer a way for users to post content (e.g. pictures, video and text) from a mobile or portable device directly to their blogs. An enhancement of blogs are Web feeds e.g. RSS and Atom feeds. Web feeds are a new mode of communication that allows e.g. blog-authors to syndicate their posts and gives blog-readers the opportunity to subscribe to selected blogs with topics they are interested in and receive new published content.

Another popular example of social software is media sharing and social tagging. Today, Web users are sharing almost everything: ideas, goals, wish lists, hobbies, files, photos, videos, bookmarks. Additionally they are using tags to organize their own digital collections. Tagging can be defined as user- driven, freeform labelling of content. Users create tags in order to be able to classify, categorize and refind their own digital collections at a later time. Tagging is implemented on the most popular social sites such as on Flickr to organize photos, on YouTube to classify videos, on del.icio.us or Yahoo's My Web to categorize bookmarks, and on 43 things to describe lifetime goals.

Podcasting is also becoming mainstream. The term is a combination of the two words iPod and broadcasting and refers to digital audio files that are recorded by individuals and then made available for subscription and download via Webfeeds. These files can then be accessed on a variety of digital audio devices. A variant of podcasting, called vodcasting (the "vod" stands for "video-on-demand), works in an almost identical way but offers videos for streaming and download.

Social software offers new opportunities for social closeness and foster changes in the ways how people network and interact with each other. In the next section, we discuss the social landscape within different social software mediated communities.

Social Software Mediated Communities

Social software has been opening new doors for social knowledge networking and dynamic community building. Social software mediated communities are organized from the bottom up. Bottom-up communities are co-constructed and maintained by individual actors. They emerge naturally and are derived from the overlapping of different personal social networks. In contrast, top-down communities are hierarchical social structures under the control mechanisms of outside forces. The social structures evolving around social software are close to Engeström's knots. In fact, social software enables the formation of networks between loosely connected individual actors using distributed tools. These networks have no centre or stable configuration and are characterized by distributed control and coordinated action between individual actors. Furthermore, social software supports the netWORKing perspective in Nardi et al. (2002); that is building and maintaining personal social networks. Social software driven networks are similar to what Nardi et al. describe as intensional networks in that they arise from individual actors that self-organize in flexible and less predictable configurations of actors. The social software networking model is based on personal environments, loosely joined. Rather than belonging to hierarchical and controlledgroups, each person has her own personal network. Based on their needs and preferences, different actors come together for a particular task. They work together until the task is achieved and thereby do not have a permanent relationship with a formal organization or institution. Owen et al. (2006) point out that an important benefit from social software is the ability to cross boundaries. People might be able to join communities that they would not otherwise join. They have the opportunity to move beyond their geographic or social community and enter other communities and at the same time others can move into theirs. Moreover, there is no barrier to be member of communities that contain other ages, cultures and expertise.

Blogs, Web feeds, wikis, podcasts, and social tagging services have developed new means to connect people and link distributed knowledge communities. Blogging began as a personal publishing phenomenon and evolved into a powerful social networking tool. Besides their usage as simple personal publishing tool, blogs can be used as (a) personal knowledge management system to help us capturing, annotating, organizing, reflecting, and exchanging our personal knowledge; (b) distributed knowledge repository that we can use to access and search for appropriate knowledge resources; (c) communication medium that enables us to comment, rate, review, criticize, recommend and discuss a wide range of knowledge assets with peers worldwide; and (d) community forming service to sustain existing social ties and develop new social ties with others sharing similar practices or interests. Moreover, blogging is a good example of a technology that starts with individuals and supports bottom-up dynamic building of personal social networks. Commenting on blog posts makes the interaction between blog-authors and -readers possible and can lead to interesting discussions. New blog-readers can then join the discussion by commenting or writing a post on their own blog with a reference to the blog post that they want to comment on. Trackbacks detect these remote references and enable to establish a distributed discussion across multiple blogs. Web feeds offer a powerful communication medium that enables people to keep track of various blogs and receive notification of up-to-date content. Through comments, citations, trackbacks and Web feeds, a social network from people with similar practices or interests can be created and even enlarged by blogrolls. White (2006) identifies three types of blog based communities: (a) the Single Blog/Blogger Centric Community emerging around a single blogger where readers return to the bloggers' site, comment and get to know not only the blogger, but the community of commentors; (b) the Central Connecting Topic Community that arises between blogs linked by a common passion or topic. What links them is hyperlinks, in the form of blogrolls, links to other blogs within blog posts, tagging, aggregated feeds, trackbacks and comments; and (c) the Boundaried Community where blogs are hosted on a central site or platform. Typically members register and join the community and are offered the chance to create a blog. The communities that emerge from blogging establish their own rules and roles. Citing Cross and Parker (2004), White (2006) points to different roles in blog based communities; i.e. Central Connectors, Unsung Heroes, Bottlenecks, Boundary Spanners and Peripheral People.

Wikis have evolved in recent years to become a simple and lightweight tool for knowledge capturing, asynchronous collaborative content creation, information organization, peer editing, and working on a team project. A wiki is also an important community service that has the potential to build communities coming in from the bottom up. A wiki can connect multiple authors across organizations and institutions. Everyone is able to post, edit, delete, and comment content. Over time, a collaborative social space and a shared knowledge repository will emerge. The most successful model for a wiki is surely the open and freely editable encyclopaedia Wikipedia. Additionally, several wiki-like, more professional services, such as Google Docs, have emerged as collaborative writing tools which let users come and work together on a shared project and rapidly create a new collaborative space. The fact that knowledge created by many is much more likely to be of better value makes wikis a key technology in collective intelligence communities that ensures that the captured knowledge is up-to-date and more accurate.

Media sharing sites, e.g. Flickr, YouTube, del.icio.us, Digg, Slideshare, CiteULike provide innovative collaborative ways of organizing media. These sites have powerful community features. Users can upload, rate, tag different media, post comments, interact with other members by forming groups, and track their activities by adding contacts. Social tagging is being used by most of the media sharing sites to classify, categorize, and manage media in a collaborative, emergent, and dynamic way. This classification scheme has been referred to as "folksonomy", a combination of "folks" and "taxonomy", which implies a bottom-up approach of organizing content as opposed to a hierarchical and top-down taxonomy. The folksonomy is a good example of the collective intelligence at work. Media sharing, social tagging and folksonomies provide a powerful way to foster bottom-up community building as users share, organize, filter interesting information for each other, browse related topics, discover unexpected resources that otherwise they would never know existing, look for what others have tagged, subscribe to an interesting tag and receive new content labelled with that tag via Web feeds, and find unknown people with similar interests.

SOCIAL SOFTWARE AND SOCIAL NETWORK ANALYSIS

As social software becomes important for building and bridging communities, tools that enable people to manage, analyze, and visualize their social software mediated networks gain popularity. Thereby, different social network analysis methods have been applied. Social network analysis (SNA) is the quantitative study of the relationships between individuals or organizations. Social network analysts represent relationships in graphs where individuals or organizations are portrayed as nodes (also referred to as actors or vertices) and their connections to one another as edges (also referred to as ties or links). By quantifying social structures, social network analysts can determine the most important nodes in the network (Wasserman and Faust, 1994). One of the key characteristics of networks is centrality. Centrality relates to the structural position of a node within a network and details the prominence of a node and the nature of its relation to the rest of the network. The centrality of a node is influenced by the following factors: (a) degree, which determines the root by identifying the object with the most direct connections to other objects within the network. This finds the object with the most influence over the network, (b) closeness, which determines the root as the object with the lowest number of links to all other objects within the network. This finds the object with the quickest access to the highest number of other objects within the network, and (c) betweenness, which determines the root as the object between the most other linked objects. This measure finds objects that control the information flow of the network (Siemens, 2005).

Our literature survey on the analysis of social software mediated networks has revealed that there is limited empirical work on the analysis of social networks issued through wikis or social tagging. There is however a growing interest in blog social network analysis. Recognizing that blogging is a highly social activity, recent blog research has focused on citations, comments, trackbacks, and blogrolls as indicators of cross-blog conversational activities and has employed social network analysis techniques to detect the linking patterns of blogs, the development of blog based communities, and the popularity of blog-authors. In fact, comments, trackbacks, and blogrolls are a measure of reputation and influence of a blog-author, as an interesting blog post will be frequently commented or cited in other blogs and a popular blog will be often listed in the blog-rolls. Blog social network analysis research has adopted different metrics for blog analysis, i.e. the link mass metric, the converstaion mass metric, and the content and conversation mass metric. Different studies have used the link structure of the blogosphere for authority detection and community identification (link mass). For example Marlow (2004) assumes thatlinks to a given blog are a proxy to the authority of that blog and uses the social network analysis metrics in-degree (links in) and out-degree (links out)to identify authoritative blog authors. Similarly, Adar et al. (2004) propose the use of link structure in blog networks to infer the dynamics of information epidemics in the blogspace and show that the PageRank algorithm identifies authoritative blogs. Kumar et al. (2005) examine the structure of the blogosphere in terms of the bursty nature of linking activity. By comparing two large blog datasets, Shi et al. (2007) demonstrate that samples may differ significantly in their coverage but still show consistency in their aggregate network properties. The authors show that properties such as degree distributions and clustering coefficients depend on the time frame over which the network is aggregated. McGlohon et al. (2007) observe that the usual method of blog ranking is in-links and stress that simply counting the number of in-links does not capture the amount of buzz a particular post or blog creates. The authors argue that the conversation mass metric is a better proxy for measuring influence. This metric captures the mass of the total conversation generated by a blogger, while number of in-links captures only direct responses to the blogger's posts. Similarly, Ali-Hasan and Adamic (2007) notice that most of the blog research to date has only focused on blogrolls and citation links. The authors stress that much of the interesting interaction occurs in comments and point out that reciprocal blogroll links indicate possibly only a mutual awareness, whereasreciprocal comments and citations imply a greater level of interaction. Bulters and de Rijke (2007) point out that traditional methods for community finding focus almost exclusively on topology analysis. The authors present a method for discovering blog communities that incorporates both topology- and content analysis (content and conversation mass). The proposed method builds on three core ingredients: content analysis, co-citation, and reciprocity.

CONCLUSION

In this chapter, we mainly discussed how social software can support the building and maintaining of ecologies that foster knowledge networking and community building. We explored the social structures emerging around social software and found out that social software mediated communities are organized from the bottom up. Finally, we would like to stress two important issues. Firstly, a sole social software technology cannot build a community. Often, relationships start with a social software technology and then extend to other communication media such as email, instant messaging, and face-to-face meetings. Secondly, successful community building and effective knowledge sharing are not primarily dependent on social software technologies. Key prerequisites for knowledge sharing are (a) trust and (b) a participatory culture that allows knowledge to flow and rewards rather than punishes collaboration initiatives. Collaboration has to become the norm and a meaningful part of the performance evaluation of knowledge workers.

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This work was previously published in Knowledge Networks: The Social Software Perspective, edited by M. Lytras; R. Tennyson; P. Ordonez de Pablos, pp. 17-27, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.3
The Essence of Organizational Knowledge:
A Social Epistemology Perspective

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ABSTRACT

The relationships between organizational static substance knowledge with 'belief', 'the true', 'true belief', or 'justified true belief' have been outlined briefly in 2003. In this article, through combining new research outcomes, I further explore why different kinds of organizational static substance knowledge can be counted as belief, the true, true belief, or justified true belief. The discussion on the subtle differences between belief, the true, true belief and justified true belief will shed light on our comprehensive and intensive understanding of different kinds of organizational knowledge and will enable managers or chief knowledge officers (CKO) to effectively and efficiently manage knowledge related activities in our knowledge era. [Article copies are available for purchase from InfoSci-on-Demand.com]

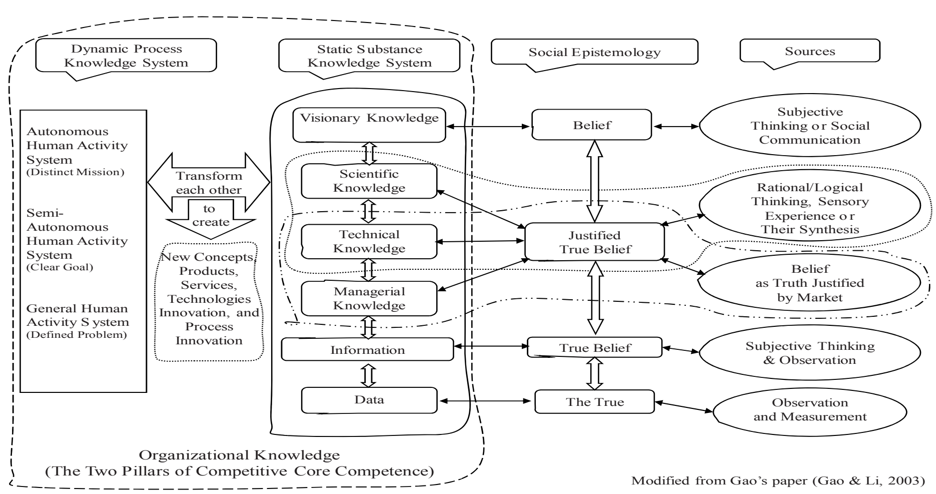
INTRODUCTION

The attributive term 'organizational' in the phrase of 'organizational knowledge' makes the phrase very different from the meaning of the single term 'knowledge'. On the one hand, organizational knowledge, as it was discussed in Gao et al (2003), must be judged by objective criteria (such as through strict scientific thinking based on scientific method, approaches, and tools like logical and rational thinking (i.e. logical deduction, rational induction, and/or rational interpretation); sensory experience (i.e. experiment or field study); and the synthesis of rational thinking and sensory experience; and Nonaka's evaluating criteria of the market[1]). On the other hand, organizational knowledge has also to be judged by subjective criteria, and further, these subjective criteria are established by the organization based on its own social and cultural background, history, and actual environmental position. This subjective aspect of organizational knowledge is different from

Polanyi's postmodern philosophical meaning i.e. the tacit dimension of knowledge (Polanyi, 1958, 1962; Li & Gao, 2003). It also means that some justified true belief, such as a scientific theory or an advanced technology, can be excluded from organizational knowledge if this scientific knowledge and technological knowledge has no relationship to the organizational operation or business. What is more, a false statement might be understood as organizational knowledge and considered highly useful, as long as the people in that organization have reached some sort of consensus as to its value, such as a false interpretation of a piece of information, or a false description of an event. Although such phenomena generally would not last a long time, its negative influence on organization may. In nature, organizational knowledge is a product of the organizational social/human activity through social communication. Therefore, misunderstandings can happen. To reduce these types of mistake, organizational knowledge needs to be carefully reviewed from a social epistemology perspective as in our following paragraph.

In Gao et al's paper (2003), organizational knowledge was defined as *organizational static substance knowledge* and *organizational dynamic process knowledge*. Organizational static substance knowledge is classified further into visionary knowledge (i.e. corporate vision, mission, and norm, plus corporate culture and value); scientific knowledge; technological knowledge; managerial knowledge; information; and data. Organizational dynamic process knowledge is then defined as knowledge related human activities, which are classified into the autonomous human activity of distinct mission; semi-autonomous human activity with a clear goal; and the general human activity surrounding a defined problem, because organizational knowledge in modern high-tech corporations consist of natural sciences, applied sciences/technologies, and social/human sciences (Gao, 2007; Gao, et al, 2003, 2008). Human activities here are the activities of creating, codifying, acquiring, categorizing, distributing, transferring, and utilizing various kinds of static substance knowledge and the knowledge workers' own personal knowledge to create new products; better services; advanced technologies (both hard and soft technology); and technical/process innovations for realizing the economic value of this knowledge for the good of the organization, society, and individuals (see the left-hand side of Figure 1).

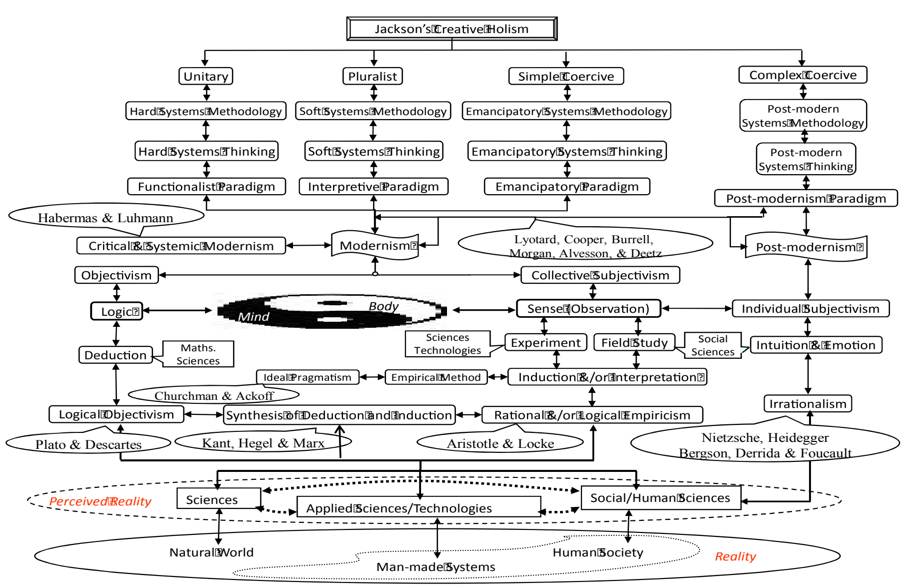
Figure 1. Organizational knowledge, sources, and social epistemology perspective



On exploring how we know what we know and in what way we know them, a concept model is built to illustrate the differences between science, technology/applied science, and social/human science (see Figure 2, Gao, 2007, 2008). Figure 2 is a concise map that points out the underlying theories and philosophies of various systems methodologies (i.e. hard systems methodology, soft systems methodology, emancipatory systems methodology, and post-modern systems methodology), and in what way and how, the different kinds of systems methodologies were generated for dealing with their corresponding ideal problem contexts i.e. unitary, pluralist, simple coercive, and complex coercive (Jackson, 2000, 2003; Jackson and Gao, 2004). The different ways of approaching different knowledge in different fields results in different standards of justification and different criteria of evaluation for both research outcomes and research approaches.

Here we introduce the concepts of 'belief', the true, true belief, or justified true belief and their relationships with organizational static substance knowledge are explored from a perspective of social epistemology. Through exploring why organizational static substance knowledge should be counted as belief, the true, true belief, or justified true belief, the different characteristics of different static substance knowledge can be better understood and thus proper criteria can be used for their accurate evaluation and correct justification. Organizations may pay dearly when they confuse the different kinds of organizational knowledge (i.e. mistaking one kind of organizational knowledge for another kind of organizational knowledge), because it can lead to incorrect decisions being made. Therefore, distinguishing between different kinds of organizational static substance knowledge is one of the most important factors to be considered in relation to undertaking quality control of knowledge related activities.

Figure 2. Reality, perceived reality, problem contexts, underlying philosophies, and management methodologies



Source: Modified from (Gao, 2008)

BELIEF; THE TRUE, TRUE BELIEF; JUSTIFIED TRUE BELIEF; AND ORGANIZATIONAL STATIC SUBSTANCE KNOWLEDGE

In discussions of social epistemology, the terms 'belief', 'the true, true belief', or 'justified true belief' are often mentioned as useful for the assessment and validation of knowledge. Here we relate belief; the true, true belief; and justified true belief to organizational static substance knowledge (see the right-hand side of Figure 1). This connection between them sheds new light on our understanding of organizational static substance knowledge and its management.

Belief

'Belief' is something believed or accepted as true, especially a particular tenet or a body of tenets accepted by a group of people. It is a mental acceptance of, and conviction in, the truth, actuality, or validity of something by some person. Belief has weak relationship with whether what was believed in is true or false, rational or irrational, agreed to or not agreed to by other members of the believers' community. It comes from subjective thinking or social communication. What an individual believes in greatly depends on his/her education background, social environment, cultural tradition, and personal experiences.

An individual's belief decides not only what the believer does but also by what means and how the believer can carry out it. Ramsey and Armstrong said that 'Beliefs are maps by which we steer' (Armstrong, 1973 p193; Ramsey, 1931, p238). And further Armstrong (1973) said that the belief-map will include a map of the believer's own mind, and even, as a sub-part of this sub-map, a map of the believer's belief-map (that is, his beliefs that he holds certain beliefs). Beliefs are thought of as maps, which carry their interpretation of reality within themselves. It is due to this characteristic that no objective rational judgment is involved. To an individual, his/her belief is his/her personal knowledge such as value, morals, and ethics.

In knowledge management, a knowledge worker's belief is their professional value and professional moral and ethics. It is the 'map for steering' in their career and daily life. Equivalently, an organization's belief is its visionary knowledge in the form of organizational vision and mission embedded in corporate culture, value, norm, and evaluation system. Organizational visionary knowledge is the outcome of subjective thinking or social communication and has close relationship with its tradition and social environment. Organizational visionary knowledge reflects its founders' personality. It can be radically changed by some powerful strong person/s or through special influential events. In general, it is often modified in an evolutionary way with the development of organizations. The modified statements of organizational vision or mission with a corresponding change in evaluation will guide the evolution of corporate culture and business pattern. Organizational visionary knowledge should be of humanity, justice, fairness, and honesty.

An organization's good visionary knowledge not only reveals the vision and mission of an organization but also sets clear criteria to evaluate different kinds of knowledge work. The evaluation of knowledge workers' work should be different from the evaluation of other organizational operation work. The reasons for the separation are that first, knowledge work and knowledge related activities are very different from conventional operational work and activities in organization (Gao et al, 2000); and second, that highly autonomous knowledge related human activity needs sound support from top management group rather than only from the middle level managers in organization. A Chief Knowledge Officer (CKO) needs to be empowered to distribute a budget, reward outstanding elites, and make decisions on personnel. Due to the different characteristics between different kinds of knowledge work they cannot all be evaluated using the same approach. The evaluation system of knowledge work should ensure that the organization's desired personal beliefs come true and the undesired ones are eliminated. Or in other words, it is to align the individual's vision and mission with the organizational vision and mission.

Most management evaluation systems pay great attention to the operational process. It is believed that if the process is correct, the desired results will be obtained, but this is not true for knowledge related activities. In Gao's articles (Gao et al, 2002, 2003), it was pointed out that no one knows the knowledge work better than the knowledge workers, so it is useless to judge knowledge work by laymen observing the working process. To them the knowledge work process is a black box. The most important thing is not the process being observed but the content and outcomes of knowledge work. If one lacks the ability to identify the quality of knowledge related work, the work has to be evaluated by its outcomes through the markets[2]. Knowledge management, to some extent, is to build various enabling 'Bas' of knowledge sharing and creating based on the organizational visionary knowledge for a given organization (Li & Gao, 2003; Nonaka & Konno, 1998; Nonaka & Takeuchi, 1995). This then is the function of organizational visionary knowledge.

True Belief

Putting the term 'true' in front of belief to form the phrase 'true belief' implies that the meaning of this phrase may be not true, but is intended to lead others to believe that the statement of this true belief is in fact true. In other words, whether the believer/s (the sender/s) believe that the 'true belief' itself is true or not, the believer/s (the sender/s) expect/s others (the receivers) to accept it as true. So something labeled as true belief may be not true at all. Here we relate organizational information to true belief, because organizational information often has such a character.

In general, information is something told (i.e. message) or facts or details about somebody/something; from a professional perspective, information is the meaning given to data by the way it is interpreted or data in context (Earl, 1994; Davenport, 1997). Information should be sufficient, reliable, relevant, simple, objective, and timely; but it is actually a subjective outcome and could be created from nothing for a special purpose (such as Hwuang Woo-Suk's academic fraud disclosed in 2005 in South Korea[3]). In knowledge management, managers or CKOs should be carefully to distinguish true belief (i.e. information especially those deliberately created) from the true (data), belief (visionary knowledge), or justified true belief (scientific knowledge, technological knowledge, or managerial knowledge).

The True

'The true' as a concept means right or correct (not false), or being what exists rather than what was thought, intended, or claimed. The use of *true* here requires the statement of the *tru*e to be consistent with reality in the eyes of everyone. In other words, if something is described to be the truth, it requires that statement to be objective, accurate, and reliable.

Data, and the representations of events or signs or symbols of facts collected through observation and measurement without value judgment, are characteristics of the meaning described by the phrase *the true*. People objectively and accurately collect data to obtain a true representation of facts based on the individuals' ability and experiences or social communication. Data are the representations of facts or events; therefore, data are counted as *the true* in organizational knowledge system. To collect and judge data, sometimes professional knowledge is a necessity.

Although data, or the true, should be objective, accurate, and reliable, the same data could be interpreted into very different information by different individuals for different purposes, or because of their different abilities or background. Therefore, the true (i.e. data) and true belief (i.e. information) are very different in nature. Managers or CKOs should understand, or at least know, in what way and how data or facts are interpreted/manipulated/presented into information, because it is these items that determine the quality and characteristics of information. Information and data are normally seen as generic knowledge (Gao, el at, 2003).

In general, people often take information as facts i.e. take true belief as *the tru*e. This is very dangerous, because it leaves impostors space to work. Like fortune-tellers and illusionists, impostors, especially academic fraudsters, are good at creating/producing events [for their own special purposes] to make others believe that what they spread was *the true*. It is due to this reason that honesty and professional morality and ethics are viewed as one of the most important characteristics of knowledge workers. When knowledge becomes the synonym of intellectual asset and knowledge work implies not only fame and social status but also high salary and other benefits, knowledge management must take the responsibility of discerning the fake from the true - distinguishing information from facts. Under any condition, purposeful cheats must be forbidden. Facing the current global financial crisis started from America, it is time for all professionals, academics or practitioners to rethink the standards of professional ethics and morals and corporate social responsibility because we need some more criteria beyond market requirements. The success of Wall Street financial derivatives on global capital market, which have been mainly invented to reduce the risk that the value of the underlying asset will change unexpectedly, actually became the very source of the current global financial crisis and now is spreading to our real economy. Therefore, a new task has emerged for knowledge management, which is to prevent purposeful professional fraud in the name of innovation or 'over innovation'. Otherwise, the Enron scandal or Hwuang Woo-Suk's case will happen again and again. Blurring the boundary between information and facts is one of the tricks of the imposter.

Justified True Belief

Organizational scientific knowledge, technological knowledge, and managerial knowledge are judged here as justified true belief, because all of them, besides holding their corresponding characteristics, need to be justified by a third party. The third party, as Nonaka said, is the market. Business practical success is the final criteria for evaluating organizational knowledge. In the following section, the characteristics of scientific knowledge, technological knowledge, and managerial knowledge are briefly introduced.

The arguments of the characteristics of scientific knowledge, technological knowledge, and managerial knowledge can be found in philosophy, sociology, and organization studies (Burrell & Morgan, 1979; Clegg et al, 1996; Kuhn, 1970; Russell, 1961). In philosophy, if something is considered as 'justified true belief', it is called the 'truth'. Justified true belief means that a belief was justified as being true in some way. If the method of justification is through reasoning in terms of rational and logical deduction (such as Plato and Descartes), by empirical induction from sensory experiences (Aristotle and Locke), or by the synthesis of rational deduction and empirical induction (Kant, Hegel, or Marx), the statement of justified true belief is to be counted as either science or technology. If the method of justification is mainly through collective subjectivism and/or individual subjectivism, the statement of justified true belief is to be to counted as social science or humanity (as shown in Figure 2, Gao et al, 2003; Gao, 2007, 2008; Russell, 1961, 1989). Science and technology take objectivity and rationality as a necessity and both natural scientists and technologists/engineers tend to separate their work objects, research discoveries and inventions, from individual subjectivity; while social science is based on subjectivity or personal understanding and interpretation and social scientists cannot separate their personal value judgment from their research objects, approaches, and conclusions. Scientific knowledge in organizational knowledge management, as Drucker (1969) asserted, is part of the 'history of technology', which recounts how man puts tools to work.

Therefore the body of knowledge of social/human sciences is social scientists' personal understanding and interpretation about the social reality of human society. The difference between science, technology/applied science, and social science/the humanities, as well as the difference between scientists, applied scientists/engineers, and intellectuals are incompatible because of their different cultures (Gao, 2007; Snow, 1998). Natural scientists aim to *answer a question*; technologists/engineers aim to *solve a problem* (Ackoff, 1999); and social scientists/practitioners aim to interpret/change social phenomena. Natural scientists, technologists/engineers, and social scientists/practitioners take different objects as their research targets in different fields with different approaches, and by different means, for different purposes. They believe in different philosophies. Figure 2 illustrates the relationships of different elements and their connection roads. Management/organization theories, methodologies, approaches, and skills have been developed for dealing with man-made systems and human society; they belong to social/human science as shown in Figure 2 (Gao, 2008).

SUMMARY

The different kinds of organizational static substance knowledge can be counted as belief, the true, true belief, or justified true belief because of their different ways of generation as showed in Figure 2. Human subjective opinion and social consensus play an important role in the creation and formation of organizational business knowledge. Therefore, to build a high quality organizational knowledge system and make full use of this valuable resource, i.e. to effectively and efficiently manage organizational knowledge for the organizational vision and mission; means that how to organize the processes of human activity, and how to evaluate the results of human activity, become the key points of successful knowledge management. As the subjective factors of a human being cannot be avoided in dealing with organizational knowledge, the various kinds of organizational knowledge should be treated based on their different characteristics, in this way, critical systems thinking is of great help in carrying out fairness, justice, and is objective (unbiased) for individuals, groups, organizations, community, and society (Gao, 2008).

The definition of knowledge in Nonaka's knowledge-creating theory directly points out that we should study organizational knowledge from a social epistemology perspective, because knowledge is defined as a dynamic human/social process of justifying personal belief and skill towards the truth (Nonaka, 2000, 2002). With Takeuchi he not only confirmed the social process of knowledge creation but also established a SECI model (Socialization, Externalization, Combination, and Internalization between tacit knowledge and explicit knowledge) to facilitate the dynamic social process of knowledge conversion (Nonaka and Takeuchi, 1995).

For static substance knowledge, the evaluation should be based on the different criteria as shown in Table 1. With regard to knowledge workers, besides separating knowledge managers from knowledge workers, we further classify the workers into knowledge brokers, knowledge processors, and knowledge creators, to identify who actually create knowledge in organizations; who add new value; what they contribute to the organizations; and what roles these various actors play. It does not mean some roles are superior to others; the aim is to identify what each player does and what role he actually plays. Based on

Table 1. Organizational static substance knowledge and their corresponding evaluation criteria

	Name	**Contents**	**Criteria**
Organizational Static Substance Knowledge	Visionary Knowledge	Vision Mission Ethics Moral	Humanity Justice Fairness Honesty
	Objective and/or Subjective Knowledge	Scientific Knowledge	Justification Falsification
		Technological Knowledge	Advancement New Applicability
		Managerial Knowledge	Performance Applicability
	Generic Knowledge	Information	Reliability Simplicity Timeliness
		Data	Objectivity Accuracy Reliability

this, organizations can make decisions based on their actual situations and value systems. When an organization pays attention to what each player actually does, what results they obtains, and what role/s the actor plays, professional/academic frauds will be reduced. Although past achievements of individuals, either failure or success, cannot decide their future performance, their tacit knowledge, especially professional knowledge and skills, can. As professional, systematic and theoretic knowledge is the basic element or background of a qualified knowledge worker, to evaluate each knowledge worker longitudinally will help to identify the fake from the true expert. To some generalists, it is more important to find out (in each field) whether they are evaluated as an expert by the experts in that field. To professionals, generalists usually mean no profession. As they know some basic terms or principles in a few fields, it is easy for them to disguise themselves as gurus. The question of what they really know must be asked and examined carefully before recruiting knowledge workers.

CONCLUSION

The article discusses the nature of organizational static substance knowledge, what various business related knowledge are, and how and where they come from. Based on this, organizations can establish effective management system to organize, support, and motivate knowledge related activities, and manage them through evaluating the outcomes of the activities. Business related knowledge as both a production factor and a means of production, as well as an intangible asset to organization has very different characteristics from other production factors. Knowledge workers with special personal knowledge determine the success or failure of the knowledge related activity. Because belief, true belief, the true, and justified true belief are different and interconnected, how to manage organizational knowledge and maximize its economic value through transforming its form or position among individuals or between organizations, and embodying it into routines of operation, products, and service, is the essential role of knowledge management.

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ENDNOTES

1 Nonaka believes that organizational knowledge must be evaluated by the market (personal discussion with Professor Nonaka). This implies that organizational knowledge has to be business related knowledge and market is a necessity for evaluating organizational knowledge. The different viewpoints about knowledge conceived by the intellectual in general and by the people in business organization are at that intellectuals care about the answer to the statement of the knowledge itself; people in business organization care more about the function of knowledge (Gao, 2003a, 2003b). Figure 1 and 2 are supposed to help managers or CKOs to justify the answer to organizational static substance knowledge, while Table 1 provides criteria to evaluate it.

2 Markets here means the academic community and business world.

3 South Korea scientist Hwang Woo-Suk, with some of his co-workers together, conducted scientific fraud through faking original scientific experiment data. This is a typical example of blurring the line between 'the true' and 'true belief' (i.e. blurring the line between data and information). Unfortunately, Hwang and his group were intending to clone human embryos (which is repeatable) and had failed to do this before the fraud was disclosed.If they had succeeded in cloning human embryos before its disclosure, the scientific fraud might have never been found. In this case, through faking data, they would become known as the first scientists to know how to clone human embryos even if some other scientists had cloned human embryos before Huang's group. However, if Hwang's research was in the field of social science, where what had been done might have been unrepeatable, could such collective frauds have ever been found? To this, I raise some questions here: should we question such inventions or discoveries that are similar to those well developed theories or approaches in social sciences in today's international academic community (seems such inventions or discoveries are developing more and more)? How do we identify such similar theories or approaches were not faked as developments from the original well developed ones? What can knowledge management do to reduce collective academic frauds?

This work was previously published in International Journal of Sociotechnology and Knowledge Development, Vol. 1, Issue 3, edited by E. Coakes, pp. 63-75, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 5.4
Social Identities, Group Formation, and the Analysis of Online Communities

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ABSTRACT

Central to research in social psychology is the means in which communities form, attract new members, and develop over time. Research has found that the relative anonymity of Internet communication encourages self-expression and facilitates the formation of relationships based on shared values and beliefs. Self-expression in online social networks enables identity experimentation and development. As identities are fluid, situationally contingent, and are the perpetual subject and object of negotiation within the individual, the presented and perceived identity of the individual may not match reality. In this chapter, the authors consider the psychological challenges unique to understanding the dynamics of social identity formation and strategic interaction in online social networks. The psychological development of social identities in online social network interaction is discussed, highlighting how collective identity and self-categorization associates social identity to online group formation. The overall aim of this chapter is to explore how social identity affects the formation and development of online communities, how to analyze the development of these communities, and the implications such social networks have within education.

DOI: 10.4018/978-1-60566-208-4.ch007

INTRODUCTION

Central to research in social psychology is the means in which communities form, attract new members, and develop over time. The mechanisms in which communities grow depend on an individual's ability to find and collaborate with others with relevant knowledge, skills, and beliefs that meet a particular need. While these mechanisms of social collaboration are not unlike traditional face-to-face interactions (Tyler, 2002), there are some important differences in the way in which group members interact in online environments. Relative anonymity, selective self-disclosure, physical appearance, and the ease in finding 'familiar others' through search, embedded traits, and predefined groups, are some of the important differences between Internet communication and face-to-face interactions (Bargh & McKenna, 2004; McKenna, Green, & Gleason, 2002; Walther, 2007). Research into Internet social interaction has led to an increased understanding of face-to-face communications and brings into focus the implicit assumptions and biases that exist in traditional communication (Lea & Spears, 1995; Tyler, 2002). Assumptions that mediate face-to-face interactions such as physical proximity and non-verbal cues, assumed necessary to communicate and relate, do not exist in most Internet communications. However, given these limitations, online social communities continue to thrive and grow. The evolution of online communities confronts current views of how social and psychological dynamics contribute to human relationships, communication, and community formation.

Research supports the idea that the relative anonymity of Internet communication encourages self-expression and facilitates the formation of relationships outside of what is considered 'normal' socially mediated communication (Wallace, 1999). The complex origins of shared values and beliefs (Bargh & McKenna, 2004), self-expression through identity experimentation (Ruitenberg, 2003), and relative anonymous interaction (i.e. strangers on the train effect; Derlega & Chaikin, 1977; Rubin, 1975) challenge ideas of an 'individual' identity in relationship formation (Lea & Spears, 1995). As individual identities are malleable, adaptable, and the perpetual subject and object of negotiation within each context (Jenkins, 2004), the notion of identity requires an incessant comparison between the individual, the context in which they are interacting, their intentionality in the context of that interaction, and their 'true' (nominal) identity. The irregular nature in which individuals present arbitrary identities in various contexts, with multiple intentions, and within different social groups, results in a novel dynamic to human community formation and evolution.

In this chapter, we consider the psychological challenges unique to understanding the dynamics of social identity formation and strategic interaction in online social networks. We start with a brief overview of aspects within social psychology that are pertinent to a discussion on social identity formation in online social networks. Specifically, we introduce Social Identity Theory as a perspective in which to frame our current understanding of online social network formation. Next, the psychological development of *social (virtual) identities* (Jenkins, 2004) are explored in online social networks using the conceptualization of *self-presentation* (Goffman, 1959/1997). A discussion of collective identity and self-categorization follows and relates how social identity contributes to online group formation and evolution. Further, to illustrate how to evaluate the effectiveness of online social networks, we review several studies on online social networks using ethnographic methodologies, visualization techniques, and social network analysis (SNA). Finally, we present practical teaching and learning strategies educators can use to facilitate the use of social software for online social network formation within educational environments. The overall aim of this chapter is to explore how social identity affects the formation and development of online communities, to present some methodologies for evaluating the effectiveness of group formation, and to explore the implications of online social networks within education.

SOCIAL IDENTITY AND THE INTERNET

All human identities are social identities (Jenkins, 2004). Social identity concerns how we identify our similarities and differences to other known groups of individuals. Social identify is an ongoing interplay between how we identify ourselves and how others identify us. To identify with any given group of people, whether it is an ethnic group or an online organization, we look for similarities between the group members and ourselves. While similarities initially attract an individual to a group, this initial attraction enables an individual to recognize their individual differences. This comparative process is identified in Social Identity Theory as "*internal* and *external moments of dialectic identification*" (emphasis in original; Jenkins, 2000, p. 7). These internal comparisons are how individuals distinguish themselves from others in both the similarities they share and the differences they recognize. Alternatively, external comparisons involve how others identify individuals, in the similarities and differences they see between that individual, themselves, and a particular group. As internal and external comparisons determine the *active* and *socialized* aspects of a person, they enable the differentiation of the *I* and *me* which make up an integrated *Self* (James, 1891/1950). Given that social identification involves the interplay of internal and external dialectic processes, the Internet further enables individuals to develop and express multiple social identities and experiment with new virtual identities. As individuals' social identities evolve from within social groups, they also facilitate the alignment or differentiation of an individual from the group. This alignment or differentiation reaffirms an individuals' social identity.

Social identity is a central construct in understanding intergroup relations and is a key element in linking an individual to his or her social group (Tajfel, 1974, 1981). According to Tajfel (Tajfel, 1974, 1981), the foundation of the Social Identity Theory of group membership and behavior recognizes that grouping (social categorization) influences people's perception of others and one's Self. Social identity is "that part of the individual's self-concept [or self-identity] which derives from his or her knowledge of membership to a social group (or groups) together with the value and emotional significance attached to it" (Tajfel, 1981, p. 255). As individuals belong to a variety of social groups, their overall self-concept is composed of multiple social identities (Ashforth & Mael, 1989; Hogg, Terry, & White, 1995; James, 1891/1950; Jenkins, 2004). These multiple social identities enable an individual to adopt various roles and adapt to a variety of social contexts. The contexts in which a social identity exists, supports the pluralistic nature of the Self. As social groups exist at multiple levels, i.e. societal, cultural, industrial, organizational, functional, and professional (Korte, 2007), individual's social identities are facilitated through communication *within* and *amongst* these levels. For example, a professor can identify him or herself as teacher, parent, friend, advocate, and administrator based on social context. The use of Internet-based communication technologies, such as Internet messaging (IM), chat, and social networks, provide an extension of social contexts in which individuals can interact. The various social context and relationships developed using such social technologies, facilitates the development and recognition of an individual's social identification.

Social Identification

Social identification is an emergent product of internal-external dialectic processes (Jenkins, 2004). Emphasizing a distinction between internal and external dialectical processes (Barth, 1969) allows a "wider distinction to be drawn between *nominal identity* and the *virtual identity*: between the *name* and the *experience* of an identity" (emphasis added; Jenkins, 2004, p. 22). A nominal identity is the label an individual identifies his or her Self with, and a virtual identity is the *experience* of that nominal identity. In other words, your nominal identity is who you believe you are (internal dialectic), and your virtual identity is the experience of being that person (external dialectic). In addition, nominal identification varies from context to context and can be associated with numerous virtual identities (Jenkins, 2004). For example, one may identify him or herself as a student (internal identification, nominal identity), but his or her identity and experience as a student is quite different from high school to university (external identification, virtual identity). Similarly, the same student may consider him or herself a quiet, shy person in face-to-face meetings (nominal identity), however, when online they present themself as having an outgoing, animated personality (virtual identity). The experience of an individual's identity, as perceived through thought and action, is influenced through the interplay of the individual and social others. The evolution and development of internal and external dialectic processes occurs through social identity experimentation.

Social Identity Experimentation

Experimenting with social identities is an important part of lifespan development (Wallace, 1999). As individuals develop, particularly through adolescence, they begin to question their place in society; leading them to question their identity and personal values (Erikson, 1963, 1980). Within today's fast paced environment, where lifestyle and career options are abundant and change quickly, many individuals return repeatedly to question their values, beliefs and life goals (Archer, 1989; Wallace, 1999). In particular, the Internet plays an important role in social identity formation and development as it allows individuals to explore their values and beliefs within environments that they perceive to be safe. The anonymity of online interactions facilitates the perception of safety of an individual's nominal identity, allowing users to experiment with multiple virtual identities. As the Internet expands opportunities for social identity experimentation, through online chat, massively multiplayer online games (MMOG), 3D online virtual worlds, and social networks, individuals readily test and experiment with multiple identities. The ambiguity of the Internet in one's life course, is an enabling factor for individuals to explore identities that they could not explore in their 'regular' everyday lives or in their youth (Archer, 1989).

Through adolescence, the uncertainty of identity dominates an individual's development and definition of who they feel they are. As identity is a process of 'becoming', identity experimentation becomes a means of self-exploration. A recent study by Valkenburg, Schouten, & Peter (2005) investigated identity experiments by adolescents and whether pre- and early adolescents engage more often in Internet-based identity experimentation and self-presentational strategies than middle and late adolescents. Of the 600 adolescents surveyed (ages 9-18, M = 13.37, SD = 1.98), 82% indicated that they used chat or Internet Messaging (IM) on a regular basis. Of those who used these technologies, 50% of them reported that they willingly experimented with their identity. Using such self-presentation strategies as presenting his or herself as older, more 'macho', more 'beautiful', more 'flirtatious', as the opposite gender, as a real-life acquaintance, or as a 'fantasy' person, these adolescents were actively engaged in conscious identity experimentation. The majority of the adolescents surveyed in the study (49.8%) presented themselves as older. Further findings reveal that relative to age differences in the group surveyed, there was a strong influence of age on Internet-based identity experimentation ($b = -.50$, $p < .001$). Meaning, that younger adolescences are significantly more likely than older adolescences to experiment with their social identities, and more frequently use their social identities to facilitate social interaction. Valkenburg et al. also report that introverts engage in identity experiments as social compensation more often than extraverts do. The results indicate that introverts were more likely to experiment with their social identity as a means to explore social communication they lack in the face-to-face world. The study concludes that older teenagers used the Internet most often to communicate with their existing personal network, whereas younger adolescents are more likely to use the Internet more frequently to communicate with strangers. The results of the Valkenburg et al. study validate some existing assumptions about why adolescents use the Internet as a predominate medium of communication, and provides additional evidence of Internet identity experimentation as a means for uninhibited self-exploration

Motives for identity experimentation are varied and diverse. Self-exploration (i.e. to explore how others react), social compensation (i.e. to overcome shyness), and social facilitation (i.e. to facilitate relationship-formation) are a few motives for identity experimentation. Identity experiments such as the one explored in the Valkenburg et al. study, demonstrate the reciprocal nature of Self and social group interaction in the formation of identity. For an individual to develop a social identity, what that individual thinks of him or herself is significant, but no less significant than what others think about him or her. To return to the internal-external dialectic discussed previously, what the Valkenburg study demonstrates is that it is not enough to assert a social identity; others must also validate that social identity through its reception and recognition. Self-presentation then, is an assertion of a social identity.

Self-Presentation

Self-presentation is an individual's projection of Self and identity in the social world (Valkenburg et al., 2005). In a traditional face-to-face setting, the reality that the individual is concerned with is generally unperceivable. The individual observes the situation and acts according to their perceptions; even if their perceptions are inaccurate. "Paradoxically, the more the individual is concerned with the reality that is not available to perception, the more must he concentrate his attention on appearances" (Goffman, 1959/1997, p. 21). People can change their persona to reflect the social audience and can have as many social 'selves' as there are situations (William James as cited in Abrams & Hogg, 2001). According to Goffman (1959), individuals present an impression by *performing* and observers are the *audience* that judges the effectiveness or the believability of the performance. Goffman describes the performer-audience dialectic as one concerning the maintenance of the impression that the performer is 'living up' to the standards by which their actions are judged. Whether or not these actions are true of the individual's identity, remain the subject of the audience's judgment. Studies reveal that in virtual settings, such as online social networks, inaccuracy of interpretation resulting from individual presentation is a major challenge with Internet communication (Donath, 1999; Lynch, 2005; Valkenburg et al., 2005; Walther, 2007). As previously discussed in the study by Valkenburg et al. (2005) and in the literature on identity experimentation (e.g. Wallace, 1999), the Internet presents many opportunities and motives for identity experimentation. As most participants in online social networks are likely to be actively experimenting with different social identities, 'audience' members need to be aware that people may be presenting an identity that may only be a small part of the 'performers' nominal identity (e.g. Walther, 2007). This awareness brings literal meaning to Shakespeare's assertion that "All the world's a stage, and all men and women players" (As You Like It cited in Haney, Banks, & Zimbardo, 1973).

GROUP FORMATION

Group membership is crucial to the internal-external dialectic negotiation that is identity (Amiot, de la Sablionniere, Terry, & Smith, 2007). Self-categorization theory (Turner, 1985, 1987) suggests that identification with any group is based on the extent to which individuals can enhance their social identity through categorizing themselves as group members (Chattopadhyay, George, & Lawrence, 2004). This theory suggests that individuals must associate themselves and others with particular social categories to derive social identities (Turner, 1985).

Self-Categorization

Social identity involves a process of self-categorization. Categorization as a cognitive function enables individuals to perceive the world as structured and predictable. Categorization is one of the most basic and essential of all cognitive processes that helps one focus on contextually relevant and meaningful aspects of the world; highlighting important distinctions and de-emphasizing unimportant ones (Hogg, 2001). For example, a student may categorize himself or herself as a football player, or other students may categorize that student as a football player. Given this 'football player' categorization, students (and even teachers) make certain assumptions about how that student is likely to behave, with whom he or she associates, and even his or her ability for academic achievement. Categorization of Self, relative to group membership, emphasizes perceived similarities among group members and the characteristics that best define the group in that particular context (Hogg, Cooper-Shaw, & Holzworth, 1993). Self-categorization accentuates attitudinal, emotional, and behavioral similarity to a group *prototype* (Hogg & Hains, 1996). A group prototype involves the salient characteristics that define a typical member of that group. As a prototype is shared amongst group members, it also identifies group norms and stereotypes (Hogg et al., 1993). For example, the *prototypical* football player is an individual who has superior physical abilities, is disruptive in class, and does not obtain high grades in academic subjects. Further to our prototypical football player, if this student deviates from what is stereotypical or 'normal' for this group, such as achieving high grades in their academic subjects, they may be subjected to ridicule from their peers. A group may ostracize a fringe member based on what the group deems as deviant behavior or for ideas that are contradictory to the norms of the group (Marques, Abrams, Paez, & Hogg, 2001). Ultimately, self-categorization depersonalizes perception and conduct such that individual members are not 'processed' as complex multidimensional whole persons, but rather as embodiments of the group prototype (Birchmeier, Joinson, & Dietz-Uhler, 2005; Chattopadhyay et al., 2004; Haney et al., 1973). Research has found that social and group identities are generally more powerful than individual identities, and there is a tendency for individuals to go along with the group in which they identify (Hogg & McGarty, 1990; Korte, 2007; Tyler, 2002). The sense of group identity and the degree of personal identifiability to other group members are conditions known to influence this power relationship (Taylor & MacDonald, 2002). There is also a tendency of the individual to downplay personal attributes in favor of the group prototype or collective identity.

Collective Identification

Collective identification is a representation of how people are similar to each other based on the psychological connection between Self and social group (Abrams & Hogg, 2001; Jenkins, 2004). As discussed previously, social identity is a part of the Self that one identifies with a particular category or group. Put another way, social identity is "the *perception* of self in terms of stereotypical ingroup (*sic)* attributes" (emphasis added; Abrams & Hogg, 2001, p. 433). The in-group is simply the group in which one identifies, conversely, the out-group are those individuals who are not exclusive members. Collective identification, thus, results in a strong association between an individual and the group in which they are member. The individual then assumes the collective identity. Barnum and Markovsky (2007) hypothesized that in-group members would be more influential than out-group members on the collective. For example, using two theoretical approaches based on disagreements with in-group members (self-categorization theory) and the performance expectations (status characteristics theory) of the in-group members, Barnum and Markovsky (2005) observed that group membership affected social influence and that in-group members influenced their subjects more than out-group members. The results of this study support the argument that in the development of a social identity, the new group or collective identity tends to depersonalize the individual in favor of becoming a group member.

Depersonalization

Depersonalization causes people to conform to group prototypes and behave according to group norms. Similar to deindividuation of identity (Festinger, Pepitone, & Newcomb, 1952; Zimbardo, 1969), depersonalization gives an individual a sense of anonymity, in which he or she submits themself to the collective identity. Postmes, Spears and Lea (2002) hypothesized that depersonalization would increase the tendency for intergroup differentiation in attitudes and stereotypes specifically with computer mediated communications (CMC). Based upon previous research (Postmes, Spears, & Lea, 1998), Postmes et al. state that communication via CMC would potentially increase differentiation between groups on dimensions of bias, stereotyping, and attitude divergence. In addition, they postulate that CMC shifts intergroup interactions from interpersonal ("me" and "you") to intergroup ("us" vs. "them") ultimately depersonalizing interactions and stimulating a tendency for differentiation between social categories (Postmes et al., 2002). Postmes et al. (2002) could not attribute differences in their findings between the groups studied, rather, that CMC likely accentuated differences that already existed. Postmes et al. claim that the results of their study were heightened because of the online context despite the group differences that already existed. The transition from the personal (nominal) to the social (virtual) identity (as originally postulated by Turner, 1987) in which group membership (collective identification) is facilitated, is important for understanding the dynamics of individuals acting as a collective unit or group. The mixed results of the Postmes et al. study reveal that both individuals and groups are in a constant state of social flux. The dynamic nature and negotiation of these groups online makes their structure and evolution fluid and uncertain. Tools, techniques, and technologies for analyzing social networks, will enable further our understanding in social identity development and group formation, and aid in determining the measurable impact of social network tools in education.

ANALYSING ONLINE SOCIAL NETWORKS

Social network formation is a complex process in which individuals simultaneously attempt to satisfy goals under multiple, often conflicting, constraints (Kossinets & Watts, 2006). Social network analysis (SNA) involves theorizing, model building and empirical research focused on uncovering the patterns of links among network members (Freeman, 2000). Social network analysis conceives social structure as a social network. A set of social actors and a set of relational ties connecting pairs of these actors (Wellman, 2000) forms the social network. Social network structures are analyzed using measures such as density, centrality, prestige, mutuality, and role. Demographic data, such as age, gender, and ethnicity, and information about 'user' attitudes and beliefs are collected to gain an understanding of the ethnographic characteristics of group members. Methods used in SNA include graph theoretic, algebraic, and statistical models (Wellman, 2000). Due to the focus and length constraints of this chapter, the specifics of SNA methodologies and analysis are not explored in-depth. Instead, we focus on the analysis of online social networks using examples from the literature that consider linking individuals with community growth, ethnography, social discourse, and data visualization.

Examining Links

Examining links between group members enables researchers to understand how individuals influence, relate, and interact in social networks. Kossinets & Watts (2006), in an analysis of a dynamic social network of more than 45,000 students, faculty, and staff at a large university, found that networks evolve as a result of effects arising between the network topology and the organizational structure the network embodies. Of particular interest is that network characteristics (measures) appear to approach an equilibrium state, whereas individual properties such as linking and bridging are considerably more complex and are more appropriately analyzed using ethnographic techniques (as discussed in a later section). Linking and bridging of individuals-to-individuals and groups-to-groups facilitate connections outside of an individual's circle of acquaintances and promotes a diffusion of information and growth of existing and new communities (Kossinets & Watts, 2006). The rapid and dynamic nature of linking and bridging in the growth and development of social networks within a relatively stable infrastructure is recognized in the rapid growth of websites such as Facebook (2008), MySpace (2008), Second Life (Linden Research Inc., 2008), and Bebo (2008). Within these web communities, social network connections are far more complex than the technological infrastructure in which they are situated. Understanding how and why bridges occur is central in understanding the circumstances surrounding the formation and growth of online communities.

Research on Community Growth in Online Social Networks

Community growth in online social networks is of great importance to both commercial and social enterprises. As online social networks offer commercial advertising space to a captive audience and is a rapidly evolving environment for social research, understanding how, why, and under what conditions these groups thrive is of paramount importance. For example, a recent study by Backstrom, Huttenlocher, Kleinberg, & Lan (2006) explored three questions in regards to online social network growth and evolution. First, they considered membership and the structural features that influence whether a given individual will join a particular group. Second, they examined how structural features that influence a given group and whether that group will grow significantly over time. Finally, Backstrom et al. explored aspects of group change and how group foci or topics change over time and whether this dynamic affects underlying group membership. Backstrom et al. found that the formation of groups and the determining factors of membership significantly relate to the internal connectedness of an individual's friends. Meaning, individuals whose friends are in a community are significantly more likely to join that community. In a similar way to bridging, as discussed in the last section, information diffusion is similar to membership diffusion in that the more links or bridges one obtains affects the development of the social network and expedites its growth. Backstrom et al. also examined the flow of information within groups; specifically they questioned that "given a set of overlapping communities, do topics tend to follow people, or do people tend to follow topics?" (Backstrom et al., 2006, p. 8). The results to this final query were inconclusive indicating that less technical approaches to understanding community formation and growth, such as the methods used in ethnographic research, would likely provide clearer answers as to the complex dynamics that take place in online social networks.

Ethnography and Social Discourse

Ethnography is a method of research primarily concerned with the description of natural human communities (Munroe, 2000). Ethnography enables the interpretation of the flow of social discourse (Gertz, 1973/2000). In the study of online social networks, ethnography is particularly useful in studying online groups as unique cultural communities. The methodologies and perspectives of ethnography, aids in establishing new questions for research in social networks and complements existing quantitative methodologies. A recent study by boyd & Heer (2006) used ethnographic techniques to study the dynamics of the popular international social networking site Friendster (2008). The ethnographic components consisted of a 9-month participant observation, including interviews, qualitative surveys, and focus groups. Boyd and Heer's particular research questions involved examining how context is created and interpreted in digital environments, how conversations are initiated online, what are the goals of digital conversations, and how are they maintained. Exploring the possibilities and consequences of replicabilitiy, searchability, and persistence, boyd and Heer's ethnographic study revealed several interesting findings. First, in order to derive contextual cues in lieu of the physical cues present during face-to-face interactions, members of the social network interpreted what boyd and Heer describe as "artifacts of digital performance." The 'artifacts' they describe are traces of interaction history (Wexelblat & Maes, 1999), such as previous discussion postings and images. These artifacts served existing and new network members who use these virtual cues to interpret and build a social profile of the individual who left them. Second, as individuals invited existing friends to their social network, the groups grew and quickly became homogenous. Although boyd and Heer infer that homogeneity is due to the limiting nature of the website itself, the emergence of a homogenous social group exemplifies the homophily principle that similarity breeds connections to "people like us" (McPherson, Smith-Lovin, & Cook, 2001). Homophily, as demonstrated by the boyd and Heer study, serves as a limiter in individuals' social world. As social networks consist of people who know each other offline and who are similar in sociodemographic, behavioral, and intrapersonal characteristics, these networks are less dynamic and are more often a digital representation of most face-to-face social groups. As individuals interact with others similar to themselves (Baym & Zhang, 2004; Jones & Madden, 2002) and attempt to avoid conflicting relationships (Bargh & McKenna, 2004; Gross, 2004), homophily is limiting because it proliferates the divides in our personal environments and limits exposure to people and networks different from our own. Finally, boyd and Heer describe a phenomenon they call "negotiating unknown audiences" (boyd & Heer, 2006, p. 4); meaning as users generate online contexts to serve the needs of a particular group, the individuals in those groups come together already associated the group. Informed by their ethnographic investigation, boyd and Heer used data visualization to provide a macroscopic view of many of the most common behaviors they observed, such as browsing photos, exploring profiles, and searching for common interests. As qualitative and quantitative analysis of social networks provides insight into the interactions of individuals within the group, data visualization enables a macroscopic view of the social networks in question.

Data Visualization

Visualization aids in the presentation of abstract data. Data visualization enables a visual means to confirm observations made at a local (in this case individual) level, as in the boyd and Heer study (2006), but also provides an alternative perspective on the patterns the data presents, as in a recent study by Golbeck (2007). In the boyd and Heer (2006) study, the visualization served particularly useful in confirming the ethnographic observations concerning the presence and composition of network clusters which allowed the researchers to develop additional narratives. An example of the visualization presented in the boyd and Heer (2006) and Heer and boyd (2008) and represents a single user profile, and demonstrates the interconnectedness between his or her example profile and their 'friends.'

A recent study by Golbeck (2007) used visualization techniques to analyze social network membership and relationship dynamics. The visualization Golbeck uses in the study of social network growth of a sample of social networks show a steady linear growth rate. As awareness of the networks existence grew, mostly through advertising, the membership among the selected networks grew rapidly from 1000 members to more than 10 million. In analyzing the rate of relationship growth relative to membership growth, the 'spacing' of relationships increased significantly over time. 'Spacing' suggests that social networks become more densely connected as they grow larger, which was also observed in the Backstrom et al. (2006) study discussed earlier. Golbeck used visualization to illustrate this spacing effect.

The analysis of online social networks from the macro level provides specific information on community growth, social discourse, and general group dynamics. The addition of this macro-level information to the research on social identity provides further information on the ongoing interplay between the groups in which we identify ourselves and how others respond to this dynamic. The relative strength of collective associations within the group, as evidenced through density, linking, and bridging, associates individual activity with collective (group) level properties. Through this process, further detail of group prototypes and the salient characteristics that define a typical member of that group can be identified, and additional 'narratives' can be developed that further understanding of social identity and group dynamics at the micro (i.e. individual) and macro (i.e. community) levels.

STRATEGIES FOR USING SOCIAL SOFTWARE IN EDUCATION

Social networks already exist in education. Sports teams, social clubs, cheer squads, and social cliques are a few examples that are recognizable in any educational institution. As the context in which social identity supports the pluralistic nature of the Self, the learning environment is a particularly appropriate place for students to explore their nominal identities and experiment with new social (virtual) identities. For educators to capitalize and facilitate identity experimentation within online social networks, such as Facebook, MySpace, Second Life, and Bebo, they need to facilitate social interaction in all learning contexts. We have identified four important areas of research that support identity experimentation and promote the use of online social networks in education. Research important in the use of online social networks in education involves investigating ways in which educators can preserve relative anonymity, enable identity experimentation, manipulate self-categorization, and measuring the effectiveness of online social networks in education.

Preserve Relative Anonymity

To establish an equality of participation, relative anonymity should be preserved (Taylor & MacDonald, 2002). In order for online social networks to be successful in an educational context, anonymity needs to be maintained until social links are established. If anonymity is not maintained, then the social network is likely to fail given that relatively few will participate, and if they do participate, they will 'self-present' in such a way as to make the environment seem false. For example, in traditional or formal learning settings, a student will often demonstrate behaviours expected by the teacher as opposed to behaving as they actually feel. In an online environment, students should feel that they have the freedom to express and interact in ways that are not reflective of outside social influence. The use of anonymity has implications within formal learning structures where anonymity is not often preserved. Further research in this area is necessary to delineate teaching and learning strategies for use within formal learning contexts.

Enable Identity Experimentation

Encouraging identity experimentation facilitates the development of social networks that continually evolve and change with each different educational context. Identity experimentation, keeping a modicum of anonymity, enables a student to present various social identities to his or her peers and the instructor. In other words, identity experimentation through various modes of self-presentation encourages expressions of self that are accepted or rejected by members of the in-group. Identity experimentation is important to education, as it is something that all individuals 'do' and is uniquely possible within online social networking. Incorporating strategies within the educational context that encourage such experimentation in a safe and equitable way will foster tolerance and understanding of other differing points of view. Identity experimentation promotes social interaction as the individual's identity is in constant negotiation between the individual and social group.

Manipulate Self-Categorization

Building on the first two factors results in a manipulation of self-categorization. Manipulating self-categorization raises individual and collective awareness of the various effects of collective identification. In other words, teaching and learning strategies that enable self-experimentation will also influence how a student develops awareness of their impact on others in their peer group and illustrates how they are accountable for their actions. Through the manipulation of self-categorization, students are able to recognize how their participation within a social group affects the social network and remain accountable for their actions. The use of roles within group interactions enables individuals to understand the difference of their nominal identity and virtual identity in social contexts. This realization can only help students become more cognizant of the influence of social roles in identity formation.

Measuring Social Network Effectiveness

A measurable means for observing changes in the various properties of a social network, such as bridging, linking, and spacing within the network, is important in helping educators determine the level of interactivity in the network overall. For example, a network with low interactivity would have few bridges, few links, and very large spaces between individuals in the network. Alternatively, an active network is one with high interactivity, has bridges, several links, and has less space between individuals in the network. From an educational perspective, an active classroom network, whether face-to-face or online, that has many bridges and many links is a more productive learning environment. It is the ability of the instructor to facilitate these links that will provide an effective social learning environment.

CONCLUSION

Experimenting with social identities is an important part of lifespan development (Wallace, 1999). As individuals develop and change, they question their place in society leading them to question their identity and personal values (Erikson, 1963, 1980). People often change their persona (James, 1891/1950) and have as many social 'selves' as situations (Abrams & Hogg, 2001) and social groups. Categorization of the Self relative to a group accentuates the perceived similarity between individual group members and one's representation of the features that best define the group in a particular context (Hogg et al., 1993). A representation of how people are similar to each other, is based on the psychological connection between the self and social group (Abrams & Hogg, 2001; Jenkins, 2004). Collective identity aids in the development of social identity, but tends to depersonalize the individual in favor of becoming a group member. Although depersonalization facilitates a transition from a personal (nominal) to social (virtual) identity, where group membership (collective identification) becomes increasingly important, social network formation is a complex process in which many individuals simultaneously attempt to satisfy their goals under multiple, conflicting constraints (Kossinets & Watts, 2006).

The use of Internet-based communication technologies facilitates the development of social groups and social identification. Social identity is central in understanding intergroup relations and is a key element linking individuals to their social group (Tajfel, 1974, 1981). As social groups exist at multiple levels, social identity development is facilitated through communication within and amongst these levels. Social identification, as an emergent product of internal-external dialectic processes (Jenkins, 2004), enables an individual to experiment with different virtual identities and explore what it is like to experience those identities in the social world.

Motives for identity experimentation, such as self-exploration (i.e. to explore how others react), social compensation (i.e. to overcome shyness), and social facilitation (i.e. to facilitate relationship-formation) are all important factors in social development. As schools are inherently social institutions, the factors that contribute to healthy social development are of paramount importance for educators to consider for students growth. The strategies for social identity experimentation in classrooms, allows students to become active interpreters of social interaction. Educators that facilitate participation, experimentation, and research of social identity, will ultimately contribute to student's insight into the dynamics of learning and development as a social process.

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KEY TERMS AND DEFINITIONS

Artifacts of Digital Performance: Artifacts of digital performance refer to traces of interaction history (Wexelblat & Maes, 1999), such as previous discussion postings and posted images, that new network members use as virtual cues to interpret and build social context.

Collective Identity: Collective identification is a representation of how people are similar to each other based on the psychological connection between the self and social group (Abrams & Hogg, 2001; Jenkins, 2004).

Depersonalization: Depersonalization causes people to conform to the group prototype and behave according to group norms.

Ethnography: Ethnography is a method of research primarily concerned with the description of natural human communities (Munroe, 2000) and enables the interpretation of the flow of social discourse (Gertz, 1973/2000).

Nominal and Virtual Identity: A nominal identity is the label with which an individual is identified and a virtual identity is an individual's *experience* of the nominal identity. In other words, your nominal identity is what you believe you *are* (internal dialectic), and your virtual identity is the experience of being (external dialectic).

Self-Categorization: Self-categorization theory (Turner, 1985, 1987) suggests that identification with any group is based on the extent to which individuals can enhance their social identity through categorizing themselves as group members (Chattopadhyay et al., 2004).

Social Identity: Social identity is central in understanding intergroup relations and is the key element linking an individual to his or her social group (Tajfel, 1974, 1981).

Social Network Analysis: Social network analysis involves the theorizing, model building and empirical research focused on uncovering the patterning of links among network members (Freeman, 2000). Social network analysis conceives of social structure as a social network: a set of social actors and a set of relations ties connecting pairs of these actors (Wellman, 2000).

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 86-101, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.5
Enhanced Interaction in Mixed Social Environments

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ABSTRACT

We introduce the term 'mixed social environments' as a strategic learning construct to augment student interaction when utilizing virtual world environments such as Second Life in the classroom. While an increasing number of institutions are investigating the use of virtual world environments for enhanced learning, at present there are at least three major areas that are underdeveloped: interdisciplinary research, documentation of best practices, and exploration of the use of mixed social environments. In the spring of 2007, a new interdisciplinary research seminar addressing these aspects was offered at a large American university. We present an overview of the resultant learning artifacts, outcomes, and research questions in hopes of helping to inform best practices, expand interdisciplinary research, and assist in the design of future mixed social environments for enhanced learning.

DOI: 10.4018/978-1-59904-808-6.ch009

INTRODUCTION AND CONTEXT

For the purposes of this chapter, games and other interactive graphical scenarios that consist of multiple environments (compared with a single-focus virtual reality simulation such as flight training in a virtual cockpit or emergency room training inside a simulated hospital) are referred to as virtual world environments (VWEs) due to the large "world-like" scale of the virtual reality they create. Games are broadly defined in the literature and may cover a wide range of educational purposes. User-driven VWEs (pronounced "vyoo-eez") can often be considered games and have great potential for teaching and learning (Foreman, 2003). As a VWE, Second Life (SL) affords a sense of social interaction, visual indication of level of participation, and 3D models for instruction or simulation—all factors that can be utilized for enhanced learning environments. This potential flows across various academic disciplines. In spring 2007, a new course utilizing SL entitled Interdisciplinary Research Seminar was offered as a collaborative effort between a professor of biomedical engineering and a professor of digital media at the University of Florida's Digital Worlds Institute.

This chapter frames a context for the course from the gaming, virtual reality, and simulation literature; provides an overview of the learning artifacts produced and research developed in the course; and suggests potential future directions for researchers and practitioners who are interested in exploring mixed social environments (MSEs) as a means of merging traditional and virtual classroom spaces. We define a MSE (pronounced "mis-ee") as a physical space wherein multiple scales of screen display and simultaneous points of view of a shared VWE can be seen, heard, experienced, and collaborated upon by persons physically present in the space, in addition to remote participants. Both personal and group displays are integrated into the space in such a way as to allow simultaneous social interaction among those in the physical space of the room and multi-perspective displays of the participants' virtual interaction in the VWE.

GAMES IN EDUCATION

A succession of theorists and philosophers have found 'games' and 'play' difficult concepts to define (Huizinga, 1980; Salen & Zimmerman, 2004; Wittgenstein, 1972). Equally challenging is the understanding of the processes that assist game-play. Games in general can be defined in surprisingly numerous ways, often changing the way games are used and perceived (Wittgenstein, 1958). Some popular definitions define games as a series of choices or as rule-based play.

To refer to different types of games, current terminology utilizes terms such as: computer games, video games, serious games, game-based learning, massively multiplayer online role-play games (MMORPGs), massively multiplayer online games (MMOGs), persistent games, massively multiplayer online first-person shooter (MMOFPS), educational games, game-based learning, instructional games, sim games, gamesims, electronic simulations, virtual reality systems, training simulations, or simulators. Gaming environments now utilize diverse resources, including streaming video and audio, multiple-user interactivity, simulations of real-world circumstances, and immersive non-linear exploratory environments (Aldrich, 2004, 2006).

Since we are primarily interested in the uses of electronic games in education, we will use a definition that focuses on learning: "applications that can use the characteristics of video and computer games to create engaging and immersive learning experiences for delivering specified learning goals, outcomes and experiences" (de Freitas, 2006, p. 15). These uses tend to cluster around the activities highlighted in Table 1.

Table 1. Uses of games for learning (de Freitas, 2006)

Selected Uses of Games	References
To motivate and engage learners, e.g., underserved learner groups (e.g., with low literacy/language levels)	Amory et al., 1999; de Freitas et al., 2006; Garris et al., 2002; Gee, 2003; Mitchell & Savill-Smith, 2005
For skill or part-task rehearsal and practice, e.g., literacy and numeracy skills	de Freitas et al., 2006; Delanghe, 2001
To provide therapy for pain relief and cognitive difficulties	Pelletier, 2005c
To role-play particular jobs and professions in advance of real-life practice	Aldrich, 2004, 2006; Maharg, 2006
To empower learners as authors and producers of multimedia, mixed media, and game-based content	Pelletier, 2005b; Druin, 2002; Dickey, 2005

There are many aspects of gaming that can be educationally sound. Games are supportive and safe, a quality that supports higher-level learning (Diamantes & Williams, 1999). They also include a strong aspect of play, which is important in the development of "flow," which is "the mental state of operation in which the person is fully immersed in what he or she is doing" (Csikszentmihalyi, 1990, p. 21). Promotion of flow and play in childhood is important because their absence can have a negative impact upon social development and socialization (de Freitas et al., 2006). Games also encourage multiple opportunities for practice, which is important because the reinforcement of practiced tasks and activities has been found to accelerate learning (Delanghe, 2001). They can also be highly motivational, which is a key aspect of effective learning (Garris et al., 2002). Multiplayer games enhance computer literacy (Benedict, 1990), visual attention (Bavelier & Green, 1993), and reaction time (Orosy-Fildes & Allan, 1989), and give multiple opportunities for making mistakes, which is an important aspect of learning (Jones, 1997). They also teach players to become problem solvers through role-playing (Gee, 2003; Johnson, 2005). Games based on historical events or stories that explore real-world social issues allow learners to step out of the immediacy of the present and imagine what it might be like to be someone else who may have lived at a different time, place, or under different social or historical circumstances (Francis, 2006).

VIRTUAL WORLD ENVIRONMENTS AND GAME-LIKE CHARACTERISTICS

Under the definition and scope defined above, VWEs can often be considered games. Such games are deeply immersive and highly scalable three-dimensional systems. In the VWE called Second Life, people enter the virtual world through the use of an avatar, a character that embodies their presence and intent. Many popular VWEs allow for multiple users to be in the same virtual space and interrelate with each other at the same time (New Media Consortium, 2007a). Even in their nascent state, virtual worlds allow for the development of real-life cultures through the use of individuated dialects, political configurations, multifaceted social customs, social networks, social capital, and common history (Steinkuehler, 2004; Jakobsson & Taylor, 2003). VWEs combine social networking, seamless sharing of rich media, and a feeling of presence in a generalized, persistent non-contextual environment that is applicable to almost all disciplines (Castronova, 2001).

Virtual worlds also offer an opportunity for people to interact in a way that conveys a sense of presence lacking in other media (Castronova, 2001; New Media Consortium, 2007a). This aspect lends itself to role-playing and situation construction, freeing up learners to assume the responsibilities of a physicist, artist, physician, or architect without the real-world training (or the real-world consequences). The effect is two-fold, providing an environment free of the limiting "thought boxes" that often accompany deep single-disciplinary training, while allowing for risk-free experimentation (Delwiche, 2006) and thinking outside the proverbial "box." This can lead to expanded understanding of cultural and societal experiences, as well as broad experimentation with new forms of human expression and endeavor.

VWEs have significant and largely untapped educational potential. Foreman (2003) predicts that shared graphical worlds are "the learning environments of the future" (p. 14). Steinkuehler (2004, 2006) and Gee (2003) argue that the educational promise of VWEs can only be fulfilled through a social constructivist approach to learning. VWEs hold considerable potential for the development of complex social practices such as leadership, collaboration, and relationships. These worlds are complex rational groups distinguished by their social practices (Steinkuehler, 2004). When novices enter a virtual world, they can be progressively initiated into intricate social scaffolding by means of the support of other group members. Virtual worlds are compelling because social relations, collaboration, and information sharing are essential ingredients, and they encourage collaboration both within and beyond game parameters (Delwiche, 2006). According to Yee, Bailenson, Urbanek, Chang, and Merget (2003), more than half of those involved in virtual worlds have gained proficiency in mediation and leadership, such as solving conflict in groups.

Although also present in many types of electronic games, the concept of flow can positively enhance the educational experience in virtual worlds. Hoffman and Novak (1996) and Csikszentmihalyi (1990) explain that the flow state is characterized by factors including user confidence, exploratory behaviors, enjoyment, distorted time perception, and greater learning. Peng (2004) notes that people learn in a flow condition when they are not passive receivers of information, but are actively participating in and owning the learning activity and reaching a personally derived goal. In a recent study of 30,000 VWE users, Yee et al. (2006) found that 70% had spent at least 10 continuous hours in a virtual world at one sitting. If the amount of continuous time spent is any indication of interest and immersion in the activity, this is evidence of a compelling and flow-oriented environment that can enhance learning.

Virtual environments can also facilitate enhanced exploration of and experimentation with various social roles. Although many electronic games provide such role exploration and experimentation, student use of VWEs provides a period during which the emerging adult is free to delay taking on adult commitments. The student can explore new social roles in an authentic situation while interacting with other individuals, a situation that has been shown to have significant psychological and learning advantages (Turkle, 1995). Virtual worlds have been shown to promote role-playing behaviors (Delwiche, 2006), which have been shown to help students escape the grip of contemporary norms and beliefs (Luff, 2000), affect attitudes and behavior (Bell, 2001), and can have significant therapeutic benefits (Douse & McManus, 1993; Hughes, 1998). Yellowlees (2006) documents the use of Second Life to help students experience the role of the patient. Students learn about the subjective experience of psychosis as they navigate through a virtual psychiatric ward. "In this environment, users can literally see and hear hallucinations as a patient might, as they walk through the halls of the virtual hospital" (Yellowlees, 2006, p. 441). This application of SL enables students to explore and experiment with the role of the patient, thus gaining important insights into particular psychoses and developing a deeper empathy than through more traditional means.

SECOND LIFE AS A VIRTUAL WORLD ENVIRONMENT

As a well-known and widely distributed VWE, Second Life possesses significant potential for innovations in learning. For example, Dave Taylor, knowledge transfer leader at the National Physical Laboratory, says that the use of SL opens up "new opportunities for collaboration across disciplines and geographies that would not otherwise occur" (Edwards, 2006, p. 32). The development of complex social practices such as collaboration is enhanced by two major benefits: social context and visual context (Harris & Lowendahl, 2007). In a learning experience, students are more likely to develop as leaders, collaborators, and relators; experience flow; and deeply experience alternative roles when there is a social and visual context. The emergent benefits of VWEs include:

1. An enhanced sense of social interaction
2. Visual indication of level of participation
3. Ability to see conceptually and spatially through the use of 3D models for instruction or simulation.

Table 2. Comparison of virtual world environments

Characteristics	Second Life	World of Warcraft	SimCity
Base	Based in reality	Based in fantasy	Based in reality
Intellectual Property	Belongs to the user	Belongs to the company	Belongs to the company
Purpose or Goal	User-defined	Pre-ordained—quest oriented	Pre-ordained—procreation/population
Open or Closed System	Open—trajectory determined by the will of the user	Closed—trajectory determined by computer algorithm	Closed—trajectory determined by computer algorithm
Educational Capabilities	Supports a wide variety of tasks, social interactions, contextual situations, and technical affordances	Outcomes limited by preprogrammed algorithm	Outcomes limited by preprogrammed algorithm
Access to Software Code	Open source	Closed—proprietary	Closed—proprietary

The VWE Second Life (created by Linden Labs) currently boasts more than 6.6 million residents worldwide, and more than US$7 million are spent in a given month. The top 80% of residents hail from more developed nations, but a significant portion also log on from places like Africa, Southeast Asia, and Latin America. The typical resident is male, between 25 and 34 years old, and among the top 5% of the world's wealthiest individuals.

Second Life is reality based in its economic and legal system in order to maximize the quality and quantity of user-created content. This approach is quite different than conventional massively multi-player online games. Most companies that own and operate online games: (a) own all of the content in their world, (b) own any content generated by the player, and (c) specifically deny residents the right to earn real-world incomes while using the online game (see Table 2). For example, Sony (Koster, 2002) and Turbine (Castronova, 2004a) have banned the sale of digital items and currency on eBay. Additionally, while basic membership in SL is a free service, most other MMOGs are subscription services, requiring ongoing monthly fees from players in order to stay in the games. As mentioned above, SL has a somewhat unique approach to intellectual property (Herman, Coombe, & Kaye, 2006). Linden Labs acknowledged the value of the creative contributions that game players made to the virtual worlds that they otherwise controlled by granting their players intellectual property rights in their creations both within the game and in reality. This allowance has resulted in an entrepreneurial spirit that has made SL one of the fastest growing online games (SimTeach, 2007).

Another unique quality of SL concerns the game's purpose, or in this case, lack of purpose (Edwards, 2006). Unlike the popular online game World of Warcraft (Blizzard Entertainment, 2007), in which users interact in a closed, quest-oriented system, everything in the SL universe is user created and user driven. There are no overarching quests or game-created goals handed down by the game developers. Much like real life, there are only individual and group goals such as business, education, or personal quests. Users are not required to advance through levels in the way they must in a controlled game. All activity in the VWE is actually created by the users themselves. This user-created purpose leads to another unique characteristic of SL—freewill. Unlike the popular game SimCity (Electronic Arts, 2007), which uses a computer algorithm to simulate how a city will evolve, activities in SL are governed by real people with the ability to act individually. Giving users the ability to freely determine their fate has opened up a wide variety of tasks, social and linguistic interactions,

Table 3. Various selected educational uses of Second Life

Institution	Purpose	Location
Idaho State University	Bioterrorism preparedness program	http://irhbt.typepad.com/play2train
Dartmouth College	Simulation for distribution of medical supplies in crisis.	http://iml.dartmouth.edu/index.html
National Oceanic and Atmospheric Administration	Interactive educational simulations about the ocean and weather	http://www.esrl.noaa.gov/
Global Kids Island	Place for teen residents to learn about social and world issues	*http://holymeatballs.org/*
Kids Connect Island	Youth collaborate via performing, storytelling, and collaboration	*http://zoomlab.org/kc/*
Social Simulation Research Lab	Library with papers, Web sites, homepages, and references of interest to social scientists	*http://tinyurl.com/y3wlat*
BrainTalk Communities	A place for autistic and cerebral palsy patients to interact socially	http://braintalk.blogs.com/brigadoon http://braintalk.blogs.com/live2give/
American Cancer Society	Walkathon raised more money in a short time than what the society would make in real life over many months	http://www.cancer.org/docroot/GI/content/GI_1_8_Second_Life_Relay.asp
Seattle University	Property law course applies issues of law to virtual environments	http://fizzysecondlife.blogspot.com
University of Houston	Design Economics course helps students to try their entrepreneurial skills against an entire market	http://www.arch.uh.edu
New Media Consortium	Virtual laboratory constructed to provide dozens of settings for experiments in social interaction	http://sl.nmc.org/wiki/Main_Page

and technical affordances that may not otherwise have been available (Peterson, 2006).

A significant number of universities, colleges, schools, organizations, and businesses are exploring the educational potential of Second Life. According to the *Chronicle of Higher Education* (Foster, 2007), as of September 21, 2007, more than 150 colleges in the United States and in 13 other countries have a presence in SL. Additionally, according to the Second Life Wiki (SimTeach, 2007), 17 educational organizations, four libraries, and four museums are currently active in SL. Second Life education-related Web sites number more than 200. The purposes of these groups' involvement in SL are as varied as their creators (see Table 3).

Second Life and other virtual worlds also possess great potential for research. According to Yee et al. (2007) and Blascovich et al. (2002), social norms of gender, interpersonal distance, and eye gaze transfer into virtual environments even though the modality of movement is entirely different (i.e., via keyboard and mouse as opposed to eyes and legs). As a result, these online environments are also being explored as unique research platforms for the social sciences and clinical therapy.

These environments can be customized through the use of in-world 3D construction tools. Settings can be created to pertain to any subject or area of study, locations and artifacts can be as realistic and detailed or as generic and undefined as desired. Even objects of large or micro scale can be easily portrayed. The combined effect of recorded interactions and customizable environments provides the ideal conditions for future interdisciplinary research.

For all of its potential and current uses, there are still three major educational aspects that are underdeveloped in VWEs such as SL: interdisciplinary research, development of best practices (Delwiche, 2006; Keesey, 2007), and exploration of the use of a mixed social environment. The New Media Consortium (2007b) is attempting to work toward interdisciplinary research in the social sciences, but the inclusion of other academic disciplines could provide great benefit. Much could be learned by including biology, chemistry, physics, and other disciplines not typically included in social science research. Whereas the 2007 Second Life Best Practices in Education Conference (http://slbest-practices2007.wikispaces.com) was a major step forward in developing best practices in education, it served to highlight the need to move beyond simple re-creation of the classroom experience to more of an emphasis on creative practices when using VWEs (Keesey, 2007). Given the current state of interest in usage of VWEs in education, there are other emergent parameters that can and ought to be cultivated within the template of a mixed social environment. These parameters are discussed in the context of the course presented below.

WELCOME TO OUR ISLAND: BACKGROUND AND PROCESS

The University of Florida's Digital Worlds Institute is a transdisciplinary research and academic entity that provides strategic integration of arts, technology, and culture across traditional academic boundaries. Digital Worlds (DW) planned to offer a new Interdisciplinary Research Seminar (IRS) in Spring 2007 as a collaborative effort between a professor of biomedical engineering and a professor of digital media. Second Life was to be used as the VWE within which the onscreen interaction would take place.

Prior to the beginning of the spring semester 2007, an island was acquired and two staff members at DW created three initial buildings on the barren landscape in preparation for the first cohort of students. First, the university's iconic Century Tower was re-created. This tower was built in the physical world in 1953 to commemorate the 100th anniversary of the university and was dedicated to University of Florida students who perished in World Wars I and II. Included in the virtual tower's features were replicas of the unusual cast-bells carillon that mark the time of day and often play musical interludes during class breaks. Second, a multi-level virtual representation of the Digital Worlds Research, Education and Visualization Environment (REVE) was built. The structure itself was modeled on the metaphor of ascending levels of achievement, a common construct in quest-based video games. In this case the ascending levels of the free-floating building structures themselves formed virtual platforms that marked levels of interaction and achievement in interdisciplinary research (i.e., brainstorming, laboratory, invention, and prototype). Finally, a biomedical engineering building was added, based on architectural plans of a structure that has not yet been built in real life. On the first day of class, students had these three structures, which provided landmarks and functional space in which to meet and interact, but the rest of the island remained undeveloped.

Students from a wide variety of disciplines enrolled in the class, which was offered as a means of investigating the use of VWEs in collaborative team-based research. The physical class sessions were held in the Digital Worlds' REVE [pronounced "rev" as in Rêve, the French word for "dream"]. The REVE was designed as a multi-purpose social and learning space, and featured a 52-foot wide immersive display screen, allowing local participants the opportunity to engage the VWE at near-life-size scales. This MSE afforded students and faculty a multiplicity of perspectives that proved integral to a groundswell of creativity and interdisciplinary achievement within the class.

The goal of the research seminar was to investigate if the VWE (dubbed "Gator Nation Island") could provide a compelling non-traditional framework for rapid prototyping, interdisciplinary collaboration, and invention.

RAPID PROTOTYPING IN A MIXED SOCIAL ENVIRONMENT

Wilson, Jonassen, and Cole (1993) define rapid prototyping as follows: "In a design process, early development of a small-scale prototype used to test out certain key features of the design. Most useful for large-scale or projects" (p. 21.1). The REVE provided an effective rapid prototyping environment because it readily offered a facility in which the students could meet physically, virtually, or in a hybrid MSE. This immersive environment encouraged the initial development of system sketches and virtual mock-ups, followed by user evaluation, concept refinement, and implementation of refined requirements in a spiral cycle. The rapid prototyping environment was enhanced by the multiplicity of perspectives simultaneously provided to students and instructors on the REVE's large-scale projection surfaces. While each person had their individuated laptop perspective, everyone in the room could also simultaneously share the common space from the perspective of other individuals' diverse points of view during each phase of the design process. This MSE provided an enormous amount of visual information to inform design choices, allowing students and instructors alike to see the results of their ideas early on, detect errors in judgment and accuracy, and apply creative solutions through real-time feedback. The MSE also encouraged active student participation and enhanced collaboration throughout the design process.

The "enhanced" aspect of this process emerged from several affordances not typically offered in traditional classroom settings. These include the ability of each of the students to interact either proximally in the REVE classroom, virtually within the VWE displayed on the REVE immersive displays and on their own laptops, or in any mixture of the two social environments deemed appropriate to the activities at hand. Additionally, the persistence of the virtual environment and the artifacts being created over the course of the semester, coupled with their accessibility both during and outside of class time, provided another mechanism not available when students collaboratively create "real" objects and prototypes in the physical world.

Using SL as the platform for the VWE, the IRS professors established interdisciplinary student teams and assigned an ambitious number of projects. Over the course of the semester, each of the students participated in several team-based projects. Each of their tasks involved creating a process or artifact in SL that did not currently exist in the physical world. At the end of the semester, a significant number of diverse student projects had come to fruition as a result of the rapid-prototyping process. These included:

1. A suite of MIDI-based musical instruments
2. A dance/music entertainment complex and a Visual Arts Gallery
3. The Protein Pavilion
4. A large Welcome Center for the island
5. Numerous media clips and playback interfaces for island visitors.

Within these original designs, structures, and conceptual developments, a number of interdisciplinary concepts and potentials were embedded:

1. The Protein Pavilion provided a 3D environment for learners to visualize protein folding, the physical process by which a polypeptide folds into its characteristic three-dimensional structure. While students from humanities and arts backgrounds had never encountered the concept of protein folding in their standard courses of study, being able to visualize this ongoing physical process provided a compelling introduction to biomechanics. The outdoor structure resembles a large veranda in which three large screens can be user activated to reveal animated 3D visualizations of various processes at the sub-molecular level.

2. The Visual Arts Gallery featured the work of an internationally renowned photojournalist from the university's College of Journalism and Communications. Students who typically would not have visited an art gallery in real life explored this virtual space as part of their IRS experience, viewing two exhibitions of the photographer's work in the process.
3. The NoteMaker's Lounge is a large, complex structure featuring a dance floor, multi-level social spaces, and recording studios containing novel musical instruments designed in the class. Guests could either walk in on the ground floor or fly into upper-level public rooms. One of the computer engineers in the class designed a secure entry system that permitted only paying customers or predetermined VIPs to pass through a force-field structure to gain admittance to exclusive upper levels. When guests entered the music studio portions of the NoteMaker's Lounge, a variety of non-traditional instruments acted as a catalyst for the development of original music compositions created when visitors interacted with the virtual devices.
4. The multi-level Welcome Center was designed and constructed by students with no previous experience in computer coding or architecture. The students took it upon themselves to learn how to create automated glass doors and numerous teleport jumps directly to many of the island's facilities, each accompanied by a detailed pictorial and narrative description of the intended site to be visited.
5. An ultra-modern Experimental Media Space combined 3D computer graphics with live and pre-recorded video capabilities. Numerous interactive media artifacts were designed and built by students with little or no previous experience with computer graphics or programming.
6. The class also experimented with creating its own currency and banking system, and created a series of interactive video billboards and kiosks where visitors could obtain useful information about their surroundings.

SOCIAL INTERACTION AND ENTROPY: A NOVEL FORM OF RAPID PROTOTYPING

A number of events were planned to be included in the Open House, ranging from guided tours to musical performances. The first 45 minutes of the Open House proceeded according to plan. But after that, a number of surprising developments occurred. While the majority of the online interactions during the semester were modeled after the usual and customary modes of generally accepted social practice, three-quarters of an hour after the Open House began, entropy—defined as "inevitable and steady deterioration of a system or society" (American Heritage, 2000)—broke out.

Previously courteous student interaction rapidly gave way to blasts from laser guns, unicorn riding through the shared space, driving vehicles up walls, and so forth. While end-of-semester enthusiasm and excitement about the culmination of students' projects is understandable, there is also another potential explanation: a rapidly emergent social entropy.

Whether a social construct or artifact seems to be contributing to the development or deterioration of a society or system is a socially constructed assessment, rather than an intrinsic property of the artifact (Bijker, 1995). As a result, we should consider the observation of one of the social scientists in the IRS class, who noted that this seemingly entropic development could be a manner of rapid prototyping of social constructs and artifacts in the VWE (Black, Beck, Dawson, Jinks, & DiPietro, 2007). These results should not automatically be discounted as a negative or simple anarchy, but instead should be explored. The use

Figure 1. Visitors perform on the new MIDI musical instruments (center screen) in the REVE's Mixed Social Environment

of the VWE to explore this novel type of social construct rapid prototyping should be investigated in future work. One potential application for this type of transdisciplinary research might be in the collaborative design and population testing of new urban environments or large-scale public facilities (stadiums, shopping complexes). Said structures could be placed within VWEs to assess traffic and user patterns created by live virtual users (as opposed to pre-programmed simulation algorithms) before finalizing the municipal approval of the building plans. (Figure 1, 2, 3)

Figure 2. The Protein Pavilion (center screen) shows visualizations of complex sub-molecular protein structure and folding

Figure 3. Faculty and Students on Gator Nation Island at the REVE. Images courtesy of the UF Digital Worlds Institute.

IMPLICATIONS AND FUTURE WORK

From the developments during one short semester using SL as the VWE in a research and education setting, a number of observations come to light that lead us to the following recommendations:

1. **Observation:** Students worked effectively across disciplines as diverse as biomedical engineering, economics, fine arts, journalism, law, and computer science both in class and online in the VWE. *Recommendation:* Encourage partnerships with other departments and programs within your institution in to facilitate collaborative learning. An interdisciplinary partnership between departments or programs sponsoring the course will result in a greater breadth of cultural, academic, and social diversity among students and faculty.
2. **Observation***:* Students and instructors appeared to be in a state of flow (Csikszentmihalyi, 1990) during most of the course. The flow state provided greater confidence, exploratory behaviors, enjoyment, distorted time perception, and greater learning than had occurred in past experiences with rapid prototyping by both instructors and students. Specifically, the added immersion provided by the REVE's MSE appeared to enhance enthusiasm for the tasks at hand and fruitful collaboration by the interdisciplinary student teams. Access to the VWE and projects-in-process from outside of the classroom provided another collaborative potential. In addition to the proximal interaction in the REVE, students frequently met online in the VWE on their own time during evenings and weekends from their own personal spaces. *Recommendation:* Encourage gaming and involvement in other MMOGs by students and faculty. Instructors should consider hosting a hands-on seminar on using VWEs such as SL for education for other faculty and graduate students to attend. This exposure will help students to be more comfortable with various gaming interfaces and make it easier for them to enter the flow state in and out of class.

3. **Observation:** Students exhibited significant enthusiasm for creating their own architectural models and invention prototypes. This is resonant with the current trend towards user-generated content in the broader online world (Bruns, 2007). *Recommendation:* Instructors should allow as much latitude as possible for students to create their own content- and concept-driven prototypes. Instructors should also build on the enthusiasm generated with customized content that will aid each student in his or her development. Also, in light of what occurred at the open house, students should be given opportunities to socially construct their own models and prototypes in groups and not just individually.
4. **Observation:** With the assistance of two designated teaching assistants (a graphic artist and a digital media specialist), students were able to overcome their lack of background in design and technical areas (i.e., computer programming, 3D graphics, architecture, etc.) and create significant results despite lack of formal training in these areas. *Recommendation:* Instructors should consider avoiding disciplinary limitations on students in such a course and allow open enrollment from across disciplines and academic levels. This will also result in greater diversity and a multiplicity of academic perspectives as students enter the course from a wider variety of educational backgrounds. Instructors should also consider scaffolding their students by providing additional resources for those interested in pursuing independent studies in the areas of computer programming, 3D graphics, architecture, and so forth.
5. **Observation:** Rapid prototyping of social constructs and artifacts within VWEs is an intriguing area that needs further exploration. *Recommendation:* Faculty and students need to overcome personal value judgments and biases against particular social constructs and artifacts. Researchers need to explore the potential for social construct rapid prototyping within VWEs for the insights it may provide into the relationship between artifact creation and population behavior in the "real" world, and how potential crossover effects between real and virtual worlds may lead to new understanding of system dynamics.

A number of challenges for interdisciplinary research within SL and other VWEs also emerged from this seminar:

1. **Challenge:** Current technological constraints (i.e., limitations on the importing and exporting of objects and processes created within the VME, lack of interoperability standards with other business applications such as learning management systems (LMSs) and HR management systems (HRMSs), system access and security, etc.). *Recommendation:* Integration with other software applications may not seem necessary, but it could greatly affect the adoption of the VWE innovation into your learning community (Black et al., 2007). Unfortunately, the technical inefficiencies of some business applications, such as LMSs, utilized by most higher education institutions have hindered integration, as vendors provide little in the way of easy, plug-and-play systems that can be implemented with little effort (Egan, 2002). While current generation VWEs such as SL hold enormous potential for learners, getting them to work efficiently with easy interaction with LMSs can be time consuming, frustrating, and expensive. By spending the extra resources necessary to achieve integration with your LMS and other software systems, an institution will be paving the way for an easier adoption process.
2. **Challenge:** Access to appropriately designed class and lab space for group interaction.

Recommendation: Provide both individuated and group display to create an effective mixed social environment. The larger and more immersive the common display, the more conducive it will be to shared group interaction. Hertz (2002) observes that "the interaction that happens through and around games as players critique, rebuild, and add on to them, teaching each other in the process. Players learn through active engagement not only with the software but with each other" (p. 173). These kinds of environments do not have to be prohibitively expensive (Oliverio et al., 2004).

3. **Challenge:** Clear guidelines on ownership of intellectual property created in classroom VWE. *Recommendation:* In keeping with your institution's intellectual property guidelines, encourage faculty and administration to give ownership of intellectual property (IP) created within the VWE to the person or team that created it. The increased production of authentic learning objects and innovative research concepts is a desirable outcome (SimTeach, 2007). Continued use of original IP in subsequent classes can then easily be arranged by simple permission from the creator/owner of the desired IP.
4. **Challenge:** Overhead in setting up and maintaining the VWE. *Recommendation:* Seek out partnerships with other programs and departments within and outside your university in order to spread the overhead cost. Your course will not only benefit from lessened financial constraints, but will also benefit from an increased diversity in students and faculty.
5. **Challenge:** Acceptance within established academic traditions and cultures. *Recommendation:* The chalkboard, filmstrip, and overhead projector are all examples of technologies that enabled increased interaction and shared experience in the classroom. VWEs are an inevitable and evolutionary step in the same direction, but they also must face some of the same hindrances as their predecessors. Development of quality best practices for using VWEs in education will equip teachers to overcome these hindrances and utilize them more fully.

It is apparent that network-based interaction in VWEs has much to offer in terms of contemporary learning and research applications. In our work we are particularly interested in facilitating effective MSEs by designing scalable physical classroom spaces whose affordances can maximize the effectiveness of interdisciplinary activities in research and education (Oliverio & Pagano, 2004).

Future studies should focus on in-class social interaction in mixed reality settings and the cultural and technical potential for rapid prototyping of objects, inventions, social constructs, and dynamic interaction systems.

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KEY TERMS AND DEFINITIONS

Best Practices: Processes and activities that have been shown in practice to be the most effective (Delwiche, 2006; Keesey, 2007).

Flow: Concept developed by Csikszentmihalyi (1990). "The mental state of operation in which the person is fully immersed in what he or she is doing." Flow is the feeling of complete and energized focus in an activity, with a high level of enjoyment and fulfillment. (Wikipedia, 2007a)

Interdisciplinary Research: Research efforts that bring together the humanities, physical sciences, and social sciences to develop and enhance a broad understanding of particular populations, cultures, or other related areas of research. (NCCS, 2007)

Massively Multiplayer Online Game (MMOG): A type of computer game that enables hundreds or thousands of players to simultaneously interact in a game world they are connected to via the Internet. Typically this kind of game is played in an online, multiplayer-only persistent world. Some MMOGs are played on a mobile device (usually a phone) and are thus mobile MMOGs or MMMOGs or 3MOGs. (Wikipedia, 2007b)

Mixed Social Environments: Meeting places, such as the Polymodal Immersive Theatre (PIT) in the Digital Worlds Institute's REVE, that allow both proximal social interaction typical of traditional classroom or auditorium settings and simultaneous shared display of virtual world environments in which the physically present persons can also interact virtually.

Research, Education and Visualization Environment (REVE): A multi-purpose social and learning space that features a 52-foot-wide immersive display screen, allowing local participants the opportunity to engage a VWE at near-life-size scales. The REVE allows students and faculty a multiplicity of perspectives that promote creativity and interdisciplinary achievement within the classroom.

Second Life: An open-ended virtual world created by San Francisco-based Linden Lab. Its foci are socialization, economic activity, and non-profit interactions. The creation of former RealNetworks CTO Philip Rosedale, Second Life gives its users (referred to as residents) tools to shape its world. (Wikipedia, 2007c)

SimCity: A real-time strategy/simulation computer game created by game developer Maxis. There are four versions: the original SimCity (1989, later renamed SimCity Classic), SimCity 2000 (1993), SimCity 3000 (1999), and SimCity 4 (2003). All of the games were re-released with various add-ons including extra scenarios. In addition, SimCity Classic is available for a palm-connected organizer and on the *SimCity.com* Web site as Classic Live. (Wikipedia, 2007d)

Virtual World Environments: A virtual world is a computer-simulated environment intended for its users to inhabit and interact with via avatars. This habitation usually is represented in the form of two- or three-dimensional graphical representations of humanoids (or other graphical or text-based avatars). Some, but not all, virtual worlds allow for multiple users. (Wikipedia, 2007e)

World of Warcraft: A class-based massively multiplayer online role-playing game developed by Blizzard Entertainment. It is the fifth Blizzard game and is set in the Warcraft Universe, a fantasy setting introduced by Warcraft: Orcs & Humans in 1994. World of Warcraft is set four years after the events at the conclusion of Blizzard's previous release. (Wikipedia, 2007f)

This work was previously published in Handbook of Research on Effective Electronic Gaming in Education, edited by R. Ferdig, pp. 146-162, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.6
The Usability of Social Software

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ABSTRACT

Emergent Web 2.0 technologies and applications (such as blogs, wikis, podcasts, mashups, and folksonomies) present a range of opportunities and benefits and are increasingly used by people to interact with each other. Despite the growing popularity of social software, there is a lack of research on the usability of these tools. This chapter focuses on how users interact with Web 2.0 technology, discusses a conceptual framework for a usability evaluation of social software, describes the different types of social software applications, and offers guidelines for their usability evaluation. The argument advanced is that social software usability should be viewed as a set of principles and practices aimed to deliver more service-orientated Web 2.0-based applications.

DOI: 10.4018/978-1-60566-368-5.ch050

INTRODUCTION AND BACKGROUND

Social software has emerged as a driving force of Web 2.0. The term *Web 2.0* was coined by Tim O'Reilly (2005) to describe a sea change in web services and technologies. It should be noted that Web 2.0 is not a single development but rather a heterogeneous mix of new and emergent technologies. Overall, there is an increasing presence of social software applications that allow users to communicate, collaborate, and share their personal interests. This chapter introduces a usability perspective on social software and offers guidance for evaluating the usability of social software applications.

Bryant (2007) defines *social software* as a combination of various social tools within a growing ecosystem of online data and services, all joined together (aggregated) using common protocols, micro-formats and Application Programming Interface (API) methods. It is also underpinned by some general principles about engaging people as active participants in online social networks and communities to achieve new and exciting effects through distributed collaboration, co-production and sharing. Central to the notion of Web 2.0 is the ideas of scale, the belief that the tools become more useful as more people apply them, and changing the world through the Social Web.

According to Leadbeater (2007), the tools associated with social software transform our capacity for civic activism. Firstly, these tools allow people to participate by creating, publishing and distributing content, such as video, pictures, music and texts through the Internet. Secondly, social software allows people with similar interests to find one another and connect through social networking sites, such as MySpace, Facebook, and Bebo. People can also use search tools and systems for collaborative tagging of information and ideas. Thirdly, people can coordinate their activities and collaborate through raising petitions and funds, and planning and conducting mobile campaigns and communities programs. Fourthly, through large-scale collaborations, people can create reliable, robust, and complex products such as open source software applications such as Linux. As to Leadbeater (2007), the rubric of social software is: contribute, connect, collaborate, and create.

There are three characteristics commonly attributed to social software, namely:

- Support for conversational interaction between individuals or groups, ranging from real-time instant messaging to asynchronous collaborative teamwork spaces. This category also includes collaborative commenting on and within blog spaces.
- Support for social feedback that allows a group to rate the contributions of others, perhaps implicitly, leading to the creation of digital reputation.
- Support for social networks to explicitly create and manage a digital expression of people's personal relationships, and to help them build new relationships (Boyd, 2003).

Owen and others (2006) suggest that social software can be also characterized by community gains, that is, many users benefit from other users acting in sociable and community-oriented ways:

- Social software delivers communication between groups
- Enables communication between many people
- Provides gathering and sharing resources
- Delivers collaborative collecting and indexing of information
- Allows syndication and assists personalization of priorities
- Has new tools for knowledge aggregation and creation of new knowledge
- Delivers to different platforms as is appropriate to the creator, recipient, and context.

In addition, social software offers great promise for education as it supports group interaction. Phipps (2007) lists the following educational benefits of social software:

- Using instant messaging to conduct tutorials at a distance with a distributed group
- Providing easier opportunities for students to collaborate and make word of mouth recommendations about sites including, or related to, course content
- Allowing students to create their own interest groups allied to their studies
- Allowing students to interact with students from different universities and countries
- Providing researchers with ways to share results faster and with opportunities for instant feedback
- Allowing the formation of *ad hoc* research groups
- Providing a way of having material peer reviewed by a broad audience before publication

USABILITY PERSPECTIVE

Usability is central to the use of any software application. Jacob Nielsen defines *usability* as the quality attribute that assesses how easy a user interface is to use (Nielsen, 2003; Nielsen & Loranger, 2006). Despite the rapid growth of social software, there is little research of its usability. According to Silva and Dix (2007), when a social software application such as YouTube was subjected to usability evaluation, it failed the test. The main aim of usability examination is to ensure that interactive products such as social software are easy to learn, effective to use, and enjoyable from the user's perspective (Preece, Rogers, & Sharp, 2002). Usability goals include:

- Effective to use (effectiveness)
- Efficient to use (efficiency)
- Safe to use (safety)
- Have good utility (utility)
- Easy to learn (learnability)
- Easy to remember how to use (memorability)

Usability goals are typically turned into specific criteria to enable the usability of a product to be assessed in terms of how it can improve a user's performance. Usability tests are often used to orient web product designers towards thinking about different aspects of their applications. Social software design principles are derived from a mix of theory-based knowledge, experience, and common sense. Some well-known design principles include well-established testing criteria, such as visibility, feedback, constraints, mapping consistency, and affordances (Norman, 1998). When design principles are used in practice, they are referred to as *heuristics*.

Whereas design principles are used mainly for informing a product development, usability principles are used mostly as the basis for evaluating prototypes and existing systems. They provide the framework for heuristics evaluation (Preece et al., 2002). Nielsen and his colleagues (2001) have developed ten main usability principles that can be equally applied to social software usability examination:

1. **Visibility of system status:** Always keep users informed about what is going on, through appropriate feedback within a reasonable time.
2. **Match between system and the real world:** Speak the user's language using words, phrases and concepts familiar to the user, rather than system-oriented terms.
3. **User control and freedom:** Provide ways of allowing users to easily escape from places they unexpectedly find themselves by using clearly marked "emergency exits."
4. **Consistency and standards:** Avoid making users wonder whether different works, situations, or actions mean the same thing.
5. **Help users recognise, diagnose, and recover from errors:** Use plain language to describe the nature of the problem and suggest a way of solving it.
6. **Error prevention:** Where possible, prevent errors occurring in the first place.
7. **Recognition rather than recall:** Make objects, actors, and options visible.
8. **Flexibility and efficiency of use:** Provide accelerators that are invisible to novice users but allow more experienced users to carry out tasks more quickly.
9. **Aesthetic and minimal:** Avoid using information that is irrelevant or rarely needed.
10. **Help and documentation**: Provide information that can be easily searched and provides help in a set of concrete steps that can be easily followed.

Evaluation can be broadly divided into two types: evaluation by the designer (or a usability expert without direct involvement by users) and evaluation that studies actual use of the system. The former is useful for assessing early designs and prototypes. On the other hand, the latter typically involves a working prototype or implementation. The goals of evaluation are: (a) to assess the extent and accessibility of the system's functionality, (b) to assess user's experience of the interaction and (c) to identify any specific problems with the system.

Evaluation of the usability of social software should be tackled throughout the design life cycle, with the results of the evaluation feeding back into the modification of the design. Although it is not possible to carry out extensive experimental testing continuously throughout the design, analytic and informal techniques can and should be used (Silva & Dix, 2007).

The functionality of the system is also important. It must be in accord with the users' requirements as well as matching the use of the system to the users' expectations of the task. In addition, it is important to assess the users' experience of the interaction and its impact upon him/her. Usability testing is the approach typically used to carry out users' evaluation. Although users should be involved in the evaluation of the software throughout the design process, this may not be possible because it is rather expensive. Another approach is to use experts to carry out the evaluation. This approach is relatively inexpensive because it does not require user involvement. However, this approach does not assess actual use of the system, only whether or not a system upholds accepted usability principles.

According to Tognazzini (1995), user testing is an integral part of the design process. Usability evaluation is important to determine that software meets user needs and one can use the product and adopt it. Without evaluation we cannot be sure that the social software is usable and what the users want. Preece and colleagues (2002) identified four different evaluation paradigms:

1. **Quick and dirty evaluations:** This is a practice in which designers informally get feedback from users or consultants to confirm that their ideas are in line with users' needs. This method is called *dirty* because this can be don*e in* a short space of time. It is particularly useful for applications that need to be completed in a short timescale.
2. **Usability testing:** Usability testing involves measuring typical users' performance on carefully prepared tasks that are typical of those for which the system was designed (Preece et al., 2002). In this evaluation, it is strongly controlled by the evaluator. Tests typically take place in laboratory-like conditions that are controlled. Everything that the participant does is recorded. Quantifying users' performance is a dominant theme in usability testing.
3. **Field studies:** Field studies are done in the natural settings where the aim is to increase understanding about what users do naturally and how technology impacts them. There are two approaches to field studies. The first involves observing explicitly and revealing what is happening, as an outsider looking on. Qualitative techniques are used to collect the data that can then be analysed qualitatively or quantitatively. The other approach is where the evaluator may be an insider or even a participant. A typical type of inside evaluation is ethnography. The aim of ethnography is to explore the details of what happens in a particular social setting,
4. **Predictable evaluation:** In this method, experts apply their knowledge of typical users, often guided by heuristics, to predict usability problems. Users need not be present in predictable evaluation. This makes the process quick, relatively inexpensive, and attractive to companies.

Typical expert methods include heuristic evaluation and cognitive walkthrough. Heuristic evaluation is an informal usability inspection technique developed by Nielsen (1994), in which experts, guided by a set of usability principles (known as *heuristics*) evaluate whether user interface elements, such as dialog boxes, menus, navigation structures, online help, etc. conform to the principles. Expert evaluators work with the product, role-playing typical users and noting the problems encountered (Preece et al., 2002). The main advantage of this approach is, because users are not involved in the evaluation, it is quick and cheap. Heuristic evaluation is thus known as "discount evaluation."

Walkthroughs are another method for heuristic evaluation for predicting users' problems without doing user testing. These involve performing a task and noting problems associated with system usability. There are cognitive walkthroughs and pluralistic walkthroughs. Cognitive walkthroughs involve simulating a user's problem-solving processes at each step in the human-computer dialog, checking that the user's goals and memory for actions can be assumed to lead to the next correct action (Preece et al., 2002). The steps involved are:

1. Characteristics of typical users are identified and documented, and sample tasks are developed that focus on the aspects of the design to be evaluated.
2. A designer and expert evaluators come together to do the analysis.
3. The evaluators walk through the action sequence for each task replacing it within the context of a typical scenario. As they do this, they try to answer the following questions:
    ◦ Will the correct action be sufficiently evident to the user?
    ◦ Will the user notice that the correct action is available?
    ◦ Will the user associate and interpret the response from the action correctly?
4. A record of critical information is compiled as the walkthrough is being performed.
5. The design is revised to fix the problems presented.

Pluralistic walkthroughs are a method in which users, developers, and usability experts work together to step through a task scenario, discussing usability issues associated with dialog elements involved in the scenario steps. Each group of experts is asked to assume the role of typical users. Interestingly enough, Silva and Dix (2007) found that conventional usability evaluation does not work well for social software, such as YouTube. Despite this, You Tube has been a great success. Even though we know what *usability* means for such sites; how do the site developers take into account the usability of a radically configurable site? What about consistency? How do we effectively communicate with 10 million end-user designers? These and other issues should be addressed by further research of social software usability.

SOCIAL SOFTWARE USABILITY

Blogs

A *blog* is a system that allows a single author (or group of authors) to write and publicly display time-ordered articles (called *posts*). Readers can add comments to posts. Increasingly, blogs incorporate multimedia, and you can also upload and read them via mobile devices. The main benefits of blogs are that users with disabilities can access an online blog using assistive technology (for example text-to-speech tools or voice recognition software) in a way that would be impossible to replicate in paper-based update reports. The inbuilt templates, content management, tracking and searching facilities of a blog system can make the organization and retrieval of information much simpler than using a process that depended on their own organizational skills. The main disadvantage of a blog is that users with learning difficulties may struggle to acquire the range of skills necessary to effectively keep records via an online system. Different blog systems will have different levels of usability and accessibility, in the navigation and retrieval of content and their usability with different assistive technologies.

Wikis

A *wiki* is a system that allows one or more people to build up a corpus of knowledge in a set of interlinked web pages, using a process of creating and editing pages. Wikipedia is the most famous wiki. There are many possible uses for a wiki, including research collaboration, multi-authored papers, project work, and maintenance of documents which require regular updating.

There are several advantages of using wikis. These include giving an opportunity for users with different types of knowledge, confidence, and communication to contribute equally to a joint publication, reducing e-mail traffic. Collaborators who lack confidence to argue a case in a "live" face-to-face debate can feel more comfortable making the same points in a wiki environment where the pace of discussion is slower and the quality of the thinking is more significant than force of personality. The main drawback of a wiki is its iterative nature (sections appearing and disappearing as a document evolves), which can be very difficult to track, especially for those with slow reading speeds.

Podcasts

A *podcast* is a collection of digital media files which are distributed over the Internet, often using syndication feeds, for playback on portable media players and personal computers. Many podcasts also allow users to directly download, by giving a link to the audio file in an RSS feed or web page. The ability to listen to content rather than read it offers many benefits to users. Users with poor reading skills or visual impairment particularly benefit; however, there are also significant benefits for all users who want to absorb content while doing something else, such as driving. Users need not only be recipients – it can be very easy to create personal audio content and in some circumstances it may be a more successful way of recording knowledge and understanding than a blog or a traditional textual write-up. The main problem with podcasts is that audio-only resources pose significant problems for people with hearing disability.

Social Networking Tools

Social network services allow people to come together online around shared interests, hobbies, or causes. For example, some websites provide dating services where users post personal profiles, locations, ages, gender, etc, and are able to search for a partner. Other services enable business networking (Ryze, XING, and LinkedIn) and social event meetups (Meetup). More recent developments include virtual reality worlds, such as Second Life.

Nowadays, social networking sites such as MySpace, Facebook, and Bebo attract millions of users, and the services grow exponentially, with each new user encouraged to introduce others. The main benefits of social networking tools enable the creation of online communities, whether geographical communities, people linked by a particular interest, or simply random networks of online users. It also offers such benefits as expanded networks, informal positive filtering (e.g., "friend of a friend" recommendations) and opportunities to both advertise and search for specific skills and experiences. There is no disadvantage if the tool is built with accessibility in mind.

Mashups

A *mashup* is a web application that combines data from more than one source into a single integrated tool. An example is the use of cartographic data from Google Maps to add location information to real-estate data from Craigslist, thereby creating a new and distinct web service that was not originally provided by either source. The benefit is in being able to combine datasets in new ways. The limitation is that with a high reliance on spatial data, mashups are very difficult for visually impaired users. People with poor spatial skills (for example, those who prefer a list of directions rather than a map image) may also find mashups difficult to use.

Sharing Tools

This provides users with the ability to record (bookmark) web pages and tags these records with significant words (tags) that describe the pages being recorded. Most websites enable the uploading of your own resources, and viewing of those uploaded by others, through configuration options that usually enable you to make your resources available only to a private group if required. Del.icio.us and Furl are two of the most popular bookmark-sharing services, while CiteULike and Connoteaare more academically oriented, for sharing bibliographical references. Image-sharing sites include Flickr and Phlog, while Odeo focuses on audio material. The benefits include: the ability to visualize information in different ways (for example, cloud tagging in Del.icio.us); the ability to collaborate effectively without needing physical access or physical proximity to other collaborators. The main problem is the interface. If the interface is designed for accessibility, there should be few difficulties.

Folksonomies

Folksonomy is also known as *collaborative tagging*, *social classification*, *social indexing*, and *social tagging*. It is the practice and method of collaboratively creating and managing tags to annotate and categorize content. A folksonomy is a user generated taxonomy. Folksonomic tagging is intended to make a body of information increasingly easy to search, discover, and navigate over time. Among the most widely cited examples of websites using folksonomic tagging are Flickr and Del.icio.us. The main benefit of folksonomy is that by using them, we can discover new and more current digital content due to its ability to be updated immediately. Folksonomies can also be organized so that one can explore the "long tail interests" – the less frequently used keywords that people choose that can help users focus their searches and applications. However it is criticized for a lack of terminological control causing it to produce unreliable and inconsistent results. Another problem is the lack of precision inherent in tags (Guy & Tonkin, 2006).

Usability Evaluation Guidelines

Nielsen (1994) derived his heuristics evaluation from an analysis of 249 usability problems. Preece and others (2002) expanded on that and produced the following guidelines:

- Visibility of system states
- Match between system and real world
- User control and freedom
- Consistency and standards
- Help users recognise, diagnose, and recover from errors
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help and documentation.

Nielsen (1999) argues that the above guidelines are too general for evaluating new products: such as, online communities, WAP devices, and others. Instead, Nielsen suggested an easy to remember constellation of usability principles (acronym HOMERUN):

1. **H**igh-quality content
2. **O**ften updated
3. **M**inimal download time
4. **E**ase of use
5. **R**elevant to user's needs
6. **U**nique to the online medium
7. **N**et-centric corporate culture

The authors concur with Preece and colleagues (2002) that it is important to develop heuristics that are best tailored to the specific product. The heuristic evaluation method consists of three stages (Preece et al., 2002):

1. The briefing session in which the experts are told what to do
2. The evaluation period in which each expert typically spends 1-2 hours independently inspecting the product using the heuristics for guidance
3. The debriefing session in which the experts come together to discuss their findings and to prioritise the problems they found and to suggest solutions.

Whereas usability is concerned with how users interact with technology, sociability is concerned with how members of a community interact with each other through the enabling technology (Preece 2001). The success of professional learning social software is determined not only by its high usability, but also good sociability, with both of these principles comprising a set of criteria and measures (Law & Hvannberg, 2006).

We concur with Klamma and others (2006) that four key quality attributes and their sub-attributes for social software are needed: functionality, usability, interactivity, and naturalness.

1. Functionality
   - How do I join the group?
   - Do I feel part of a thriving community?
   - What are the rules?
   - Can I express myself as I wish?
   - Is the community safe?
   - Can I trust the application?
   - Do people behave themselves appropriately?
   - Would it support me to carry out the activities I want to do?
   - Can I find out who is there?
2. Usability
   - Can I use the application easily?
   - Do I feel that I am able to follow and understand what I am doing?
   - Do I enjoy using the application?
   - Do I know how to join the group?
   - Can I get, read, and send messages?
   - Can I send a private message?
   - Can I find the information and people easily?
   - Can I navigate the site easily?
   - Do I feel comfortable using the application?
3. Interactivity
   - Does the application allow me to communicate easily?
   - Does the application offer simple, consistent pages and clear navigation?
   - Does the application know where I am at all times?
   - Does it let me know clearly where I can go from here?
   - Does it let me know where I have been?
   - Does it make it obvious what to do to get somewhere?
   - Does it indicate what clicking a link will do?
   - Does the application give appropriate feedback?
   - Does the application give concise, timely and polite help?
4. Naturalness
   - Is the layout simply and easy to use?
   - Is the text clear and easy to read?
   - Is the page consistent?

- Is the colour natural and pleasing?
- Are the navigation items large and bold:
    a. Using clear text to make the purpose of each link apart from unambiguous?
    b. Positioning permanent navigation links apart from content?
    c. Differentiating navigation using colour, tone, and shape?
- Does it have too many columns?
- Does the application provide appropriate help when I get stuck?

Currently no standard ways exist to measure the above attributes, making benchmarking studies especially difficult. Evaluation of social software is difficult, given the high variability in users, tasks, and contexts. Despite this, we believe that the principles of functionality, usability, interactivity, and naturalness can be successfully used for evaluating social software.

FUTURE TRENDS

Emerging social interaction technologies present opportunities and benefits to institutionally based and personal learning. As familiarity with social software grows in the larger community, these tools are now being increasingly explored for their pedagogic value. According to Aspin and Chapman (2000), "life-long learning" refers to a society in which learning possibilities exist for those who want to learn (Fischer, 2001). There is an increasing demand for new approaches towards fostering life-long learning perspectives. Emergent Web 2.0 concepts and technologies are opening new doors for more effective learning and have the potential to support life-long competence development.

Social software techniques enable richer capturing of context in which content has been produced. This allows for automating the generation of metadata ("descriptions"): e.g., by reusing metadata from artefacts produced by "close neighbours" in the social network) (Klamma et al., 2007). This sort of mining of social information can enhance the Automated Metadata Generation framework (Cardinaels et al., 2005). According to Klamma and colleagues (2007), social software based context capturing offers great potential to create advanced tools and services for dealing with the need for content. A simple example is to augment user queries with metadata that constrain results to those that are relevant to the context at hand (e.g., in a language that the user has demonstrated mastery). A more advanced example is to alert users to relevant content, even before they are aware that it may help them in the task at hand (e.g., because the actions of their peers and colleagues have indicated that this content is relevant in this situation).

CONCLUSION

Users will not adopt an application if they find it difficult to use. Designers cannot expect that user-friendliness can be achieved automatically by following the product design guidelines. Usability evaluation is necessary to make sure that users approve the application. Creators of a usable Web 2.0 site should: 1) adhere to standards; 2) think about what users will actually do; and, 3) think about user tasks. The difference between traditional applications and social software is that users become both designers and end-users. As we argue above, many of the already established principles for software usability can be successfully applied to evaluating the usability of the Social Web. In addition, some new features have to be considered to take into account the specific nature of social software. Overall, social software usability should be viewed as a set of principles and practices aimed to deliver more service-orientated Web 2.0-based applications.

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KEY TERMS AND DEFINITIONS

Heuristic Evaluation: A usability inspection technique based on a set of established usability principles.

Social Software Usability: A set of principles and practices aimed to deliver more service-orientated Web 2.0-based applications.

Usability: A qualitative attribute that refers to the ease of use of computer software and web-based applications.

Usability Evaluation: Refers to an assessment of the degree of efficiency to which a software product can be operated by the users.

Usability Testing: Involves procedures and techniques to measure the users' performance of most typical tasks.

Walkthrough: A usability evaluation technique used for identifying potential problems.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 574-584, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 5.7
Social Impact of Collaborative Services to Maintain Electronic Business Relationships

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ABSTRACT

This chapter looks at the impact and opportunities of semantic technologies and Web services to business relationships and how social Semantic Web techniques foster e-business and collaborative networks in many dimensions. For this the authors follow the vision to support collaborative services for business relationship management within semantic services. Based on a newly approach for business partner management with ontologies in large business communities, the chapter elaborates the conceptual framework for the design and implementation of collaborative services. The often postulated adaptiveness and intelligence of novel collaborative structures, foremost collaborative networks, require new approaches to deal with the increasing difficulty to cope with the resulting complexity of relational ties in communities and business networks. This research strives to leverage the capabilities to deal with large number of business relationships. The chapter formulates a vision based on three stages developing digital business ecosystems. Semantic Web technologies, mainly modelling business partner profiles (BPP) with ontology, combined with sound techniques of information retrieval and selected concepts and methods of social network analysis build the conceptual framework. On this basis, a newly approach is elaborated which offers support for communication processes and complex interactions of business entities in collaborative spaces.

DOI: 10.4018/978-1-60566-650-1.ch032

INTRODUCTION

During the last decade, along with growing interest and increasing use of electronic networks, society, science and business have been affected by remarkable changes. Electronically networks have had a tremendous impact on the every day and working life changing the way people interact, live and work. In our economy today, networking plays a crucial role in various application domains. Services are designed to support collaboration and networking among agents, whether humans or machines, in electronic networks.

Services are designed to overcome identified boundaries for Collaborative Networks (Martin-Flatin et al., 2006). The focus of this research is social ties between network entities. In electronic networks the linkages of entities (e.g., business partners, employees, experts, etc.) have to be supported by electronic services. Semantics, self-organization, security, trust and privacy, awareness and incentives are variables influencing the relational ties between units. However, linkages between agents require the right climate and conditions of a collaboration environment. This environment should provide opportunities for or constraints on individual action in a specific given context. These horizontal dimensions facilitate and catalyze the emergence of relational processes and structures to evolve.

This chapter claims that organisational structures with the asked abilities to self-manage, self-configure and self-optimise require besides the necessary culture, and "[…] semantic-informed self-organizing structures […]" (Camarinha-Matos et al., 2003, p. 8). Culture and structure are constituted in the collaboration and innovation environment and provides the "breeding environment" for establishing relational ties between agents (e.g., units, actors, etc.).

In this environment relational ties are to emerge between agents (e.g., units, actors, etc.). From a network perspective, linkages and related relational processes and structures are subject of analysis. The status of relational ties is either latent (passive) or evident (active). If made evident in a specific context given, they offer the channels for transfer or "flow" of resources (either material or nonmaterial). Our research aims at provisioning of a framework allowing to analyse and to conceptualise structures in form of models as lasting patterns of emerging relationships among agents. Again the conditions and environment catalysing the emergence of relational processes and structures in the context of collaboration and innovation processes are looked into. The goal is to analyse related interactions at the level of individuals, teams (or groups), organisations, networks and communities (After Figure 1, see Figure 2).

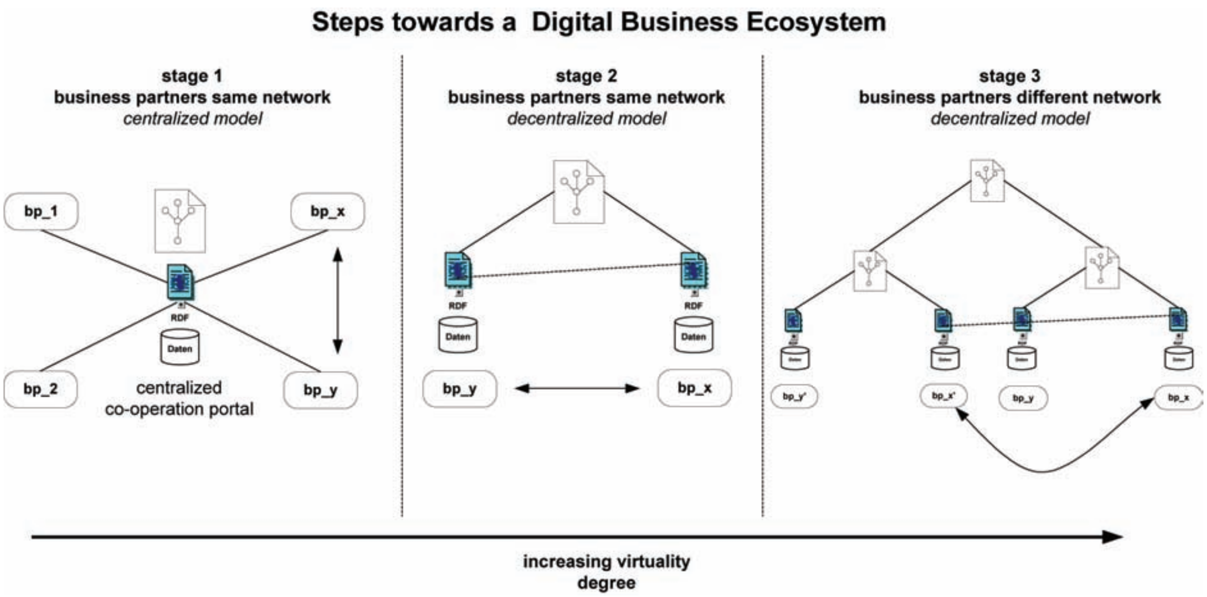
The concept of semantically enriched business partner profiles and sound, proven techniques of information retrieval, data mining, and machine learning, respectively, are combined together to develop a collaborative service environment. Discovery, matching and trust services provide the field for further enhanced services and functionality in collaborative networks.

One of the challenging tasks analysing business networks is to propose the clearest possible view of network characteristics. The concept of network suggests the existence of nodes, which interplay in different patterns according to the network structure. In the future networks will be characterised by the ability to self-organise their shape and to adapt rapidly to changes in their direct environment as e.g. the change of market conditions or new developments in technology. In this chapter we look at the fundamental basis for the design, development and implementation of collaborative services for the efficient partner relationship management in dynamic business ecosystems.

The approach aims to extent existing b2b integration technology architectures. For this, Weiß (2005, 2007) developed a methodology ODAMY[1] transforming the metrics of an empirical model into an ontology based model. The conceptual framework is based on the KAON tool set and infrastructure (KAON 2003). KAON tool set allows iteratively checking at this early stage of development how the conceptual framework shall be used and implemented.

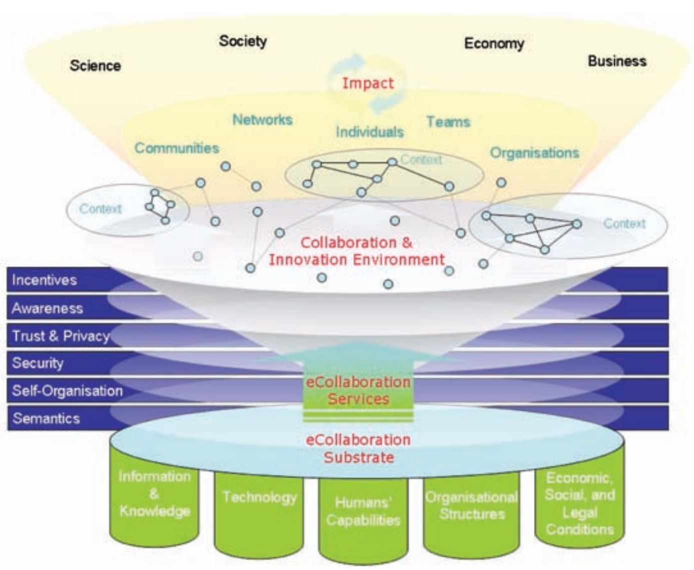
Our research concentrates on the extension of the centralised approach presented by Weiß

Figure 1. Steps towards a Digital Business Ecosystem (Weiß 2005)



(2005, 2007) by using a decentralized model for the fingerprints. It focuses on dynamic integration of business partners in the light of emerging digital business ecosystems. The work followed the approach to assess decision criteria in order to support the self-formation and self-organisation of adaptive business networks. Business partner profiles are build based on a shared explicit data model. An ontology-based model describes underlying data structures and concepts which have been taken from an empirical model. The empirical model encompasses important dimensions for the

Figure 2. Framework of collaborative networks' infrastructure (Klink and Weiß 2007)



configuration and analysis of business relationships. Weiß (2005, 2007) discussed and overlooked the future and emerging trends.

In Figure 1 the three stages towards a digital business ecosystem are illustrated. Research described in (Weiß 2005) addressed foremost the scenario at stage 1 (left side in Figure 1). At this stage a centralised model for the business partner profiles is applied. Business partners that can be accessed through the ICT infrastructure are limited to information stored and accessible through the registry in form of an Enterprise Portal of the domain network. Related work can be found in the area of business registries for Web services, e.g., UDDI[2] and ebXML[3].

Our research gravitates around the realisation of the scenario shown at stage 2 (middle in Figure 1). At this stage, a decentralised model is developed which is analogous to peer2peer networks. Business Partner Profiles are no longer stored in a central information portal. Instead, they are stored decentralised but are created on basis of a shared conceptual model in form of a domain ontology. Business partners maintain latent business relationships solely within the boundaries of the business network they have registered. Boundaries of this network are defined by the number of registered users.

At stage 3 (left side of Figure 1) the approach strives for an advanced decentralised model that allows contacting and querying business partners not limited to any boundaries of the defined network. The information desired for discovery and selection of business partners is retrieved beforehand through machines in form of agents or Web crawlers.

The semantics of data in profiles has to be made explicit and has to be stored in a machine-processable form. The described approach fulfils the needs of the described scenario but has to be further elaborated and developed. Especially, retrieval of collaborative information and data stored in business partner profiles poses interesting questions for future research endeavours. Future developments in adaptive business networks will be driven and dominated by current paradigms of service oriented architecture (SOA) and technologies related to Web services (Weiß, 2007), (Klink and Weiß, 2007).

STATE-OF-THE-ART/BACKGROUND

In the past, network perspective has proved fruitful in a wide range of social and behavioural science disciplines. Today, network perspective noticeably impacts other research disciplines, namely informatics, economics, engineering, law, etc. Network concepts are conceived increasingly as fundamental components for research activities in the field of virtual organisation (Sydow 1992), (Krystek et al. 1997), (Ritter 1998), (Picot et al. 2003), (Weiß 2005).

In today's b2b (business-to-business) integration concepts, strategic aspects are mostly not addressed adequately. In this context Bussler (2003) discusses the problem of integrating business partners into an existing information and communication technology (ICT) infrastructure depicting options by looking into types of b2b integration concepts and scenarios. Current b2b integration concepts are focused merely on technical needs and aspects as definition of interfaces for information exchange, remote invocation of applications or formalisation of business transactions and processes as well as business semantics (Weiß and Stucky 2004). Most influential initiatives to be mentioned here are EDI[4]-based and/or XML[5]-based (Weiß 2005).

New business patterns are characterised by diminishing geographical and time boundaries, globalisation of the labour market, increased connectivity, extended or virtual enterprises, new forms of customer management, and individualised marketing (Lengrand and Chatrie 2000). Beyond doubt, the relevance of networked co-operations in business can be expected to increase strongly in future. Delic and Dayal (2003) discuss and describe future enterprises that will transform themselves into better forms by becoming "more intelligent".

"Intelligent" in this context is perceived as the capability of a business entity to exploit emerging business opportunities and to adapt its operations to changing market conditions. It is also perceived as the capability of a business entity to sense its environment, to understand the situation, and to adapt its business objectives and behaviour accordingly. Enterprises form strategic partnerships with other enterprises "[…] to create dynamic business ecosystems" (Delic and Dayal 2002), that will be self-managed, self-configured and self-optimized. Adaptation can be identified as a key behaviour derived from the behaviour of natural systems. Both systems, natural and business systems, share the same ultimate objective: to survive in an evolving environment and changing circumstances (Delic and Dayal 2002).

Survival in an evolving environment is also a question of how far away is the actual business reality today from the future dynamic business ecosystem. Currently, new efficiencies can be mainly achieved through automation of core business processes, and exploitation of knowledge. In this connexion popular concepts are customer relationship management (CRM), enterprise resource planning (ERP), enterprise application integration (EAI), and enterprise knowledge management (EKM). In essence they encompass enterprise activities aimed at improving efficiency or injecting intelligence into operations (Delic and Dayal 2002). The mission is offering interfaces for integrating proprietary information systems from both internal perspective and external perspective encompassing integration of respective business partners, suppliers, and customers into the enterprise's own operations. In consequence, enterprise's borders are blurring, turning into fuzzy and dynamic borders.

Today, many research endeavours noticeably gravitate around the realisation and problems related to the implementation of concepts mentioned above. Common denominator and underlying problem of many business endeavours can be summarised in the appropriate combination of two extremes: self-organisation versus extrinsic organisation; or more general evolution versus organisation.

This vision sets clear targets for our research endeavour. After having motivated the background of our research, actual needs and aims of this research are further elicited in the following.

Collaborative Networks

Further flexibility and interoperability of the underlying ICT infrastructure is expected to have a tremendous impact on the ways business is conducted. Semantics and related technologies are expected to be of growing importance and are an important enabler for the scenario described above. Enterprise modelling has to respond to these developments through the development and take up of appropriate technologies, methods and tools. Subsequently, we look at important characteristics and show possible ways forward for the development of intelligence of and emergence of structures in business networks.

Collaborative Networks as research discipline are facing noticeably a renewal of interest due to newly emerging trends such as Web2.0 and other emerging paradigms of future applications and software architectures. Strong communities emerged which address in particular research topics and questions related to collaborative networks. (Camarinha-Matos et al., 2002 - 2006). From a network perspective, linkages and related relational processes and structures are subject of analysis. The need of a comprehensive scientific framework of collaborative networks (see Figure 2) is argued facilitating to structure interdisciplinary research activities towards common goals and visions. Subject of analysis are related interactions at the level of individuals, teams (or groups), organisations, networks and communities. It supports evolution of dynamic networks and self-organisation of network entities. The required emergence of relational structures re-quires specific services within collaborative networks.

Conceptual Model of Digital Business Ecosystems

Three stages towards a digital business ecosystem as already highlighted can be realized in literature (see Figure 1). Research described so far addressed foremost the scenario at stage 1. At this stage a centralised model for the business partner profiles (BPPs) is applied. These profiles represent information required to discover, select, and integrate business partners preferably dynamic, on demand into emerging or existing value chains. Business partners that can be accessed through the ICT infrastructure are limited to information stored and accessible through the registry in form of an Enterprise Portal of the domain network.

Current research gravitates around the realisation of the scenario shown at stage 2. At this stage, a decentralised model is developed. BPPs are no longer stored centrally in an information portal. These profiles are stored decentralised but are created on basis of a shared conceptual model in form of a domain ontology. Business partners maintain latent business relationships solely within the boundaries of business network they have registered to. Boundaries of this network are defined by the number of registered users.

At stage 3, the approach strives for an advanced decentralised model that allows to contact and query business partners not limited to the boundaries of the defined network. Information desired for discovery and selection of business partners is retrieved beforehand through machines in form of agents or Web crawlers. The semantics of data in profiles has to be made explicit and has to be stored in a machine-processable form.

Conceptual Framework

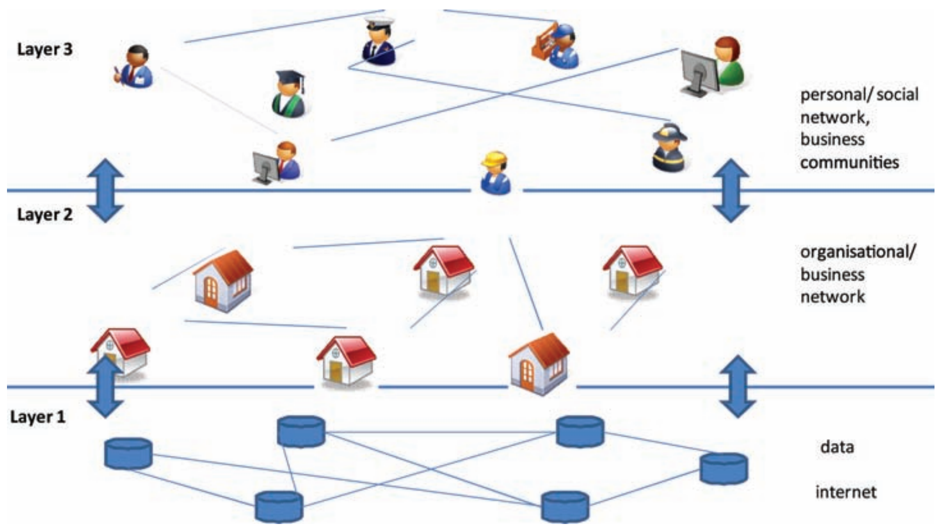
Our work follows the approach to assess decision criteria in order to support the self-formation and self-organisation of adaptive business networks. Based on a centralized approach with a shared explicit data model for the BPPs as "fingerprints", it is looked at further development of this approach to fulfil the envisioned scenario and requirement at stage two and three of our model. Thus, profiles are again regarded as a major concept which we will uptake. Profiles as a concept to store collaborative data will be the major approach we follow. Profiles are based on an ontology-based model (based on an ontology structure) which has been developed on basis of an empirical model encompassing important dimensions for configuration and analysis of business relationships (Weiß 2007).

BPPs are stored either in a central or a distributed database for retrieval and for further analysis. Klink (2006) investigated how information retrieval query techniques can be used to extract concepts from various information resources. Thus, the results of this research flow into our conceptual framework. As shown in Figure 1, we have to deal with some difficult questions and challenges for realising the scenario described at stage 2 and stage 3. Information retrieval as a core discipline seems to have some answers to these questions. Mainly, these questions relate how to deal with different semantics of semi-structured (Web) resources.

There are "[…] multiple theoretical mechanisms that contribute to the emergence of organizational networks" (Huang et al., 2008). Huang et al. (2008) discuss:

[…] multi-theoretical, multilevel (MTML) hypotheses about the structural tendencies of networks. The study suggests that the social drivers for organizing networks in communities have diverse goals such as exploring new ideas and resource, exploiting existing resources and capabilities, social bonding, mobilizing for action, and rapid

Figure 3. Electronic business relationships



response (or "swarming"). These drivers have different levels of impact within and across communities and hence change the mechanisms of recommender systems. For example, looking for a quick solution and producing innovative ideas will result in completely different recommendation systems" (Huang et al., 2008).

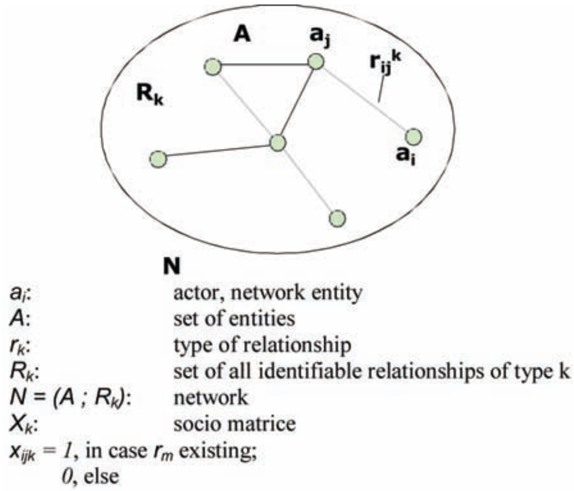
Figure 3 shows three perspectives or levels to analyse business communities. It can be assumed that the rapid emergence and growing popularity of online communities to initiate, manage and maintain business relationships will have tremendous impact on the way business is conducted in the future. The astonishing success of online community portals as Xing[6], LinkedIn[7], Plaxo[8], etc. underline these developments and further motivate the vision of collaborative networks which are self-managed, self-configured and self-organised – a behaviour that can be summarised as a sort of "intelligence".

This relates to the ability to create structures in a self-organised way. This behaviour is often characterised as "emergence"[9]. Looking at concepts and ideas that stand behind emergence would be interesting but shall and can not be covered in the given scope of this chapter. We stress that the basic understanding of self-organising processes is required to come up with any solutions and thus need to be analysed in detail to be clearly understood. Network abilities as "self-reference" and "emergence" are key concepts to be primarily looked into.

Organisation research has identified this as an interesting topic since decades (see for example (Sydow, 1992), (Krystek, 1997)). With the emergence of new ICT technologies and new trends and developments, e.g., concepts discussed as SOA and Web 2.0, bring this fundamental research work back again into the foreground and many technical and conceptual elements can be derived. This applies as well to the fields of information retrieval and social network analysis. (See Figure 4)

Social Network Analysis has emerged as a key paradigm in modern sociology, technology, and information sciences. The paradigm stems from the view that the attributes of an individual in a network are less important than their ties (relationships) with other individuals in the network. Exploring the nature and strength of these ties can help understand the structure and dynamics

Figure 4.



of social networks and explain real-world phenomena, ranging from organizational efficiency to the spread of information and disease. (Dasgupta et al., 2008)

Let us come back to central question which we already posed previously in this chapter: *how far are future dynamic business ecosystems from real business reality?*

For answering this difficult question, let us have a look at current developments, in particular in the field of online communities and social network analysis. The latter has gained tremendous popularity and revival due to growing importance of collaborative networks.

The selection of business partners is to be seen as key to success for the realisation of dynamic business ecosystems in near future. Therefore, business relationships need to be conceived increasingly as intangible asset of an enterprise that needs special care. Namely, they have to be maintained continuously through an adequate management. Thus, the areas under investigation are relational ties and enabling organisational structures and cultures in the light of aspired intelligence and ability of systems to self-organise (Weiß, 2007).

There is an obvious need to construct complex data structures to express the complexity of business related information. Besides, there is a need to be able to access these complex data structures and extract relevant information from them within a specification of requirements (Field and Hoffner, 2003).

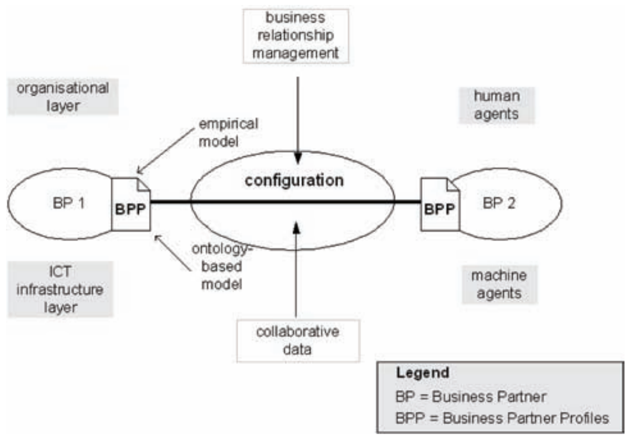
Figure 5 depicts the core of the research approach. The configuration of business relationships takes place primarily on the organisational layer. To involve the ICT infrastructure collaborative data has to be represented in machine-processable form. This can be realised using ontology for structuring and modelling of the BPP. Profiles are a prominent concept also used by Web services to store service descriptions.

Therefore, this is seen as an appropriate way to approach the problem at hand. BPP are anticipated to bridge the existing barrier between the organisational and ICT infrastructure layer. Through the application of ontology, collaborative services as, e.g., for discovery and/or matching of BPP can be used to support the self-reference and emergence of collaborative structure and cultures. Especially zones of trust can be established with filtering collaborative information and an intensified interaction and information exchange of business entities in advance of concrete business endeavours (Weiß 2007).

For analysing a social network of business partners and their relationships we use the following basic definitions based on typical concepts used in social network analysis:

More concrete, in contrast to classical network analysis our approach is to introduce different types of relationships r_k. In this way we describe business relationships using a multi-dimensional model. In case a relationship type is existing x_{ijk} has the value 1 in the socio matrice, else 0 indicates that this type of relationship does not exist (Weiß 2005, 2007). Various other types of matrices are used to display interactions and connectivity of network nodes (see e.g., Musolesi et al. 2007; Wassermann and Faust 1994; Scott 2000). (See Figure 6)

Figure 5. Design of approach for business partner relationship management with ontology (Weiß, 2007)



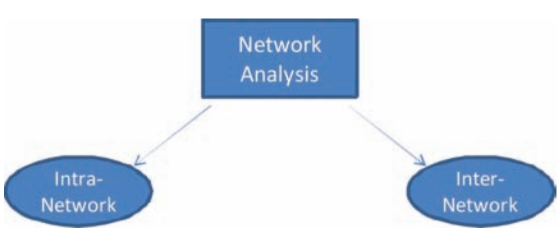
Measurement

The measurement is realised on basis of an empirical model which lays the foundations for later configuration of business relationship. In the following we look at the empirical model which aims analysing the network structure. The network structure encompasses network entities and relational ties between them.

The analysis framework distincts two views: intra- and inter-network view. The intra-network analysis looks at entities inside the network. One particular challenge in analysing business networks is to define boundaries of a network. For this purpose social network analysis offers various techniques how this information can be extracted from business cases.

Network analysis looks at the network itself without describing the quality of the relationships between entities. Presented model delivers additional dimensions which allow analysing business relationships in more detail.

Figure 6. Empirical model for network analysis



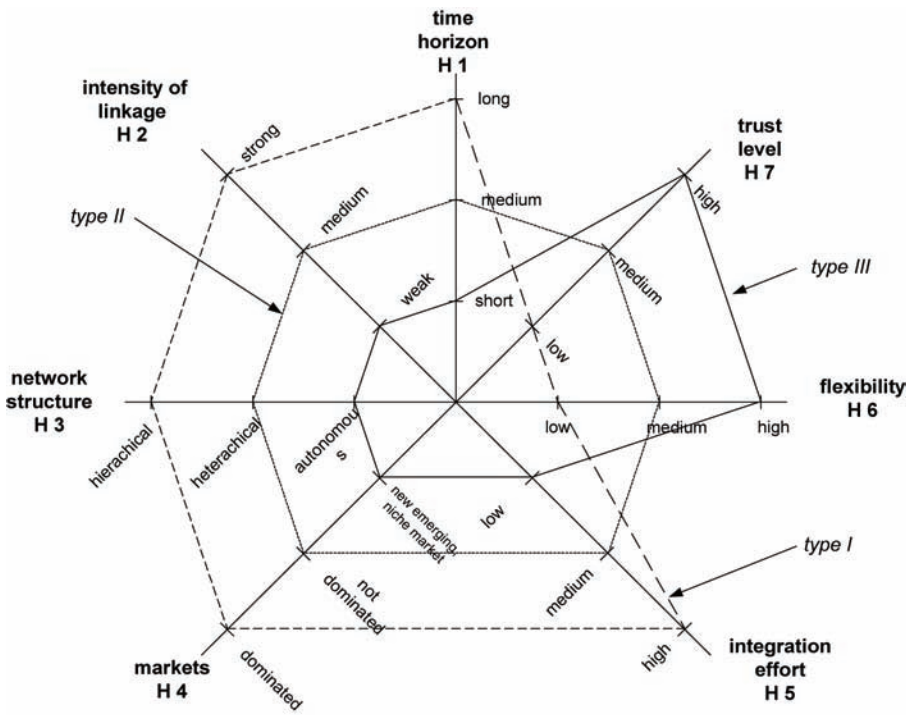
Inter-Network Analysis

The inter-network analysis looks at characteristics of relationships between companies. The perspective is not restricted to boundaries of a network. The measurement assess collaborative about preferences and behaviour of companies (in retrospect). The analysis framework delivers information concerning the configuration of business relationships. Based on this profile the entity is able to find business partners in the network corresponding to their collaboration requirements.

Figure 7 displays in a diagram the seven areas or dimensions that are analysed: flexibility, time horizon (th), network structure (ns), intensity of linkage (il), market (m), trust level (tl), integration effort (ie). Each dimension is supported by a hypothesis which expresses the assumptions made.

The aim of this analysis is to classify network entities according to the given seven dimensions. Quantitative values are aggregated to qualitative values in the range of low, medium and high. How this information is processed will be looked

Figure 7. Dimensions of inter-network analysis (Weiß 2007, 2005)



at later on in more detail. Table 1 describes three types of "idealised" network types which span a "continuum of virtuality" according to which cases can be classified and positioned. For more details about development and information about the empirical model readers are recommended to consult (Weiß 2005).

Intra-Network Analysis

Inter-network analysis mainly can be seen as "external" perspective having the network company or entity in focus and its cooperation behaviour and preferences. Whereas, intra-network analysis complements our measurement with an additional "internal" view. From this perspective, we are interested to analyse existing network ties within boundaries of an identified business network within its boundaries. But, defining boundaries of a network is a difficult task (Scott 2000), (Wasserman and Faust 1994). While the inter-network perspective determines the co-operation behaviour in retrospect, the intra-network perspective aims analysing the degree of strategic fitness between network partners. Dimensions for the analysis are: roles in network, information exchange performance, co-operation, goal definition, profit share, success, goal binding. Again, quantitative values of variables are aggregated to qualitative values in the range of low, medium, and high. Later on, we will primarily look at the seven dimensions of the inter-network analysis. Nevertheless, implementing the intra-network analysis follows the same principles.

Ontology-Based Model

"*Ontologies are a formal conceptualization of a particular domain that is shared by a group of people*" (Maedche, 2002). Social network analysis combined with ontologies offer new ways to analyse and to deal with collaborative information of networks. Available methods, techniques and tools have considerably improved during the last years, namely KAON[10] and Protégé[11].

Table 1. Types of network partnerships, based on (Weiß, 2005)

Type	Description
Type I	long term oriented partnerships focal partners dominate (contracts) optimisation of the supply or value chain high intensity of linkage (contracts) high level of integration centralised network structure main objective: efficiency
Type II	dynamic project oriented partnerships heterarchical network structure latent business relationships loosely coupled partnerships main objective: efficiency and flexibility Web-based portals and collaborative solutions democratic structures (code of conducts, constitutions)
Type III	spontaneous, temporary partnerships main objective: flexibility business opportunities at short term Service-oriented architectures win-win-driven

In the following, the empirical model presented above is transformed step by step into an ontology structure.

An ontology structure O is defined is a tuple $O = \{C, R, H^C, rel, A^O\}$, where (Maedche 2002):

1. C is a set whose elements are called concepts.
2. $R \subseteq C \times C$ is a set whose elements are called relations. For $r = (c_1, c_2) \in R$ one may write $r(c_1) = c_2$. C and R are two disjoint sets.
3. $H^C \subseteq C \times C$ is a concept hierarchy in form of directed relationship $H^C \subseteq C \times C$, also called taxonomy. $H^C (C_1 \times C_2)$ means C_1 is subconcept of C_2.
4. *rel*: function $rel: R \rightarrow C \times C$ which sets to concepts in non-taxonomic relationship
5. A^O is a set of axioms on O expressed in an appropriate logical language, e.g., FOL.

To cope with the lexical level, the notion of a lexicon is introduced. For an ontology structure $O = \{C, R, A^O\}$ a lexicon L is defined as $L = \{L^C, L^R, F, G\}$, where:

1. L^C is a set whose elements are called lexical entries for concepts.
2. L^R is a set whose elements are called lexical entries for relations.
3. $F \subseteq L^C \times C$ is a reference for concepts such that: $F(l_C) \{c \in C{::}\ (l_C,c) \in F\}$ for all $l_C \in L$; $F^{-1}(c) = \{l_C \in L^C{:}\ (l_C,c) \in F\}$ for all $c \in C$.
4. $G \subseteq L^R \times R$ is a reference for relations such that: $G(l_R) = \{r \in R{:}\ (l_R, r) \in G\}$ for all $l_R \in L^R$; $G^{-1}(r) = \{l_R \in L^R{:}\ (l_R, r) \in G\}$ for all $r \in R$.

In summary, ontology can be formally defined to be a structure O. Whereas, L is a corresponding lexicon. Ontology structure O represents an explicit specification of a conceptualisation of some domain. Agreed vocabulary is delivered through lexicon L and allows communicating about this formal conceptualization.

Collaborative data stored in BPP builds the knowledge base of the network about characteristics of network entities, available capabilities. It is important to understand the relations between ontology and knowledge-base. Ontology aims to capture the *conceptual structures* of a domain consisting of intentional logical definitions (characteristics that distinguish concepts). Whereas, a *knowledge-base* aims to specify a concrete state of the domain comprising of extensional parts (entity instances).

At this stage of development, the resulting model does not intend to fulfil the criteria of the formalism presented above. We derive a full-fledged ontology-based model with maximum of expressivity. Aim is to realise a complete transformation of the empirical model into an ontology-based structure. We do not claim at this stage to fulfil all requirements of above defined ontology structure. Thus, the model processed maximum semantics and expressivity during modelling process without considering requirements of information processing through machines. At this stage of development human agents are in the foreground.

Ontology-based model includes concepts of ontology structure. The model does not fulfil formal requirements of ontology. Requirements for reasoning and inference have to be considered. This requires a further step of transformations so that these models fulfil requirements imposed such as OWL-DL, OWL-Lite and OWL-Full.

OWL is a family of richer ontology languages that enhance RDF schema. The simplest language is OWL-Lite, a limited version of OWL-Full that enables simple and efficient implementation. Finally, OWL-DL is a more simple subset for which reasoning is known to be decidable so that complete reasoners can be constructed on this basis, even if less efficient than OWL-Lite reasoners. OWL-Full is the full ontology language which is in theory undecidable, but in practice useful reasoners can be constructed (Motik et al., 2003), (Weiß, 2005). In order to achieve a better understanding of the measurement we describe the seven dimensions of the inter-network analysis (see Table 2).

The example following shows the dimensions of the inter-network analysis in OWL-notation. In the domain of network-company and typology we see the corresponding concepts subsumed under the object property typology is of the empirical dimensions or areas of measurement.

Example:

```
<owl:ObjectProperty rdf:ID="include">
  <rdfs:label xml:lang="en">typology is</
  rdfs:label>
  <rdfs:domain rdf:resource="#
    network-company"/>
  <rdfs:domain rdf:resource="#typology"/>
    <rdfs:range rdf:resource="#
      time-horizon"/>
  <rdfs:range
    rdf:resource="#Flexibility"/>
  <rdfs:range rdf:resource="#
    network-structure"/>
  <rdfs:range rdf:resource="#
    intensity-of-linkage"/>
  <rdfs:range rdf:resource="#
    Trust-level"/>
  <rdfs:range rdf:resource="#market"/>
  <rdfs:range rdf:resource="#
    integration-effort"/>
</owl:ObjectProperty>
```

Excerpt of BPP: Network Typology in OWL

Next, we continue looking at the structure of business partner profiles.

Business Partner Profile

Business partner profiles (BPP) may differ concerning their structure based on probably varying requirements resulting from type of network, type of involved organisations in a network and as well the objectives and last but not least the branch regarded.

The typical structure of a BPP looks as follows (see Table 3).

Table 2. Measurement – description of dimensions (Weiß, 2005)

no.	concept *network-company*	description/ measured as
1	time horizon	time frame or duration of co-operation (depends on co-operation objectives)
2	trust level	degree of information filtering (exchange of data/ information) degree of trust compensating/ substituting measures (such as control structures, contracts, formal agreements, etc.)
3	flexibility	ability to adapt to/ to react on external developments openness of the network (barriers for entering and leaving the network)
4	integration effort	system interfaces (data formats, standards, soft- and hardware, structure and business processes) case/ work item: complexity, variability, structuredness
5	markets	market structure and constellation in branches (culture: code of conducts, established structures, etc.) strongly influence the emerging structures of collaborative networks Characteristics of markets are maturity (stage of development), intensity of technology, discontinuities, intensity of competition, etc. emerging markets (such as bio-technology, nano-technology, etc.) dominated markets (dominated by multi-national companies, e.g. chemical and automotive industry, etc.) heterarchical markets (no dominating actor)
6	network structure	management of network way decisions are taken in the network hierarchical (focal partner) heterachical (democratic) autonomous (self-organisation)
7	intensity of linkage	measures/ means to control the network (such as contracts, financial and structural dependencies and influence, etc.)

In this chapter we concentrate on descriptions about requirements concerning strategy, structure (organisational) and culture.

Network entities are characterised within the object property “characteristic-is” with the following attributes:

```
<owl:ObjectProperty rdf:ID=
”characteristic-is”>
<rdfs:label xml:lang=
”en”>characteristic is</rdfs:label>
<rdfs:domain rdf:resource=
”#characteristic”/>
<rdfs:domain rdf:resource=
”#network-company”/>
<rdfs:range rdf:resource=
”#contact-person”/>
<rdfs:range rdf:resource=”#branch”/>
<rdfs:range rdf:resource=”#employee”/>
<rdfs:range rdf:resource=”#address”/>
<rdfs:range rdf:resource=
”#performance”/>
</owl:ObjectProperty>
```

(Excerpt BPP of property “characteristics-is” in the domain of concept “network company” in OWL).

Figure 8 shows in a diagram the realisation of the transformation of measurement metrics (empirical model). Despite the fact, that the perspective of intra- and inter-network perspective is illustrated, we focus on inter-network analysis (see right part of the figure).

As described in the previous section, the Semantic Web technology stack was applied for modelling. Figure 9 shows an excerpt of a business partner profile represented in RDF(S). Again, concepts “network company” and “strategic fit” are marked and information of business partners is stored in RDF. Now, that the BPPs containing

Table 3. Business partner profiles (BPP)

topic/ area	description
drivers business relationship	strategy: strategic factors to configure business relationship
	process:b2b-integration concepts and -standards
	information system: description of interfaces, data formats, standards, etc.
output	standardised output of business relationships
partner-specific requirements	needs and preferences concerning strategically, structural, cultural configuration of the business relationship
specific set of co-operation requirements	information concerning implementation of collaborative business processes and collaborative information systems

meta data has been explained, we are looking next at some concrete examples. In this way, underlying principles of the approach chosen are pointed out (Weiß 2007).

At the beginning of the chapter we have described the scenario of digital business ecosystems providing context and background of this research. Figure 1 displays three development stages on the way to electronic networks in the sense of digital business ecosystems. Today, the challenge for electronic networks exists in dealing with resulting complexity of a multitude of social ties, explicit or implicit, latent or activated linking the network nodes.

Weiß (2005, 2007) presents a solution for the scenario illustrated at stage 1. In this scenario a centralised repository or data base is used to store the collaborative data. Despite the fact, that BPP are build as "fingerprint" of network entities, semantics of data relies on a shared data structure or model. On stage 2 collaborative data is no longer stored in a central repository but decentral in BPPs which are possibly part of company's Web site, or any other location on the Web such as portals of online communities, etc. In this scenario which is already far more challenging with regard to processing of collaborative data we still use a common conceptualisation or data model for describing data stored in BPPs. At stage 3 which constitutes from our point of view the most challenging scenario, we have to deal in contrast with different semantics and data structures. Thus, collaborative data stored in BPPs can be retrieved but not interpreted without semantic annotations or meta data describing the retrieved data entries. (See Figure 10)

Whereas, scenario one can be solved with classic data base techniques, the latter scenario requires explicit semantics at stage of processing of retrieved collaborative data. We envision that this meta data is stored in ontologies which describe the data structure and data stored in BPPs. Techniques of information retrieval are therefore analysed as this discipline has already methods and techniques which fulfil our requirements.

The values of variables before stored are aggregated to factors as e.g. trust level according to predefined rules that are as well stored in the ontology-based model. Questionnaire is as well modelled as ontology structure with the subconcepts questions, answers and code. The latter concept contains the appropriate rules how the answers of respondents that are stored as values of variables are to be aggregated to qualitative values (low, medium, high). To determine the degree of similarity of two different profiles relative distances of values are computed. In order to achieve best possible results the stored original values of respondents are applied.

Figure 11 depicts the reference ontology. Company profiles are assessed using a Web-based questionnaire. Profiles are stored as instances of the reference ontology.

Figure 8. Business partner profiles

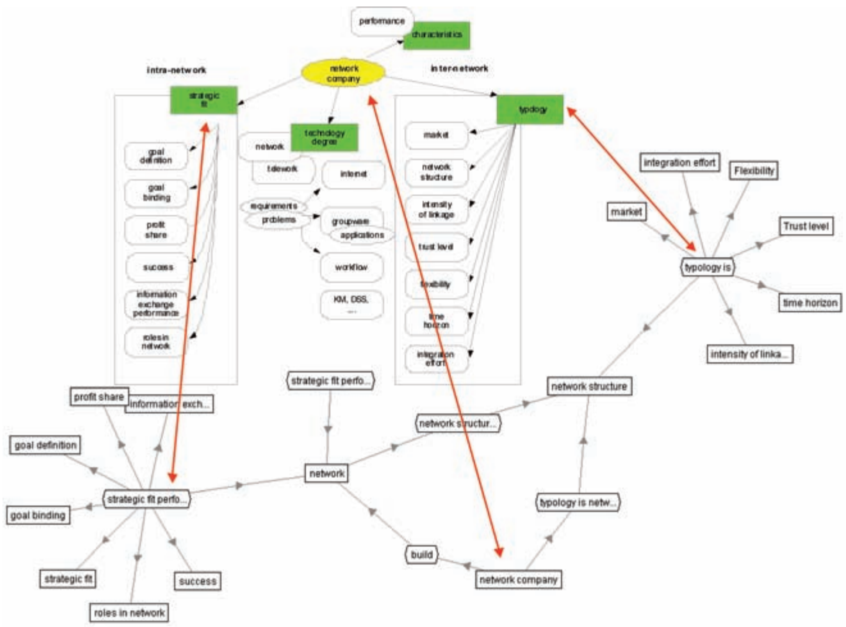


Figure 11 shows a contact person "Hubert" with contact details. "Hubert" is working for a network company "EBV-Elektronik" has a function "others". The strategic fit of the company is medium with regard to the defined criteria. The ICT infrastructure is heterogeneous. The goal binding (gb) with the virtual organisations is medium. The company intends to cooperate in long term with business partners.

Figure 9. Business partner profiles

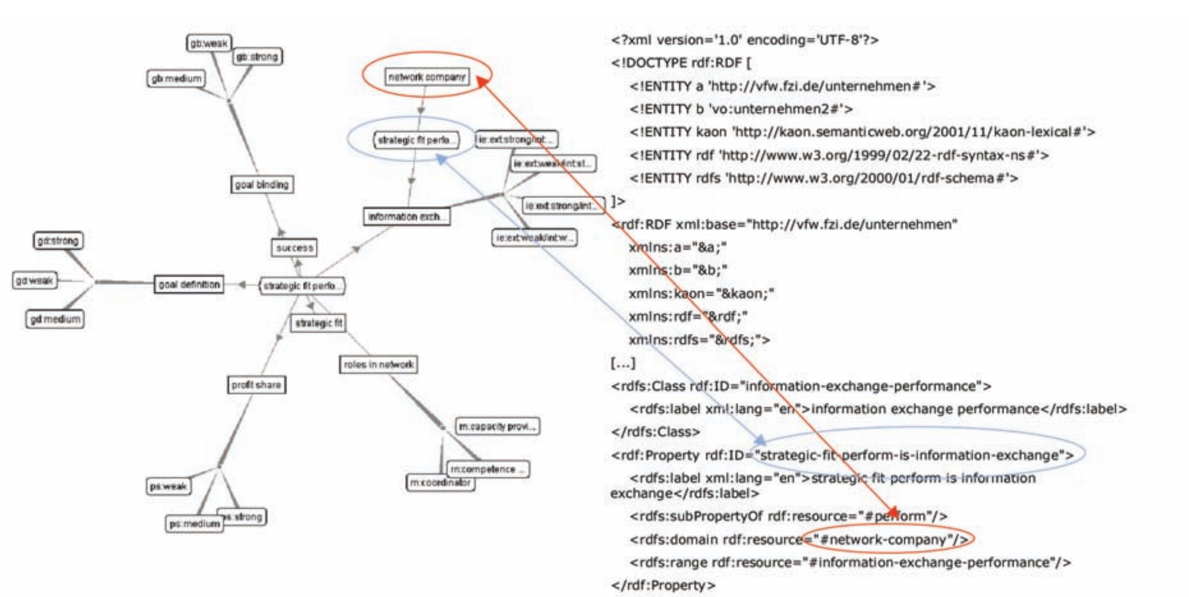
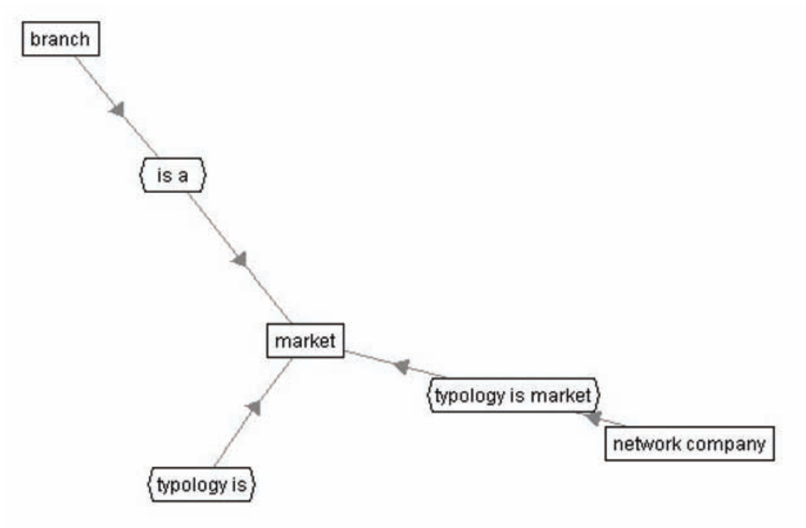


Figure 10. Concept „network company“ and concept „market“



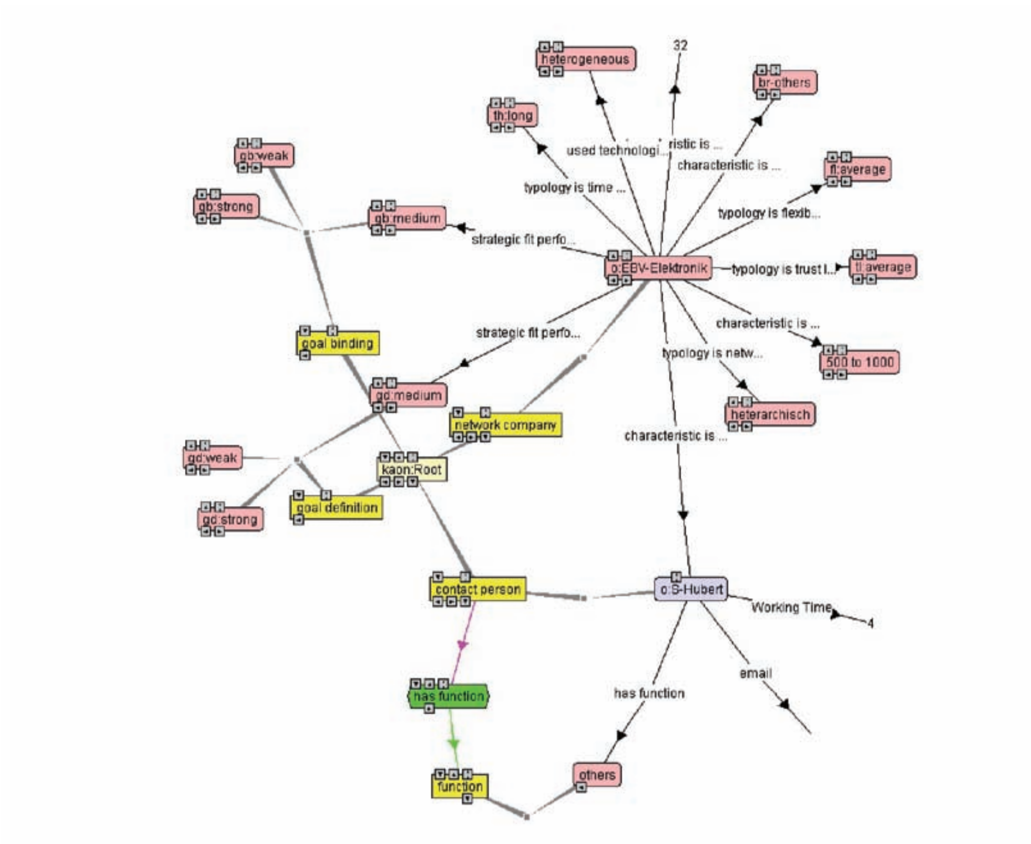
Use Case

Nowadays, cluster management gains momentum and turns out to become an important capability for economic development and management of regions. Following case shall underline the relevance of this research on basis of a concrete use case. Therefore, we describe subsequently cluster management as one possible application scenario to which presented conceptual can be applied to.

Today, cluster management is discussed in the light of regional development and building clusters of excellence and innovation. One important element of cluster management is to set up a central portal which collects and provides information about capabilities, competences, technologies, contacts, etc. in a particular region. Aim is establishing an infrastructure (according to what we have shown in the figure at the beginning: network layers, services, etc.) which supports the interaction of organisations and fosters development of a digital business ecosystem.

In Figure 3 we have already shown the three different layers (personal/ social network (1), organisational network (2) and data sources/ Internet (3)). Following use case describes a real life application scenario in the technology region Karlsruhe. In our region, social networking amongst companies is supported with various organisations. Industry and education, but as well governmental bodies build relational ties. However, what we find are rather small sub-communities which emerge on basis of personal networks and regular physical meetings. It was decided to support the "networking" and interaction of companies electronically with collaborative services. A research group has been established which is currently looking at the design of such collaborative services. Aim is to set up an infrastructure which allows relational ties to emerge. In total, four collaborative services have been considered to be crucial: (1) search for new business partners with required competences, (2) interact with business partners to plan future activities on basis of collaboration scenario, (3) skill/ competences database (in the form of an inventory what is available in the region, (4) classification of network entities by means of standard classification frameworks so that companies can be found in and beyond boundaries of the region or network. Figure 2 presented a possible framework for collaborative network's infrastructure.

Figure 11. Descriptors of concept "network company" in OI-Modeller



The following questions occurred in the process of project planning: *How and who collects collaborative data required? How will it be stored? Shall information be stored in a central repository (data base)? How can this information be explored? Who keeps this data up to date? How can networking be catalysed relational ties to emerge?* Most of these questions are related to designing collaborative services which access and process the collaborate data. In the following, we look in particular at discovery and matchmaking of business partners which shall be seen as basic concepts for design and implementation. We describe how a possible solution and process shall look like. First, we will present the conceptual base on which base we can achieve required services. Then, we sketch how the solution can be implemented and provide an outlook about next steps and future work.

Looking at the scenario shown in Figure 1, we envision a solution fulfilling the requirements at stage 3. This means that collaborative data is stored decentral in profiles. The profiling process is realised using a self-auditing tool, which supports companies to assess necessary data and to build a BPP. Companies which have no BPP can not be searched and consequently, not processed by collaborative services, because no data is provided to feed discovery and matchmaking services. Profile of a company contains ideally information as shown in Table 3.(See Table 4)

BPPs are stored on the Web site of a network company. Thus, collaborative data is kept up to date by the companies itself. Furthermore, this reduces

Table 4. Example BPPs for cluster management

no.	**company details** *(set of attributes: name, location, address, contact, Web site, etc.)*	**branch** *(branch code based on international classification systems, such as NACE)*	**business** *free key words or reference to classification system*	**products/ skills** *classification system such as eCl@ss, UNSPSC, ETIM, etc.*
1	company a	J62.0.1	software, data base, data warehouse management software	19-21-02-11[1] 19-21-02-90 19-23-20-02
2	company b	J62.0.2	systems analysis (IT consulting), software consulting	25-26-12-01 25-26-12-03
3	company c	C33.1.3	industrial maintenance, facility management, equipment f. NF metal production (maintenance, service, unclassified)	25-04-90-90 18-03-98-90

the amount of data to be stored in a central data base. Boundaries of digital business ecosystem are then determined by the reach of their collaborative services and their ability to interpret collected data. Semantic Web technologies, namely ontology, are able to overcome existing barriers by combining with retrieval techniques all over the world. The Internet provides the required infrastructure and new possibilities. Figure 12 shows the ontology as OI-Model with its sub-concepts and related properties.

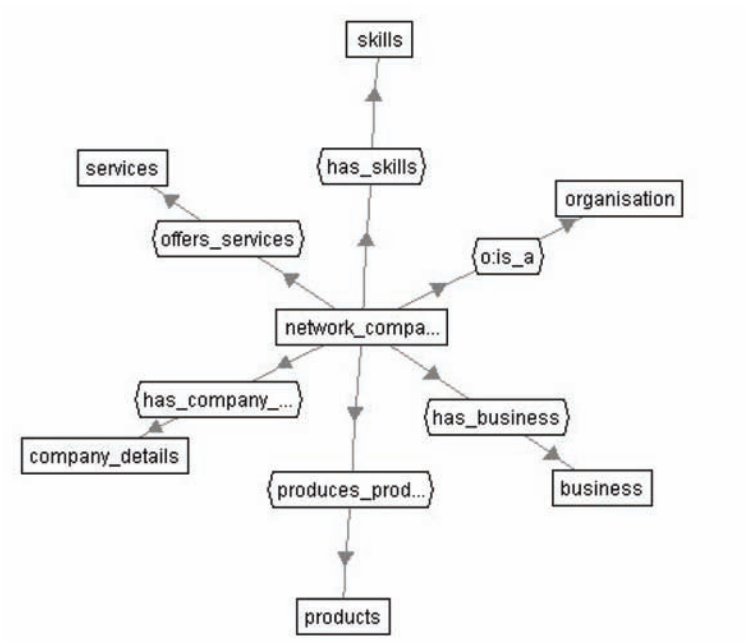
Primary information to be retrieved is data about location and capabilities of a company. This comprises as well offers of companies which can be imagined to be accessed automatically through respective Web services.

“Company_details” encompass attributes describing the company such as name of company, contact details, etc. Branch of company is described through an international branch encoding system. Business area can be either described by free key words or a key word system such as a classification system. Products and skills are characterised through descriptors taken from product and service classification systems such as eCl@ss[12], ETIM[13], NACE[14] and UNSPSC[15] or skills/ competences frameworks (such as European e-Competences Framework[16]). Alternatively, e-catalogue systems can be considered to offer more detailed product descriptions and pricing.

Example:

```
<rdf:Description rdf:ID=
”i-1215196224343-14 37321528”>
  <rdfs:label xml:lang=”en”>&lt;250</
  rdfs:label>
  <rdf:type rdf:resource= “#i-
1215195995953- 804103291“/>
</rdf:Description>
<rdf:Description rdf:ID=“i-1215195733390-
1851815013“>
  <rdfs:label xml:lang=”en”>software</
    rdfs:label>
  <rdf:type rdf:resource=
    “#i-1215195709953-1675840637“/>
</rdf:Description>
<rdf:Description rdf:ID=
  “i-1215195749093-1608225750“>
  <rdfs:label xml:lang=“en“>industrial
    maintenance</rdfs:label>
    <rdf:type rdf:resource=
      “#i-1215195709953-1675840637“/>
</rdf:Description>
<rdf:Description rdf:ID=
  “i-1215196111906-834053317“>
    <rdfs:label xml:lang=
    ”en”>www.company_b.com/rdfs:label>
  <rdf:type rdf:resource=
```

Figure 12. Descriptors of concept "network company" in OI-Modeller




```
    "#i-1215196009640-1874633493"/>
</rdf:Description>
<rdf:Description rdf:ID=
  "i-1215195764203-541590209">
  <rdfs:label xml:lang=
    "en">IT consulting</rdfs:label>
  <rdf:type rdf:resource=
    "#i-1215195709953-1675840637"/>
</rdf:Description>
<rdf:Description rdf:ID=
  "i-1215196087062-279141706">
  <rdfs:label xml:lang=
    "en">www.company_a.com/rdfs:label>
  <rdf:type rdf:resource=
    "#i-1215196009640-1874633493"/>
</rdf:Description>
```

(Excerpt of BPP of concept "network company": Instances of concepts).

The example illustrates in which way data and information is accessible for collaborative services. Each concept, property and instance can be located with a unique identifier (URI).

RESULTS/RESEARCH

In this section we will discuss the elements of our conceptual framework. First, trust in electronic networks is looked at, before two collaborative services are regarded in more detail, namely discovery and matchmaking. Those kinds of services support business partners to search for business partners in a pool of potential business partners. Matchmaking services support the decision making process through comparing the profiles of the querying company with profiles of other companies. The collaborative data is processed and the degree of similarity expressed as "strategic fit" is determined.

Trust in Electronic Business Networks

Giving a comprehensive explanation and a discussion of trust in electronic business networks is far beyond the scope of this chapter. But nevertheless, it is required to highlight how essential trust is for the success of "networking". Many authors believe that trust can replace contractual agreements and obligations between the network partners. However, business realities show us that most business partners still co-operate on legal basis and a normative document in form of a contract which regulates objectives, purpose, scope and rights and obligations in a co-operation of business partners.

The results yielded from empirical analysis have sustained that information, communication and trust are strongly correlated and inter-dependent (for example see (Jung 1999), (Bienert 2002)). Trust per se requires interaction of business partner over a longer period of time. Thus, some authors argue that relationships in a network are either latent or evident (activated). Latent relationships help to build required trust in business networks.

Commitment is another concept typically referred to in context of business relationships. Commitment expresses the degree of personal bonding, in the sense of the willingness of a network partner to invest in a business relationship in long term. This implies that drawbacks in the co-operation are eventually overlooked for the sake of a prosperous long term business relationship. Thus, commitment of a business partner expresses even stronger ties between network partners that those based on trust. Nevertheless, both terms are strongly interdependent and it is difficult to distinct them. Commitment requires trust that a business partner behaves in the expected way and in the interest of common objectives.

Against this background it becomes clearer that communication and interaction of business entities is vital for the process of trust building. They have to be supported already at early stage of co-operation. Networks rely per se on the personal ties between its members. They are essential for emergence of relational ties within a collaborative and innovation environment. Obviously, increasing dynamics in the interaction of business partners combined with shortening life-cycle of co-operations contradict the nature and actual needs of business relationships regarding trust and commitment. Both concepts occur over a longer period of time and necessitate stable relationships. Once trust is established it reduces opportunistic behaviour. This is substantiated by existing organisation theories as, e.g., transaction cost, principal-agent and property-rights (Picot et al. 2003, pp. 45; Sydow 1992, pp. 130).

Goal is to ease fast and easy docking and quick formation of network entities or new business partners. Whereby, evaluation criteria applied in discovery and selection process have been identified as main study area. Prior criterion to be applied in connexion with selection of business partners is offered business value and ability to complement knowledge, skills and competencies of the network. Aim is to enhance quality and to add value to existing or new products and/or services. As already been pointed out besides these "harder" facts, however, in particular "softer" aspects need to flow into the decision making process.

The proposed ontology-based framework for partner integration aims at developing and supporting trust building mechanisms. Trust building is, beyond any question, a complex issue that offers and necessitates different research perspectives and therefore has been subject to many investigations through different scientific disciplines (Weiß 2005, pp. 81). However, trust building evidently depends on the quality and intensity of communication and information exchange in a collaborative environment. This could be shown by empirical studies (e.g., Jung 1999, p.180; Bienert 2002, p.102). An ontology-based methodology is outlined that facilitates harmonisation and parallelizing of different cultures. In this way, a breeding environment comes into existence from which relational ties and organisational structures are likely to emerge. Moreover, the required characteristic and ability to self-organise are facilitated with self-reference and an initiated learning curve. In this way, a kind of "fingerprint" represents network entities by describing their co-operation ability and requirements. In a process of self-reflection and self-reference relational structures and cultures are then supposed to emerge (Weiß 2007).

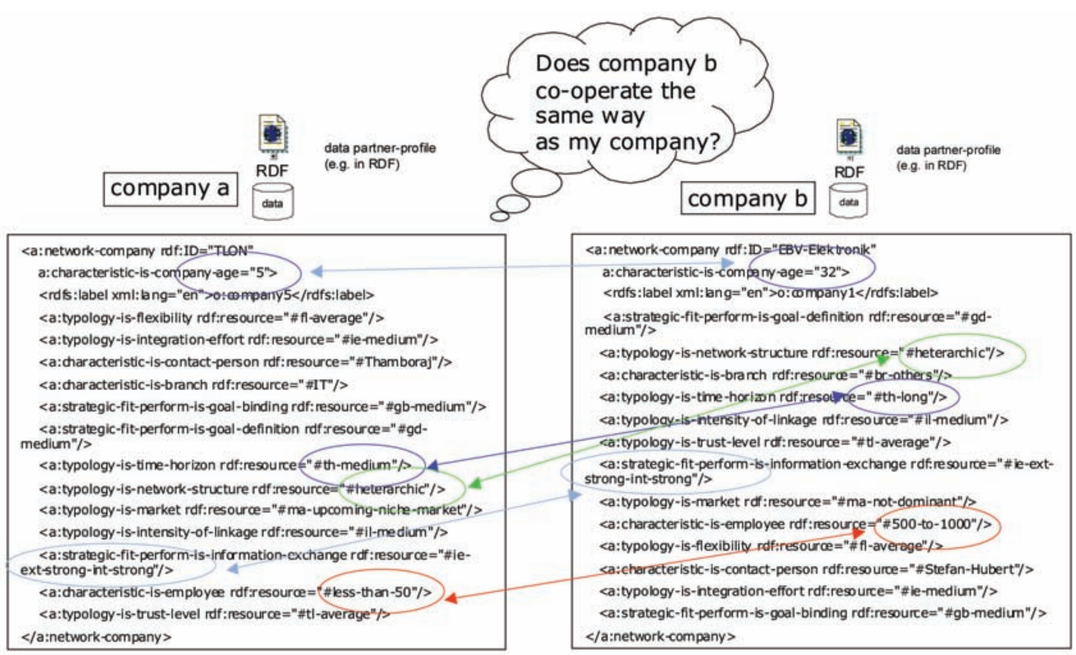
Discovery and Matchmaking

Network companies search for potential business partners using the query user interface of the demonstrator. As an advantage of using an explicit information model in form of an ontology based model, ODAMY is able to use semantic discovery to identify the best fitting partners based on the selected search criteria and applied weightings. Use of ontology brings service provider and service requestor to a common conceptual space and helps in semantic matching of requirements and specifications.

The fingerprint of a network company is produced using a formal explicit ontology-based model structuring criteria for measuring strategic partner fit. In this way, the underlying ICT infrastructure is capable for example to infer that a network company "has" a typology based on 'time horizon', 'integration effort', 'intensity of linkage', etc (Weiß and Maedche 2002).

In Figure 13 an excerpt of fingerprints of two network companies are shown and compared. Company **a** for example is looking for a co-operation with medium time horizon, whereas the network company **b** prefers to co-operate in long-term. The companies share the same conceptual model therefore the values are comparable. A matchmaking environment of a b2b integration technology architecture can process this information and may have discovered and selected business partners **b**. The iep of both companies is 'strong', the preferred network

Figure 13. Excerpt business partner profile (BPP) as "fingerprint" of a network company



structure is 'heterarchical' and the trust-level is 'average', intensity of linkage rated as 'medium' (see Figure 13).

Matching component shall retrieve those cases which show highest similarity with values of the profile of the querying organisation. In the following we look at the matchmaking component. Looking at the vision shown in Figure 1 (stages on the way to the digital business ecosystem) a possible solution retrieves data from BPPs centrally stored. On the advanced stage 2 and 3 we intend to expand the existing boundaries through application of information retrieval techniques.

As an advantage of using an explicit information model in form of ontology based model, it proposed approach enables using semantic discovery to identify best fitting partners based on the selected search criteria and applied weightings. Use of ontology brings service provider and service requestor to a common conceptual space and supports to realise semantic matching of collaborative information stored in the BPP.

Currently, we are investigating the application of different available semantic discovery mechanisms. Particularly, the matchmaking module still requires specifically further investigations and research efforts. However, researchers of different disciplines especially those working in the fields of SOA, electronic markets as well as Web services and business process modelling and management are currently looking into the possibilities to determine the degree of similarity of applied meta models. Therefore, it can be likely taken for granted that a variety of approaches and solutions will emerge soon and will add enhanced functionalities to an adequate matchmaking environment. The task is to search for an existing offer or offers that match each received search query. A central element of a matchmaking environment is the aspect of symmetry (Field and Hoffner 2003). Both sides send a profile that contains relevant data concerning description of the own entity and requirements that the other party must satisfy. According to Field and Hoffner (2003) the customisation of a related service of the ICT infrastructure results from coupling the availability of information from both parties with the ability to update some service properties dynamically.

In the current version of the demonstrator the similarity of profiles A and B is measured as sum of the distances measured of the normed values a_i and b_i of a specific theme i. For each query, themes can be selected from a list of available concepts that can be queried. Each theme i can be weighted in the range of 1 to 5 to enrich the query with individual preferences of the searching entity. The computation of similarity of profiles is described in detail in (Weiß, 2005, pp. 242). Related work of interest is the current developments in the field of Semantic Web services and matchmaking on electronic markets (Veit 2003).

Information Retrieval

As mentioned before, information retrieval techniques offer a huge field for analysing social networks (Klink et al. 2006) and for managing business information (Klink 2006) (Klink et al 2007). Discussing all bits would blast the scope of this chapter. But in particular, the fields of gathering and storing all kind of information and retrieving relevant information are still interesting topics in research which are discussed in various journals (e.g., IJDAR, *Journal of the American Society for Information Science*, etc.) and conferences (e.g., SIGIR, ECIR, ECML, CSCW etc.) and will be touched in the following.

Before a system is able to retrieve relevant information and thus becoming useful, specific information must be gathered from various sources. Especially in business environments collecting information/data and delivering relevant task- and context-specific information is vital (Holz 2005).

In our scenario of b2b environments the collected data is stored and distributed in BPPs. In the case of structured information with known semantic model, BPPs are created using a questionnaire and with the help of a Web-based self-auditing component. This case is described in paragraph 3.4.

In the case of unstructured information and unknown semantic model, BPPs have to be of such expressiveness that information retrieval techniques allow to gather information from unknown network entities (Klink 2006). In this way, network boundaries are expanded and we are able to establish business relationships with new business partners. Recently, business partners are hosting illustrative and informative Web-sites and it becomes a popular way to use Internet search engines for gathering information of potential business partners (Bergman 2000). But also for creating BPPs this is an elegantly way.

Using business Web-sites for gathering information has the advantage that these Web pages contain recent information because business Web pages are updated regularly. But the disadvantage is that Web pages contain unstructured and much information – mostly in textual form. Thus, the problem of information overflow arises (Klink 2004).

An interesting approach for handling the information overflow problem is summarisation. The huge amount of text is shortened and summarised to some paragraphs or some pages, respectively. Summarisation is one of the emerging fields of information retrieval and is a helpful tool for indexing huge amount of data in Internet search engines (Larsen and Aone 1999). In classical information retrieval summarisation is based on full-text data but recently research is more and more based on structured information and is using XML.

Weigel (2006) presents new structural summaries that enable highly efficient and scalable XML retrieval in native, relational and hybrid systems. The work shows that structural summaries significantly improve the efficiency and scalability of XML retrieval systems in several ways. Former relational approaches have largely ignored structural summaries. The results show that these native indexing techniques are equally effective for XML retrieval in relational database systems. Unlike some other labelling schemes, this system achieves high retrieval performance with a fairly modest storage overhead (see Figure 14).

Another interesting retrieval technique which is relevant to our approach using BPPs is called Case-Based Reasoning (Bergmann and Stahl 1998), (Bergmann et al. 2003). Case-based reasoning (CBR), as a sub-area of the field of knowledge-based systems, focuses primarily on problem solving by experience. It provides techniques for representing, storing, indexing, and adapting experience. CBR contributes a rich set of techniques which are highly relevant for experience management, particularly for the activities modelling, storing, reusing, and evaluating (Bergmann 2002).

The general procedure when applying CBR, is commonly described by the classical Case-Based Reasoning cycle introduced by (Aamodt and Plaza 1994) (see Figure 15).

The starting point of a new problem solving-process is a given problem for which a solution is required. This problem can be characterised as a new case for which the solution part is still unknown. This new case—often also called query—is then processed in four consecutive steps: retrieve, reuse, revise, and retain. The advantage of using CBR technologies is the learning ability of the system. The more the system is running and the more BPPs and ties to partners are created, the better and the more "intelligent" the system becomes.

Using CBR vocabulary, the cases in our scenario are the BPPs, the problem is finding an appropriate business partner and the solution is the best fitting business partner. More precisely, if some business is searching for appropriate partners then the BPP of this business is used as the new case. In the retrieve phase, previous cases (in our scenario similar BPPs) are searched in the (general) knowledge database. In the reuse

Figure 14. +Three-Level Model of XML Retrieval relates queries (top level) to their matches in the document tree (bottom level) and the corresponding hits in the schema tree (intermediate level) (Weigel, 2006)

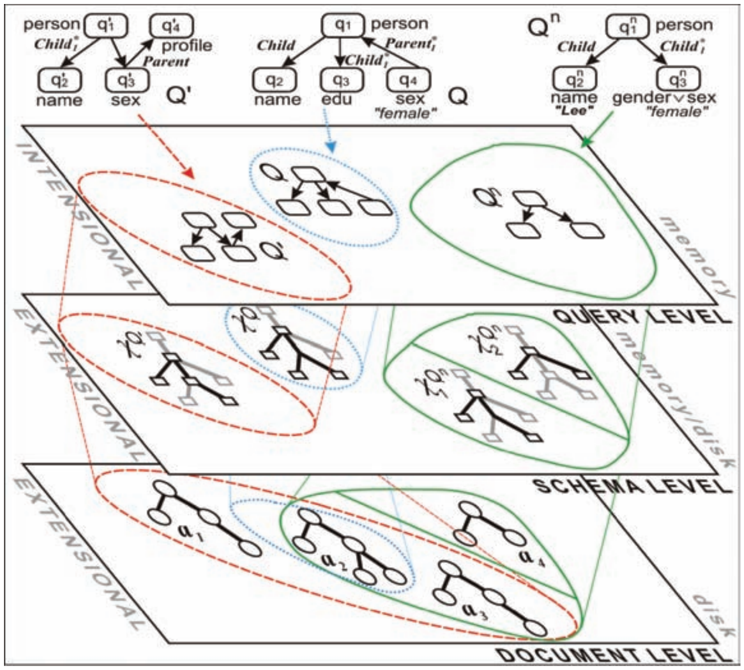
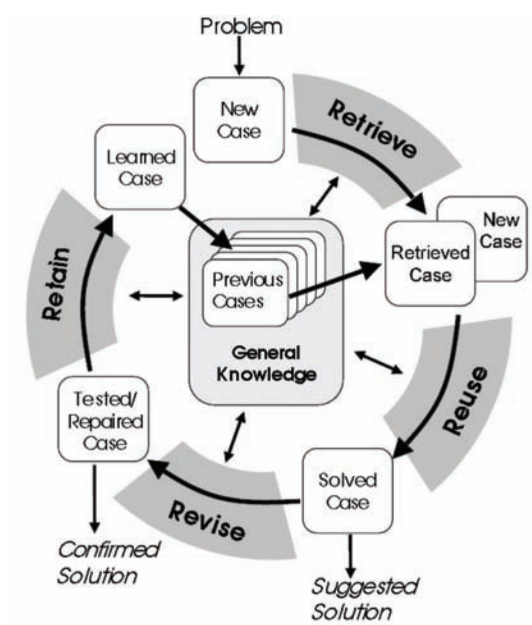


Figure 15. The Case-Based Reasoning Cycle by Aamodt & Plaza



phase, the solutions of retrieved cases are used, i.e. each stored appropriate partner is given as a suggested solution. If the solution is confirmed, then these partners are stored as the solution of the new case and the new (learned) case incl. the solution is stored as an additional previous case in the knowledge database.

Implementation

ODAMY is implemented using KAON infrastructure (KAON Dev. Guide 2003). KAON is an open-source ontology management infrastructure targeted for semantics-driven business applications. It includes a comprehensive tool suite allowing easy ontology management and application. Important focus of KAON is on integrating traditional technologies for ontology management and application with those used typically in business applications, such as relational databases. KAON consists of a number of different modules provid-

Figure 16. KAON tool overview (Gabler et al. 2004)

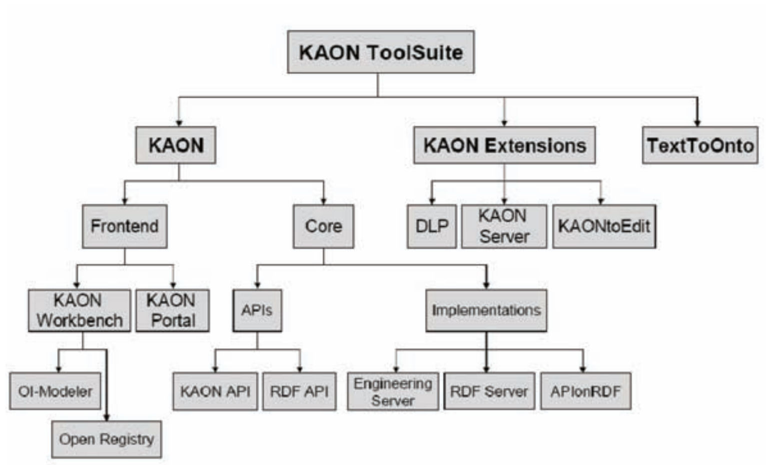
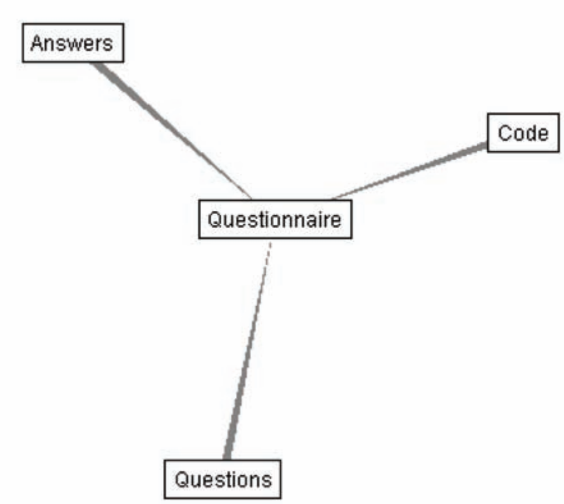


Figure 17. Concept "Questionnaire" and its subconcepts in OI Modeler



ing a broad bandwidth of functionalities centred around creation, storage, retrieval, maintenance and application of ontologies (Gabel et al. 2004). Typical model elements of KAON OI-Model are concepts, properties, property ranges (property-centric, several ranges), attributes (of type string). Min-max cardinalities are a feature but are depending on API implementation. In the following, we do not consider cardinalities for the modelling. Further features are lexical layer, modularization, evolution and meta-modelling. Main feature used for conceptual modelling is OI-Modeller (ontology editor). For implementing the self-auditing tool KAON portal is used. Figure 16 shows diagrammatically the KAON toolsuite.

BPP are created using a questionnaire which assesses the entry values for different variables. The value of these variables are then computed and aggregated according to predefined rules to values for the aggregated factor values. Figure 16 shows diagrammatically the three subconcepts which shall store assessed data set for each network entity. Concept "Answers" stores the response value for each question (variable). "Questions" contains the questions of the questionnaire. Concept "Code" assigns each value entry a classification code as class identifier.

Figure 17 shows parts of the ontology-based model: the concept "Questionnaire" and its subconcepts "Answers", "Code" and "Questions". This part of the model stores important information to deal with the life-cycle of a BPP. Entering the inter-organisational network corresponds to filling in the questionnaire and producing a BPP. Entities which do not possess a profile are not seen as part of the (electronic) network consisting of latent and activated network relationships. Once a

BPP is created collaborative services can be used to establish and maintain business relationship management electronically. In the light of steady increasing number of network nodes humans are no longer able to deal with resulting complexity. We see future networks according to (Krystek et al. 1997) as open, many inter-organisational relationships and of high reciprocity.

Referring to concept "Questionnaire", dealing with dynamics is an important feature in the given context. As already mentioned our work aims to develop a conceptual model which allows to design and develop collaborative services which are able to process the collaborative data stored in the BPPs.

In the following we explain how the model stores assessed collaborative data, and how this information shall be processed through services.

A Web-based self-auditing component supports a network entity in describing its profile. The auditing component consists of a questionnaire. The component has been realized using Java Server Pages and tag libraries which are directly connecting to the API of the KAON-Toolset. The created profile is directly stored as a set of instances into the ontology structuring the network (case base).

Having a look at following example which displays a typical data entry taken from the questionnaire. As shown, the topic is "intensity-of-linkage" as already described in previous section. "102053" documents the origin of the data entry and is stored as cross-reference of the questionnaire.

For each data entry (answers of respondent) an instance is produced in concept "Code" and stored in the ontology structure. For the instance a link or relationship is established with the concept "Answers" (number of the question within a topic in the concept and the concept "Questions". The stored answer is referencing to the respondent (in our case the network entity). In addition we have a concept "Rule" which stores information how the stored qualitative data has to be processed in order to achieve "qualitative" values. Typically, these values have the range low, medium or high (see Figure 7).

As our implementation is realised with KAON-Toolset, each data entry has a URI which provides the object with a unique identifier. As we have as well defined a respective namespace, the discovery of data entries is not restricted to borders of the regarded network.

Example:

```
<rdf:Description rdf:ID="102053">
  <rdfs:label xml:lang=
    "en">102053</rdfs:label>
  <rdf:type rdf:resource="#Code"/>
  <entry-with rdf:resource="#3"/>
  <entry-in-topic rdf:resource=
    "#intensity-of-linkage"/>
  <entry-in-question rdf:resource=
    "#Question5"/>
  <entry-in-complex
    rdf:resource="#typology"/>
</rdf:Description>
```

(Excerpt BPP of concept "intensity-of-linkage" in OWL: value entry of question 5 of the inter-network analysis).

CONCLUSION AND OUTLOOK

In this chapter we elaborated the conceptual basis for establishing and maintaining electronic business relationships. We overlooked current state-of-the-art of business networks and motivated future scenarios of digital business ecosystems. Growing popularity of business communities indicates a noticeable change and openness of business partners to publish information and data (far more than just contact details, comprising career steps, competences, and business interests).

Prominent communities are, e.g., LinkedIn, Plaxo or Xing, the latter with daily up to 30,000 users online. We highlighted that collaborative services supporting business networking and the management of business communities and networks, respectively, are demanded and are expected to have tremendous social impact on how electronic business will be conducted in the future.

The chapter motivated a development path towards digital business ecosystems comprising three distinct development stages. In particular, the scenario shown at stage 3 imposes interesting questions and challenges such as gathering unstructured and textual information from business Web sites.

Furthermore, we introduced business partner profiles (BPP) as an appropriate concept to overcome existing barriers of electronic networks. Limitations currently exist primarily with problems related to gathering and storing of all kinds of business and collaborative information. With the emergence and fast growing of business communities on the Internet, available amount of collaborative information is exploding and challenges current retrieval and analysis techniques. We highlighted some of these challenges and looked at how networks can be analysed from an inter-network perspective.

Additionally, we looked at information retrieval techniques, namely case-based reasoning and gathering of unstructured information. Ontologies are able to describe underlying data structures and semantics of data stored in BPP. Retrieval techniques allow gathering and storing information from unknown network entities and in this way enable supportive collaborative services to maintain electronic business relationships.

We presented a use case which highlighted a possible application scenario in the context of cluster management. Finding business partners and gathering information from business partners is an important task.

Business Web-sites are used for gathering information as they contain relevant business data in unstructured or textual form (typically in HTML or XML-format) but are updated regularly. However, businesses are hosting informative Web-sites containing plenty of information about competences, offerings, products and capabilities of a company. Thus, search engines have become a popular way to use the Internet as an infrastructure to maintain business relationships and to collect information about potential business partners. Ontologies provide required meta data to make information stored on business Web-sites more expressive and self-descriptive. Nevertheless, standards (such as NACE, UNSPSC, eCl@ss, etc.) and reference models (e.g., competence grids such as the European e-Competence Framework) shall be used to structure and reference contents of profiles. Besides, frameworks should be transformed by means of XML-based ontology languages as, e.g., OWL ontologies to serve the needs of our application scenario.

The use case at hand used existing classification systems for structuring and describing this information and data. Besides classification systems we used an empirical model to assess collaborative information from business partners. This information is stored in BPP to support emergence and postulated ability of business networks to be self-descriptive in order to distinct themselves from their environment (an ability called "self-referencing"). Both characteristics are foundations for self-organised systems. Collaborative services primarily aim at supporting self-organisation as it can be seen as one of the key drivers of digital business ecosystems.

Another strand we looked at is case-based reasoning. Case-based reasoning provides techniques required for implementing our collaborative services. It provides the ability to learn from daily experience and to induce intelligence in collaborative services not exclusively related to business relationship management by building required knowledge-bases.

The chapter provided answers primarily on conceptual basis but was at this stage not yet able to provide a proof of concept. For implementation of the presented approach we use KAON infrastructure. Ontology development tool sets have matured during the last years. KAON tool set is used to build BPP by means of a self-auditing tool which uses a standardised questionnaire. With regard to implementation of a software prototype, we envision in a next step further implementing the use case "cluster management" referred. For this purpose BPP profiles have to be build and implemented in a lab environment to apply state-of-the-art query and retrieval techniques. State-of-the-art techniques of information retrieval and Semantic Web have to be combined with methods of social network analysis.

The chapter described and discussed necessary foundations for discovery and matchmaking services. Fast growing acceptance and maturing of business communities will offer interesting use cases for analysis and further research activities. One of the biggest challenges ahead is to learn and to substrate necessary theories and methods from real life cases.

At the beginning of the chapter we have introduced a framework structuring the research area. The framework highlights required interdisciplinary nature of our future research design. Next step to be done is to use the self-auditing tool to build BPP. This will allow working with real life data and to set up a lab environment to analyse, explore, and validate presented concepts.

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ENDNOTES

1. Ontology-based Business Partner Relationship Management Methodology
2. Universal Description, Discovery and Integration
3. Electronic Business XML
4. EDI = Electronic Data Interchange.
5. XML = Extensible Markup Language; see http://www.w3.org/XML/.
6. See http://www.xing.com [last visit 28 July 2008].
7. See http://www.linkedin.com/ [last visit 30 July 2008].
8. See http://www.plaxo.com/ [last visit 30 July 2008].
9. See (Weiß, 2005) for the conceptualisation of self-organisation: major concepts are autonomy, self-reference, complexity, redundancy, adaptivity.
10. KAON is an open-source ontology management infrastructure targeted for semantics-driven business applications. See http://kaon.semanticWeb.org/documentation [last visit, 30 July 2008].
11. Protégé is a free, open source ontology editor and knowledge-base framework. See http://protege.stanford.edu/ [last visit, 30 July 2008].
12. See http://www.eclass.eu [last visit 30.07.2008].
13. See http://www.etim.de/ [last visit 30.07.2008].
14. Statistical Classification of Economic Activities, see http://ec.europa.eu/comm/competition/mergers/cases/index/nace_all.html [last visit 30.07.2008].
15. See http://www.unspsc.org/ [last visit 30.07.2008].
16. See http://www.ecompetences.eu [last visit 30.07.2008].

This work was previously published in the Handbook of Research on Social Dimensions of Semantic Technologies and Web Services, edited by M. M. Cruz-Cunha, E. F. Oliveira, A. J. Tavares, and L. G. Ferreira, pp. 643-674, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.8

The Use of Social Media by Nonprofit Organizations:
An Examination from the Diffusion of Innovations Perspective

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ABSTRACT

Nonprofit organizations are an essential part of the social, political, and economic landscape of contemporary society. Social media provide ample opportunities for these organizations to increase their community presence, impact, effectiveness, and efficiency. A qualitative study of 39 nonprofit leaders explored how nonprofits are utilizing the potential of the social media technologies to carry out their programs and services. Thematic analysis revealed that nonprofits are slowly embracing the possibilities offered by the new social interaction technologies. Most nonprofit organizations lag behind and wait to see how other nonprofits incorporate these new communication outlets into their budgets and daily operations. Paralleling Rogers' diffusion of innovations theory, innovators and early adopters are using social media to revitalize their fundraising and volunteering efforts while the majority lags behind.

DOI: 10.4018/978-1-60566-368-5.ch042

INTRODUCTION

Nonprofit organizations are an essential part of the social, political, and economic landscape of contemporary society. They provide a way for individuals to connect to their communities, effectively participate in the democratic process and ultimately to "make a difference." Currently, there are more than 1.9 million nonprofits in the United States (IRS, 2006). Though it is difficult to generalize about what nonprofit organizations are or what they do, most of these organizations share similar experiences, for example, raising funds or attracting volunteers.

Despite widespread interests (e.g., healthcare, economic development, religion, political, and social issues), a nonprofit organization can be defined as a voluntary association of a group of individuals bound together to pursue shared missions or goals (Lohmann 1992). In such mission-based organizations members are neither forced to relate nor enticed by the prospect of personal profit or gain, while their operation is facilitated by an endowment of resources. Through their mission-oriented work, nonprofits generate social capital—the attitude and willingness of people to engage in collective activity to address issues on the basis of shared values and beliefs, which in turn reinforce trust, confidence, and commitment of the participants (Hall, 2005).

Although nonprofits vary enormously in scope and scale, ranging from informal grassroots organizations with no assets and employees to multibillion-dollar foundations, they are facing new challenges as technological advances change the way nonprofits carry out their missions. Moreover, external stakeholders increasingly influence nonprofit organizations to adopt new technologies, including social media. The present chapter introduces a qualitative study of 39 nonprofit leaders designed to explore how nonprofits are utilizing the potential of social media to carry out their programs and services. During the study, twelve one-on-one interviews and three focus groups were conducted with nonprofit organization communicators.

BACKGROUND: NONPROFITS AND WEB 2.0 TECHNOLOGIES

Accountability and Transparency

Topper (2007) encouraged nonprofit organizations to consider all types of social media to help spread the word about their programs. Whether it be through RSS (Really Simple Syndication) feeds, Twitter updates, or podcasts, increasing the awareness of a nonprofit's activities will ultimately benefit the organization in terms of increased donations, volunteer hours, and participants in their programs and services. "It's pretty simple really. My job is to do anything I can to help educate people about what we do. Technology is helping me reach more people than our newsletter and brochures ever could," said one senior communications officer for a nonprofit research organization participating in the interview.

RSS feeds, podcasting, and making pictures or videos of the nonprofit's events available through sites similar to Flickr or YouTube are still mainly a one-way distribution of information. Albrycht (2004) encourages nonprofits to truly become interactive with their stakeholders by blogging about their successes and failures. Blogs can be useful in spreading word about a nonprofits' programs or services, but they can also be used to address an individual's questions and concerns (Wasserman, 2005).

Increasingly, nonprofit organizations are being challenged to demonstrate their accountability to donors, their operating community, and their clients and program participants. Blogs provide a channel for open communications. Individuals can openly question an organization's practices in front of their virtual peers, and the organization's answer (or lack thereof) is available for everyone to scrutinize. Marken (2005) argues that an organization's blog can provide a powerful strategic and tactical communications tool because it offers an organization the opportunity to respond to inquiries directly. This direct communication works to solidify relationships the organization has established with its stakeholders. When organizations fail to respond to comments or delete them from their blog, they risk damaging the trust they have built with their stakeholders.

Finally, blogs allow individuals to discuss a nonprofit's events in a manner that brings people together. "Last summer, we wanted to hold rallies to draw attention to the harm (a company's) operations were causing to the local watershed. We posted an announcement on our blog and had a lot of replies within 24 hours," explained one of the participants during the focus group discussion.

"The connections we made online resulted in a large turnout at our rallies." For this nonprofit organization the virtual connection resulted in a unified voice addressing an environmental concern in the physical world.

Fundraising

Social media are also helping considerably with nonprofit organizations fundraising efforts. As it was noted in the previous research (Waters, 2007b), nonprofits organizations incorporate blog management into their online fundraising, efforts because blogs offer an effective and economic means of two-way communication with potential donors. One study participant in charge of fundraising said: "We had one donor say he gave to our organization because of our blogging. We answered his questions about our programs in a timely manner, and he wanted to see us continue to advance our cause."

Recently, new websites have been created to facilitate charitable donations to nonprofits in lieu of birthday and wedding gifts. Sites, such as ChangingthePresent.org, allow individuals to register their special occasions online and have invitations sent to family and friends. These invitations encourage the recipients to donate to a specified nonprofit organization instead of purchasing a gift for the event's host.

Cybervolunteering

One new aspect of nonprofit organizations has emerged because of social interaction technologies. *Cybervolunteering* is similar to traditional volunteering in that an individual gives time and effort to work for an organization, except the work is done remotely through an Internet connection rather than being required to be onsite to complete the tasks. Online volunteers perform a variety of tasks, including: translating documents, proofreading and editing reports, designing logos and communications materials, moderating online discussion groups, and even database management. Virtual volunteering has helped many smaller nonprofit organizations attract volunteers with highly technical skills because the volunteers are able to perform work on these complex projects on their own time rather than having to work only when the nonprofits are open (Cravens, 2000).

Virtual volunteering has helped increase awareness of some nonprofit organizations' services because of *vlogging (*or *video blogging*). Similar to text-based blogs, vlogs provide regular updates and commentary on a topic through online videos. "We simply don't have the resources to produce our own videos, but one of our virtual volunteers videotapes our events and activities then edits them down to short videos that we can distribute to our donors and government officials," emphasized an interviewed communications officer from a nonprofit focusing on substance abuse recovery.

Volunteers are able to develop sophisticated videos that can be presented on YouTube, Google video, or the organizations' own websites. While these video presentations can be helpful, many organizations wish to have more control over their content. The organizations may record their own footage, upload the files to the Internet, and relay them to their cybervolunteers, who work remotely for a nonprofit organization to edit the video clips down into a clip ready for widespread Internet distribution.

Online Scheduling and Internet Conferencing

Previous research has found that nonprofits use websites, such as Meetingwizard.com and other online meeting scheduling services, to arrange meetings for their boards of directors (Lipnack & Stamps, 2000). These scheduling services offer for those who are invited to the meetings the ability to reserve a seat at the meeting or state that they would not be attending. One of the study participants, a communications director for a healthcare nonprofit said: "We use a scheduling system online that allows our board members to tell us whether or not they're coming to the meeting. The system also lets them read the minutes from the previous meeting and also lets them discuss the agenda before the meeting starts."

Internet conferencing has also helped nonprofits reach a larger number of constituents. A public information officer for a nonprofit educational institution who participated in the focus group noted, "Instead of just looking at people in our city, we're now able to reach out and help people across the country. Our local research and planning efforts are now having an impact on communities all over the U.S." By taking advantage of the boundary-free reach of the Internet, nonprofit organizations are able to increase the magnitude of their training and strategic planning efforts by reaching larger populations while reducing the costs of holding sessions on-site (Mitschke, 2008).

Whereas some scheduling software allows individuals to offer comments about a meeting's agenda or minutes from past meetings, one participant volunteered that his organization was actively incorporating a *wiki* - a social software application that allows multiple users to add and edit content collaboratively. Another focus group participants said, "It took some convincing but now that our wiki is up and running, we're getting great feedback. It lets our senior staffers share their knowledge about organization procedures in a non-threatening manner." Fitch (2007) felt that wikis would be a valuable institutional resource since content can be updated and maintained by all users and can be instantly updated as the organization's environment changes.

Technical Assistance

One final area where social interaction technologies are used by nonprofits involves the organizations reaching out to one another for technical assistance in implementing new technologies. Nonprofit organizations, large and small, have embraced the Internet Relay Chat, instant messaging and most commonly online forums so that the sectors can turn to one another for help in designing and evaluating programs and services. One such forum hosted by TechSoup.org is dedicated to nonprofit sector employees and volunteers who have an interest in helping others working in the nonprofit sector to solve information technology problems. TechSoup.org and other similar forums are also used to help develop coalitions and grassroots movements within the nonprofit sector so that societal issues can be brought to the forefront of the public's attention (McNutt & Boland, 1999). The Nonprofit Technology Network (NTEN), a membership organization of nonprofit technology professionals, helps the nonprofit sector utilize the latest technology resources to enhance community outreach and pursue effective fundraising, including online fundraising campaigns.[1]

THE USE OF SOCIAL INTERACTION TECHNOLOGIES BY NONPROFIT ORGANIZATIONS: A QUALITATIVE STUDY

Nonprofit organizations often face operational and technical challenges in carrying out their missions due to the financial constraints. However, one recent survey revealed that public relations practitioners in nonprofit organizations were not laggards in the adoption of new technologies (Porter & Sallot, 2003). Instead, they were found to be advocates for new technology. The purpose of the present study was to explore how nonprofit organizations use social media and for what purposes.

Prior Research

Review of literature on the topic of the use of technology by nonprofit organizations shows that they have slowly come to adopt new interactive online applications and services (Porter & Sallot, 2003). Employees of nonprofit organizations mostly use the Internet for productivity, efficiency, research, evaluation, and issues management (Sallot, Porter, & Acosta-Azuru, 2004). Nonprofits are generally successful in giving their organization a professional virtual presence and have been encouraged to capitalize on the interactive nature of the Internet to reach out to like-minded individuals when focusing on advocacy efforts (McNutt & Boland, 1999; Waters, 2007), but they often fail to incorporate interactive elements and two-way communication into their websites (Kang & Norton, 2004).

In part, their reluctance to incorporate the elements of interactivity has been based on their lack of sufficient resources to maintain sophisticated websites (Hill & White, 2000). Nonprofits often have minimal staff to monitor communications efforts, such as web traffic and Internet requests (Guo & Acar, 2005). Instead, they are more likely to dedicate their time, energy, and financial resources to carrying out their programs and services, rather than their communication efforts (Markam, Johnson, & Bonjean, 1999).

Ryan (2003) raised additional concerns. A survey of nonprofit communicators showed that most practitioners have the skills needed for effective web communication. However, they struggle with teaching others the components of good websites. Training in concepts and technical skills were also shown to be problematic. Yet, nonprofits recognize the beneficial nature of web-based communication, and they are making efforts to increase their competencies especially as they see how the medium can benefit their organization's programs and services.

Corder (2001) indicated that nonprofit organizations are more likely to use interactive technologies and emerging social media if their external stakeholders, such as donors or volunteers, are using them. With the expansion of social interaction technologies, nonprofits quickly have to learn how to use different applications, or they risk being viewed as behind the technological curve (Var, Chon, & Doh, 2001). Increases in web-based inquiries, the exponential growth of e-philanthropy (or Internet-based fundraising) and new developments in social media have led nonprofits to become more engaged with the Internet.

Theoretical Perspective

It takes time for innovations to diffuse within a system, and organizations go through several phases while implementing an innovation. These stages begin with identification and move through experimentation and rationalization before widespread technology transfer occurs (Raho, Belohlav, & Fiedler, 1987). Lundvall (1992) argued that technological change is gradual and cumulative in nature.

For more than six decades, scholars have studied how innovative technologies expand throughout social groups. The diffusion of innovations theory by Everett Rogers examines "the process by which an innovation is communicated through certain channels over time among the members of a social system" (2003, p. 5). Research has shown that innovations are largely spread through interpersonal channels and networks. The first adopters of technology are *innovators*, enterprising individuals who imagine the possibilities of the new technology and are eager to try it.

As innovators test the new technology and discuss their experiences, *early adopters* take mental notes based on the evaluations of the innovators to confirm their decision to either adopt or reject an innovation. Early adopters are known for their well-informed decision making abilities, and they often represent the opinion leaders in a community. When the early adopters share their experiences, it creates a domino effect throughout the rest of the social system as the *early majority* group adopts the innovation. After the majority of a social group adopts an innovation, the *late* *majority* catches on. Rogers labels the last few members of a population to adopt a technology, *laggards*.

Research Questions

The diffusion of innovations theoretical perspective discussed above informed the following research questions:

RQ1: How are nonprofit organizations using social interaction technologies?

RQ2: How often are nonprofit organizations incorporating these technologies into their efforts?

To answer these exploratory questions, twelve in-depth interviews and three focus group discussions were conducted. Although the findings cannot be generalized to the entire nonprofit sector because of the qualitative nature of the study, the researcher used a purposive sampling design to ensure that the participants were selected with a variety of experiences in adopting social interaction technologies. The interviews and focus groups were conducted outside of the nonprofit organizations so that the participants felt comfortable to discuss their organizations' use of technologies openly.

Participants

The participants in this research study represented the diverse composition of the nonprofit sector. They came from a variety of cultural backgrounds: Caucasians (41 percent), Black or African Americans (26 percent), Hispanic/Latinos (13 percent), and Asian/Pacific Islanders (10 percent), and Native Americans (10 percent). More than half (62 percent) of the participants were female. Slightly more than half worked at nonprofits with budgets larger than $1 million, and 38 percent worked at organizations with annual budgets under $300,000. All six of the Association of Fundraising Professionals' nonprofit subsections were represented: namely, arts/culture, education, health, human services, public/society benefit, and religious organizations.

Sampling Technique

Snowball sampling was used to recruit active users of social software in the nonprofit setting after three individuals responded to an initial online invitation posted on the TechSoup.org discussion board. During the interviews, participants were asked about their motivations for using the technologies, how they used social software, and what were their successes and failures with incorporating social media into their organization's communication practices. At the conclusion of the interviews, the participants were asked if they knew any other nonprofit organizations that were actively using Web 2.0 technologies or specifically individuals who might be willing to discuss their organizations successes and failures with the new technologies.

Focus Groups

For the three focus groups, participants were contacted based on their membership in professional communication associations, such as the Public Relations Society of America, the International Association of Business Communicators, and the American Marketing Association. All of these associations have nonprofit organization divisions. These individuals were informed that there would be no financial compensation for their participation; however, they would be exposed to others' views on the benefits and challenges of incorporating social software into their communication efforts. Refreshments were served at the beginning of the focus groups, and an experienced moderator was used to ensure that all focus group participants had the opportunity to speak about their experiences with social software whether they were experienced users or had not implemented the strategy into their programming.

Interviews

For the one-on-one interviews and the focus group sessions, both audio and video recordings were made to maintain accuracy in the participants' meaning. Following an approved institutional review board protocol, participants were required to sign a form indicating that they consented to be recorded. In-depth interviews and focus groups were chosen for this project since these methods allow researchers to openly explore the issues without trying to classify them into predetermined categories (Creswell, 1997).

Thematic Analysis

Thematic analysis involved reading the transcriptions and comparing each statement with the others while looking for similarities and grouping them together by category (Lindlof, 1995). Once the data stopped providing new insights into the subject being examined, the process ended. However, the researcher had to take the findings back to the participants for a member check phase to make sure that their words and experiences were interpreted correctly. Validity checks prevent the researcher from coming to faulty conclusions based on the analysis. Member checks were conducted within ten days of the final analysis.

RESULTS AND DISCUSSION

The first research question sought to determine how these nonprofit organizations were incorporating social media into their daily operations. Thematic analysis revealed that social interaction technologies were used to facilitate virtual meetings, to boost fundraising efforts, to demonstrate an organization's accountability and transparency, and to reach out to a new group of volunteers.

Though the results of this qualitative study cannot be generalized to the entire nonprofit sector, they highlight some major points of emphasis that parallel Rogers' diffusion of innovations theory. The three participants of the in-depth interviews who responded to the initial posting on TechSoup.org were clearly innovators, using diffusion terminology. Throughout the interviews, they spoke proudly of what the new technologies were allowing them to do with their organizations in ways that the organizations' management and board of directors had not imagined. One female participant (communications officer) said: "My [executive director] knew that web conferencing was a possibility but she had no idea how easy it was to use. It has increased our efficiency tenfold, especially with conducting our board meetings. We're not tied to having a monthly meeting in a location that requires members to drive to and from the meeting every month. They're happier, we're happier, and our work is being done more effectively."

Another public relations officer said that they had begun using web conferencing as a way to connect their affiliate branches throughout the Southeast. "Social media are helping us reduce the amount of money we spend on overhead. We can meet virtually, get the same amount of work done, and not run up travel expenses."

As the number of Congressional hearings (e.g., 2005's "Charities and Charitable Giving: Proposals for Reform") and public scrutiny intensify, nonprofit organizations have had to work harder to demonstrate their social and fiscal accountability. In 1999, the Independent Sector - a coalition of corporations, foundations, and nonprofit organizations that work together to strengthen America's nonprofit sector - conducted research and found that public confidence ranged from 28 percent to 72 percent for different types of nonprofit organizations (Saxon-Harrold, 1999). A Gallup Poll from May 2005 found that only 15 percent of the American public has a great deal of confidence in charitable organizations (Light, 2005).

The falling levels of confidence were due to the increasing number of questions the public has about the effectiveness and efficiency of nonprofit organizations. Light (2005) maintains that the public is less concerned about nonprofit organizations' ability to "show us the mission" but instead is more concerned with how nonprofits can demonstrate their impact and reduce the amount of overhead they spend on their programs. As the use of social media advances through the stages of the diffusion of innovations process, more nonprofit organizations will come to see that social media can help them demonstrate their financial and social accountability to audiences that are becoming increasing more web savvy.

Of all the advances the Internet has brought to nonprofit organizations, they seem most receptive to how it has changed their fundraising efforts. A representative of the Harvard Business School commented that nonprofit management officers who fail to recognize the power of e-philanthropy will find their organizations falling behind the curve. Organizations seem to be receptive to incorporating web-based fundraising; however, they have not truly grasped the benefits of social media yet. Increasingly, nonprofits are recognizing how blogs can be used to maintain a two-way communication channel with their donors and like-minded individuals. They also have begun to explore the impact of YouTube, Flickr, and other video and photograph sharing sites as vehicles for spreading information about their programs.

Interestingly, the results of this research contradict the findings of previous nonprofit organization studies. Often, changes stem from the nation's largest nonprofits and trickle their way down to smaller, local nonprofit organizations. For example, the national headquarters of the American Red Cross was one of the first organizations to conduct official fundraising campaigns online after the 1999 Kosovo relief crisis. Their successes led other larger, established nonprofits to experiment with online fundraising (Wallace, 2003). Waters (2007b) documents the rapid expansion of Internet fundraising from large nonprofits and notes how they expanded to smaller community-based organizations.

The participants in this study indicated that a reverse effect might be present. Perhaps because of the strong connectivity involved with social media, smaller nonprofits tend to be innovators and early adopters of social media technology. One participant said: "Smaller nonprofits are at greater risk for falling by the wayside because they don't have a huge financial endowment to fall back on during tough times. They need to reach out to their donors, volunteers, and everyone else however they can reach them. Facebook, YouTube, and all the other websites give us more channels to reach people."

Reflecting the diffusion stages, one public information officer from a large national nonprofit admitted the following: "We lag behind others in how we use technology. We have to follow the guidelines from our national office. We can't take advantage of Facebook or YouTube with local efforts because of the possibility of risking the national brand." For this individual, there was a desire to explore social software within the local organization; however, a bureaucracy prevented the organization from pursuing this option.

For others, they seemed to fall into the late majority, or laggard cycle, simply because they were unsure of how to use social media to advance their causes. "I really would love to be able to record a video and send it out to people when we have good news to share, but I just don't know how," said one participant dealing with fundraising. Still for others, the current success level using traditional communication channels has prevented their organizations from reaching out to new communication technologies: "My boss says if it's not broken, why fix it. I think we could benefit from seeing how other nonprofits are using the technology, but a strong resistance to change is keeping us from moving forward."

As the *Chronicle of Philanthropy* and other nationally recognized nonprofit trade publications highlight the successes of organizations that use the social media, increasing numbers of individuals will recognize the potential the software has for their organizations. Though it may take time for nonprofits to truly incorporate social media into their communication practices, the exponential growth of the use of these technologies by the entire American public—not just the "Millennial generation"—will result in greater understanding of social media and how it can be used effectively.

The second research question sought to determine how often nonprofit organizations were using social interaction technologies. Even though the study participants offered several different examples of how social media helped them advance their missions, several nonprofit communicators expressed concern about the implementation. "I see the benefit of these strategies, I really do. But, I simply don't have the time or resources to dedicate to using them," said a public affairs director for a large religious nonprofit. Another communications officer asserted, "If I had more time, I would really like to see [my organization] produce some podcasts or videos to help get our messages out beyond our core supporters." Finally, one public relations director stated, "People who use the Internet a lot get annoyed when they don't get immediate replies. I wish I had the time to be able to sit in front of a blog and monitor it all day, but I don't."

Another concern that nonprofit organizations had involved the training necessary to maintain the social media functions. Reflecting Hill and White's (2000) results, several nonprofit communicators said they simply did not know how to incorporate these strategies into their efforts. "It took me forever to figure out how to design web pages and that was with one of those *Web-Sites for Dummies* books. I wouldn't even know where to begin with RSS feeds or podcasting," said one senior communications officer at a science and technology museum. Another summed up her feelings by saying: "Even though I blog regularly on my personal website, I'd be scared to represent the organization. I'm not sure I'm prepared to be the sole voice of my organization online, and I certainly don't want others to chime in on certain topics."

Reflecting the diffusion of innovations, several individuals said that they had been using social media sites, such as Facebook and MySpace, for some time, and others had mixed experience levels with Flickr and other social interaction technologies. One focus group participant summed up her experience saying, "I think I was one of the first of my peer group to use Facebook. I'm totally comfortable using it for me. I'd have to see how other organizations used it before I tried it with (my agency)."

Several nonprofit organizations represented in a study appear to be in the early majority phase. They are waiting to see how the innovators and early adopters incorporate these technologies into their daily work especially since they have experience with them in their personal lives. The question that must be asked with future research, then, is who are the innovators and early adopters of the social media technologies for the nonprofit sector. One might expect that the larger nonprofits (e.g., those with annual budgets greater than $1 million) would be the technology leaders because of the increased availability of resources.

However, based on the results of this study, smaller nonprofit organizations appeared to be the innovators of the social media. Despite the lack of resources, smaller organizations have created a sense of community and the social media have brought them further together to work towards the organizations' missions. A volunteer in charge of communications for the nonprofit with the smallest budget said, "[Our organization] doesn't have the resources to create an expensive marketing or public relations campaign to compete with other nonprofits in town, but using social media lets me reach a lot of people without spending a lot of cash."

FUTURE TRENDS

As virtual presence becomes even more important for an organization's day-to-day operations, nonprofits are beginning to learn how to use Web 2.0 technologies to reach the stakeholders. The new approach is gaining support from donors, volunteers, and nonprofit organization clients. Technologies such as podcasting, blogging, microblogging and vlogging, RSS feeds and tagging, photo and video sharing, and social networking services, have created a promise for a nonprofit sector with greater outreach and interactivity. This trend in using social interaction technologies for strategic communication is resonating with many nonprofits as the interactivity offered by social media channels offers a unique ability to cultivate and develop a two-way communication relationship with the stakeholders rather than maintaining a one-way information conduit.

Incorporating blog management into their communications efforts allowed, for example, a Seattle-based environmental nonprofit organization Oceana to increase donations and interest in volunteering at the organization (Waters, 2007b). Shortly after this news spread through TechSoup.org, many larger organizations began expressing interest in how they could successfully blog with their stakeholders. Social software allows these smaller organizations to demonstrate their fiscal and social accountability to external and internal audiences, and the software is frequently used to help foster a greater sense of community within the nonprofit sector (Bach & Stark, 2004).

Even though some nonprofits are still resisting the integration of new technologies into their strategic communication efforts, other nonprofits (mostly smaller organizations) are serving as the harbingers of change. It is reasonable to assume that as their success stories spread, more nonprofits will be inclined to adopt social interaction technologies in the future and their influence will be felt across the entire nonprofit sector.

CONCLUSION

Nonprofit organizations are carrying out vital work to address the nation's social, economic, and political problems. Social interaction technologies are slowly changing the way nonprofits perform their work allowing nonprofits to reach out to the community in effective, open and transparent ways. Most importantly for nonprofits, social interaction technologies allow users to share their thoughts and opinions and give feedback on how the operation of an organization can be improved (Finin, Ding, Zhou, & Joshi, 2005). It may be of interest that communication consulting companies that work with nonprofit organizations have started to distribute guides to teach how to use blogs, RSS feeds, podcasts, wikis, virtual worlds, and online social networking to advance the organizational missions in an Internet-driven world. Fichter (2007), for example, encourages nonprofits to start using new technologies and learn about them first hand.

Social interaction technologies offer a rich, participatory, and collaborative experience for the user—the type of experience shown to result in enduring relationships between an organization and its stakeholders (Tyler, McGirr, & Stanley, 1998). These technologies allow community members to participate and collaborate in a nonprofit organization's efforts in a meaningful and gratifying way (Needleman, 2007). Whether through posing questions to the organization's discussion forum or blog or receiving updates about programs and services through microblogging, social media allow nonprofits to become more open and attractive to their stakeholders.

Based on the results of the interviews and focus groups conducted for this research project, it appears that currently the use of social software by the nonprofit sector still is still in the early adopters stage. However, to extrapolate findings of this study to the nonprofit sector, more research should be undertaken. The rapid growth of the usage of social media by nonprofit organizations parallels how the social interaction technologies are being used by individuals in a larger society. Early adopters of social media are encouraging their organizations to pursue the strategy of innovations, and take the possible risks that are paying off with increased fundraising results and volunteer recruitment efforts. As the adoption of the existing social software tools and applications continues to progress through the diffusion of innovations stages, the nonprofit sector can only wonder what is beginning to emerge on the horizon for the innovators to explore.

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KEY TERMS AND DEFINITIONS

Cybervolunteering: Contributing time and effort to a nonprofit organization through an online connection, rather than, or in addition to, an on-site service.

Diffusion of Innovations: The study of how, why, and at what rate new technologies and ideas spread through a social system or organization.

Early Adopters: The second (after the innovators) wave of adopters of new technologies, who represent opinion leaders in a social system because of their decision-making skills.

E-Philanthropy: The cultivation and management of relationships with key stakeholders of nonprofit organizations using the Internet.

Early Majority: The third wave of adopters of new technologies, who represent the group that adopts a technology just before the "average" person based on the actions of opinion leaders in their social system.

Innovators: The first adopters of new technologies who are willing to face uncertainty and risks as they interact with new technologies and ideas.

Laggards: The fifth and final wave of adopters of new technologies, who want to maintain the status quo by refusing to purchase or accept new technologies or ideas because they are very skeptical.

Late Majority: The fourth wave of adopters of new technologies, who represent a group that generally adopts new technologies to stay even with their peer networks even though they are often cautious of change and sensitive to prices.

Vlogging: Blog authoring that contains video clips to assist in relaying messages; vlogging is becoming more common as equipment becomes more accessible and distribution channels, such as YouTube and Google Video, increase their storage capacity.

ENDNOTE

1 http://nten.org

This work was previously published in the Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova and R. Fiordo, pp. 473-485, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 5.9
Situating Social Identity through Language Convergence in Online Groups

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ABSTRACT

According to social identity theory, individuals create and maintain their social identity through group membership. During face-to-face interactions within a group, people assess various verbal and nonverbal cues to influence the perceptions of themselves by others. However, in the context of online communication these cues are not as readily available. A screen name can be viewed as part of an individual's "social identity creation": a message that members of online discussion boards interpret and react to while trying to situate themselves within the group. This chapter explores how language convergence can function as a cue that facilitates situating social identity within online in-groups. Results of a content analysis of 400 screen names suggest that the screen names of discussion board members serve as an organizing variable for participants to situate themselves socially within the context of online interaction.

DOI: 10.4018/978-1-60566-368-5.ch028

INTRODUCTION

In spite of original visions for the Internet, it has moved beyond the constraints of impersonal and task-oriented interactions. Scholarly research has acknowledged a trend in increasing interpersonal elements within computer-mediated communication (e.g., Pena-Shaff, Martin, & Gay, 2001; Spears, Lea, Corneliussen, Postmes, & Haar, 2002; Tanis & Postmes, 2003; Walther & Burgoon, 1992; Walther, 1992, 1993, 1994, 1996; Walther, Anderson, & Park, 1994; Walther & Tidwell, 1995). Within face-to-face interactions, individuals rely upon nonverbal "cues" and interpersonal rules to guide interaction. However, computer-mediated communication (CMC) does not allow for immediate or visual assessment often relied upon to reduce uncertainty and form impressions in face-to-face settings. Yet, according to Walther and Tidwell (1995), "CMC is not bereft of the cues needed to make varied social judgments" (p. 372). The researchers contend that previous approaches limited the scope of cues to body language and tonality, failing to recognize cues that are inherent within CMC. Giles and Coupland (1991) define language convergence as a "strategy whereby individuals adapt to each other's communicative behaviours in terms of a wide range of linguistic/prosodic/non-vocal features including speech rate, pausal phenomena and utterance length, phonological variants, smiling, gaze and so on" (p. 63). The present study explored how language convergence can function as a cue within computer-mediated communication that facilitates creating and situating social identity within online in-groups.

BACKGROUND

The Internet is a truly powerful technology that enables numerous opportunities for identity construction. It allows us to think about our identity, and if desired, change ourselves to who we want to be (Chandler, 1998) and construct images of ourselves through various types of self disclosure. Research has argued that the Internet technology is limited to impersonal and task-oriented interactions. Referring to a "cues-filtered out model", Kiesler, Siegel, and McGuire (1984) state: "In traditional forms of communication, head nods, smiles, eye contact, distance, tone of voice, and other nonverbal behavior give speakers and listeners information they can use to regulate, modify, and control exchanges" (p. 1125). Such a "reduced cues" perspective suggests that CMC lacks nonverbal cues necessary to substantiate interpersonal communication amongst CMC interactants (Connolly, Jessup, & Valacich, 1990; Hiltz, 1975, 1981; Hiltz, Johnson, & Agle, 1978; Hiltz, Johnson, & Turoff, 1986; Hiltz, Turoff, Johnson, 1989). Within this perspective, CMC is viewed as somewhat inadequate, with the capacity to harm and to keep people from "real" relationships (Thurlow, Lengel, & Tomic, 2004). This stands in contrast to the optimistic claims that the Internet can foster new relationships across social and geographical boundaries and create friendships and communities rooted in common interest and concerns (Thurlow et. al., 2004).

Reactions to the "reduced cues" perspective lead to a diverse body of research exploring interpersonal relationships created, maintained, and utilized in cyberspace (Soukup, 2000). This research attempts to identify the social dimensions of interactions mediated through computers (Amaral & Monteiro, 2002; Braithwaite, Waldron, & Finn, 1999; Douglas & McGarty, 2001; Kleinman, 2000; Muramatsu & Ackerman, 1998; Pena-Shaff, Martin, & Gay, 2001; Ramirez, Walther, Burgoon, & Sunnafrank, 2002; Spears, Lea, Corneliussen, Postmes, & Haar, 2002; Tanis & Postmes, 2003; Tidwell & Walther, 2002; Walther & Burgoon, 1992; Walther, 1992, 1993, 1994, 1996; Walther, Anderson, & Park, 1994; Walther & Tidwell, 1995). As such, it is apparent that communication on the Internet has moved beyond the constraints of impersonal and task-oriented interactions into interpersonal interactions. The cues by which individuals are assessed within CMC may vary. Zhou, Burgoon, Twitchell, Qin, and Nunamaker (2004), contend that we evaluate language choices and make attributions about another's social status, background and education. Despite the surmounting research within this trend, there is a lack of known socially contextual cues within CMC interactions (Tanis & Postmes, 2003). According to Spears et. al. (2002), the exact nature of the interpersonal implications of CMC is still under debate and not well understood.

Situating Social Identity

Our identity is in continuous flux from the time we are cognizant of social realities throughout the remainder of our lives (Hall, 1990). According to social identity theory it is these social realities that shape and form our social identity (Tajfel & Turner, 1986). It is through our membership into various social groups that we discover and experiment with social identities in the hope of creating an image of ourselves that is acceptable to the social realities we are invested in (Tajfel & Turner, 1986). Furthermore, it is assumed that we will strive to remain a member of a group and seek membership to new groups if the group of interest has some degree of positive influence on our social identity (Tajfel, 1978b).

Research on impression management has concluded that a large portion of this process is conscious; individuals rely upon context to determine how they will represent themselves (Andrews & Kacmar, 2001; Berzonsky & Adams, 1999; Yoder, 2000). Within the context of CMC, Walther (1993) concluded that in a zero-history group experimental setting, "CMC users formed increasingly developed impressions over time, presumably from the decoding of text-based cues" (Walther, 1993, p. 393). Hence it is conceivable that individuals interpret text-based cues (such as a screen name) as a means of evaluating individuals within an interpersonal framework, enough so that they can make decisions/judgments about interactants.

Minority status groups, such as white supremacists groups, tend to have higher in-group identification (Brown, 2000). People who have a high identification with the group tend to see both the in-group and the out-group as more homogenous than people who have a low identification with the group (Brown, 2000). Thus, the feeling of belonging to a group places one in a social category that defines who one is in terms of the defining characteristics of the category (Hogg, Terry, & White, 1995). As such, social identities have self-evaluative consequences (Hogg, 1996); since "white supremacists" views their ideology as superior, they will take the necessary steps to maintain that perception. In accordance with this tenet of social identity theory, any display or action that will tie group, in this case "white supremacists", to their cause will result in greater identification with that group (Tajfel, 1978a). In short, individuals will know the intra-group communication thereby tying them to that social identity. Subsequently, people who feel that they are "white supremacists" will exhibit the characteristics of "white supremacists"; they will strive to situate themselves as "white supremacist" and will know and utilize language patterns and symbols that pertain to the group. The current study explores the possibility that the construction of a pseudonym utilized as the screen name within a white supremacist discussion board can serve as a means of identifying with the group. In addition, an individual screen name can function as a marker of identity and this marker is germane to white supremacist group membership. There are a vast number of cyber communities that rely mostly upon CMC as a means of maintaining contact with one another and recruiting new members (Thurlow et. al., 2004). Among them, white supremacist groups have recognized the value of CMC as a means of substantiating and maintaining communities; in fact, CMC has become their primary means of surviving and expanding during the last decade (e.g., Bostdorff, 2004; Burris, Smith, & Strahm, 2000; Duffy, 2003; Preston, 2003). According to the Anti-Defamation League (2001): "The high-tech revolution that has altered our domestic, educational, and workplace routines and habits has brought the same informational and communications opportunities to the organized hate movement" (p. 2).

As a result, the number of hate groups operating in the United States is steadily on the rise. Various watchdog organizations have noted a 78% increase in the number of hate groups and group chapters involved in racially prejudiced behavior between 2000 and 2006 (Media Awareness Network, 2000; Southern Poverty Law Center, 2008). According to the Southern Poverty Law Center (SPLC) there are currently between 450-500 "hard core" hate sites and as many as 1,500 – 1,750 hates sites that are potentially problematic on the Internet.

The discourse of white supremacy is abundant and easily accessible; in fact, white supremacy has had a long history in America and has maintained its ideologies throughout the course of this nation's history (Blee, K. 2002; Ezekiel, R. S., 1996; Daniels, J., 1997; Dobratz & Shanks-Meile, 1997; Quarles, 1999). The Internet has availed white supremacists the ability to reach a much more focused audience than their predecessors ever imagined (Anti-Defamation League, 2001). Discussion boards have become an important tool for establishing and maintaining group identity and thus are a primary source for white supremacist discourse (e.g. Bostdorff, 2004; Burris, et. al., 2000; Duffy, 2003; Preston, 2003). In essence, these discussion boards function as a community resource center that allows those interested to gather information about local events or discuss ideas with those of similar dispositions. This has become just one of many ways that white supremacist group's commune and share their identities with others for the purpose of grouping themselves. Hence, the Internet has provided a social space in which white supremacists have an opportunity to create a social identity within the context of CMC.

A STUDY OF SOCIAL IDENTITY AND LANGUAGE CONVERGENCE IN ONLINE GROUPS

An underlying assumption exists regarding the nonverbal cues exchanged and gathered in face-to-face settings which suggests that individuals treat most nonverbal behavior as intentional and designed to communicate information to others (for example, Allen & Atkinson, 1981; Buck & Van Lear, 2002; Manusov & Rodriguez, 1989; Richmond & McCroskey, 2004). In mediated contexts individuals may assume that the usernames utilized in cyberspace contain purposeful clues as to the personality or identity of the sender, which is a unique identifier since screen names cannot be duplicated within a specific discussion forum. Therefore, an individual's perceptions of volition should influence the impact that username has on perceptions. According to Heisler and Crabill (2006), screen names perceived as selected and designed by their users offer more information related to situating social identity (and greater predictability) to others.

The potential for screen names to vary, while not infinite, is substantial. With the ability to combine any number, letter, or symbol, the emergence of uniformity within a discussion board membership list would suggest convergence within their creation. Furthermore, a type of structure functions in their construction. Hence, the creation of a screen name is a process of self-identification, a message that members of online groups interpret and react to within their discussions. The current study aimed to explore whether screen names can serve as an organizing variable within participants' attempts to situate themselves socially in the context of discussion boards. Consequently, it was hypothesized that:

$H_{1:}$ Screen names of an online white supremacist discussion board will contain cues to the social identity of the group.

Method

The flow for a typical content analysis was adapted from Nuendorf (2002) and used to guide data collection and analysis. Due to the nature of the study and the data, percentage frequencies of the variables were reported. The initial form of analysis of the data was to determine and report the frequency of the coded variables. Once the frequencies were determined, mean scores of each variable were compared using independent sample *t* tests with significance at $p<.05$.

Group Selection

To address the research hypothesis of the study, it was deemed necessary to compare the group of interest to a similar group. It was important that the researcher identified an online white supremacist group and control group that utilized a discussion board as the primary means of interacting. The lack of available demographic information poses a methodological complication that required the use of a purposive sample. Review of the literature of white supremacist discourse revealed a prominent theme of music (see Crabill, 2006). Therefore, the researcher selected the website of a prominent white supremacist recording label, "Resistance Records", which is dedicated to the production and promotion of white supremacist music. Selecting a comparison group was done systematically by searching the Internet for music genres similar to that produced by "Resistance Records." The researcher identified another record label, "Plan-it-X Records", which produced a similar genre of music and maintained a comparable website design and membership. The missions of the two groups are comparable as well; both sites are interested in motivating others to take action against an oppositional entity and as such motivate others to act as social agents for change in our society. In addition, the groups maintained sufficient membership for adequate sampling.

Sample

A member list of screen names was collected from each discussion board. Since screen names are unique identifiers for members of each discussion board within the forum, it is not be possible for duplicate names to occur. However, it was possible, but not likely, that a screen name would be duplicated between the discussion boards, as the same person could belong to both groups and use the same screen name for each. Had such phenomena occurred, the screen names would have been removed from the data set. There were a total of 2,127 screen names identified from "Plan-it-X Records" and 8,045 from "Resistance Records." To ensure that coding of screen names included members who were most invested in the respective groups' social identity, posting statistics garnered from the websites were relied upon to identify the top 200 posters from each list. Screen names were rank-ordered based upon the number of posts each member made within the discussion forum. Thus, the final data set consisted of a total of 400 screen names.

Content Classification

The coding categories were inductively derived from the review of the literature and pretested in a pilot study for intercoder agreement. With the goal of finding categories pertinent to white power identity in particular, a discussion thread "What inspired your screen name?" from a prominent white supremacist website, Stormfront.org, was used for the pilot analysis. The researcher created a coding structure and a code book with supplemental content by reading 575 replies posted for the discussion thread (Crabill & Smith, 2005). The resulting codes are described below.

- *Anti-Other* included any slanderous reference to nonwhite ethnicities. This included the presence of specific references to a white supremacist organization, band, slogan, or expression commonly used by white supremacist.
- *Ethnicity* included any reference to a specific race, ethnicity, or nationality. Derogatory references about other ethnicities are not included in this category and should be coded in the "Anti-Other" category.
- *Personal Name* was defined to include names that use a formal personal name as the screen name.
- *Other* included any screen name that was not coded in the other categories.

Coding

The researcher and a trained assistant coded all the data. The second coder was provided with an in-depth description of each category along with examples taken from site content. Coders were to classify each screen name using the code book and a coding sheet. Each screen name was coded individually and placed in one of the four catego-

Table 1. Inter-Rater Reliabilities

Category	Percent Agreement		
	Overall	**Resistance Records**	**Plan-it-X Records**
Ethnicity	69.76%	68.29%	100%
Anti-Other	89.29%	91.25%	50%
Personal Name	86.36%	73.08%	91.57%
Other	87.11%	79.73%	91.67%

ries. To establish reliability of coding, Holsti's method of calculating the percent of agreement was used. According to Neuendorf (2002), this method is recommended when two raters assign codes to the same units. Reliability coefficients were calculated for each of the categories (see Table 1), ranging from 69.76% to 89.29%.

Study Results

As anticipated, the categories of *Ethnicity* and *Anti-Other* had the greatest frequency within the screen names of the white supremacist group, while the categories *Personal Name* and *Other* had the greatest frequency in the control group. Frequency distribution of the data and the means is reported in Table 2.

Two-tailed independent sample *t* tests were conducted using SPSS. The level of significance was set at $p<.05$ prior to analysis. Some variables were significant beyond this confidence interval. It was anticipated that the social identity of the white supremacist group would manifest in the codes for ethnic references and *Anti-Other* declarations within the construction of screen names. In addition, it was anticipated that the control group would have greater frequency of the coding categories for personal name and other content not included in the code book.

Results of the independent sample *t* test revealed a significant difference in the coding of screen names between the white supremacist group and the control group. There was statically significant difference of the categories *Ethnicity* (t=-8.308, df=798, $p<.05$) and *Anti-Other* (t=-14.653, df=798, $p<.05$) within the white supremacist group's screen names compared to the control group. While, there was statistically significant difference of the categories *Personal Name* (t=9.851, df=798, $p<.05$) and *Other* (t=7.093, df=798, $p<.05$) within the control group compared to the white supremacist. These results support the research hypothesis as the white supremacist screen names were constructed with distinct cues that reflect the social identity of the group.

It was anticipated that the analysis of the screen

Table 2. Frequencies and means for coding categories

	Overall			Resistance Records			Plan-it-X Records		
Category	**Coder 1**	**Coder 2**	**Mean**	**Coder 1**	**Coder 2**	**Mean**	**Coder 1**	**Coder 2**	**Mean**
Ethnicity	34	39	36.5	32	37	34.5*	2	2	2
Anti-Other	79	80	79.5	77	76	76.5*	2	4	3
Personal Name	101	104	102.5	23	23	23	79	81	80*
Other	186	177	181.5	69	64	66.5	117	113	115*

Note: *Indicates statistical significance.

names of two comparable groups would be beneficial in understanding the process of constructing social identity within an online white supremacist group. Results of the analysis suggest that the screen names of discussion board members do provide information about the social identity of group membership. The majority (55%) of screen names of the white supremacist group were coded as having content inclusive of the *Anti-Other* and *Ethnicity* codes, while only 2.5% of the screen names of the control group were coded in these categories. These findings are particularly relevant and useful in understanding how social identity is constructed online through the creation and use of online screen names.

DISCUSSION

The potential of screen names to vary is substantial, which makes it challenging to create a comprehensive coding structure that captures the full extent of possible content under investigation. However, it was anticipated that the screen names of the white supremacist group would include content that was specific to an argot that reflected group membership of white supremacist groups. Therefore, categories were created that would encompass content included within the specific argot of the white supremacist group, which were *Ethnicity* and *Anti-Other*. It was not surprising to find that the screen names of the control group had very marginal frequencies for these categories. Instead, it was anticipated that the control group would exhibit statistically significant frequencies for the categories *Personal Name* and *Other*. Thus 97.5% of the screen names for the control group were coded in these categories. There was no reason to assume that the control group would include the argot specific to white supremacists within the creation of their screen names.

Overall, the findings revealed interesting patterns in the white supremacist screen names that reflected group membership. The results suggest that the white supremacists rely upon maintaining a systematic group code, which is similar to the use of colors and symbols by street gang members to indicate membership. With the ability to combine any number, letter, or symbol, the emergence of a distinct pattern for the white supremacists screen names suggests convergence within the creation of screen names and furthermore a type of structure functions in their construction. In particular, the pairing of numbers and letters was a common feature of the screen names for the white supremacist group.

FUTURE TRENDS

The proliferation of the Internet has created an explosion in the variety of reasons people are taking the journey into cyberspace. Current trends by Internet service providers to offer affordable pricing have made the cyberspace available to even the most casual of computer users. Hence, the Internet has seen unprecedented growth and continues to emerge as a dominant form of mediated communication: for example, by 2008 the Internet penetration in the U.S. has reached 72.5% of the population (Internet World Stats, 2008). Internet discussion forums, online interest groups, and online identities are increasingly becoming ubiquitous. It is of vital importance for researchers engaged in an emerging interdisciplinary field of studies of online behavior to follow these new developments to provide an accurate scholarly analysis of the potential societal implications.

CONCLUSION

It can be concluded that the creation of a particular screen name in an online setting is part of a complex process of social self-identification, self-categorization, and enhancement. A screen name is a message that members of online discussion boards communicate, interpret and react to while trying to situate themselves within the social identity of the group. Consistent with social identity theory assumptions, screen names converged within variables that were relevant to the social identity of the white supremacists. The findings of the present study are consistent with the research by Heisler and Crabill (2006) which investigated a similar phenomenon within perceptions of e-mail usernames: the ability for participants to choose their e-mail name had implications upon the impressions that participants developed about the username. Participants acknowledged that creating e-mail usernames, opposed to assigned names, provided an opportunity to reveal information about themselves. Within the context of the current study, all screen names were created by the participants and therefore, participants had the opportunity to convey information which situated them as members of the white supremacist group by relying upon an argot specific to the group's social identity. In this regard, it seems that screen names serve as an organizing variable for participants to situate themselves socially in the context of discussion boards. It is apparent that CMC contexts do offer enough information about members to influence mediated perceptions, although it should be noted that the accuracy of such information is reliant solely upon the volitions of participants.

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KEY TERMS AND DEFINITIONS

Computer-Mediated Communication (CMC): Any form of human interaction across networked computers. Although the term has traditionally referred to those communications that occur via computer-mediated formats (i.e., instant messages, e-mails, chat rooms), it has also been applied to other forms of text-based interactions.

Reduced Cues: The "reduced cues" perspective suggests that CMC lacks nonverbal cues necessary to substantiate interpersonal communication amongst interactants.

Screen Name: A pseudonym constructed for the use of participation in an online discussion group or chat.

Social Identity Theory: A theory originally conceived and formulated by Henri Tajfel, a British social psychologist, in his early research of social perception.

White Supremacy: Broadly generalized, the term "white supremacy" can refer to a number of ideologies. The term itself is often used as a blanket label to identify individuals with perceived prejudiced or racial bias toward minorities.

This work was previously published in the Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova and R. Fiordo, pp. 315-326, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 5.10
Building Social Relationships in a Virtual Community of Gamers

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INTRODUCTION

The explosive growth of the Internet has enabled virtual communities to engage in social activities such as meeting people, developing friendships and relationships, sharing experiences, telling personal stories, or just listening to jokes. Such online activities are developed across time and space with people from different walks of life, age groups, and cultural backgrounds. A few scholars have clearly defined virtual community as a social entity where people relate to one another by the use of a specific technology (Jones, 1995; Rheingold, 1993; Schuler, 1996) like computer-mediated communication (CMC) technologies to foster social relationships (Wood & Smith, 2001). It is further supported by Stolterman, Agren, and Croon (1999) who refers to virtual community as a new social "life form" surfacing from the Internet and CMC. There are several types of virtual community such as the virtual community of relationship, the virtual community of place, the virtual community of memory, the virtual community of fantasy, the virtual community of mind/interest, and the virtual community of transaction (Bellah, 1985; Hagel & Armstrong, 1997; Kowch & Schwier, 1997). These types of virtual community all share a common concept, which is the existence of a group of people who are facilitated with various forms of CMCs. With the heightened use of CMCs, people begin to transit and replicate the same sense of belonging through meaningful relationships by creating a new form of social identity and social presence. As emphasized by Hiltz and Wellman (1997), people can come from many parts of the world to form "close-knit" relationships in a virtual community.

The purpose of this article is to understand how online gamers as a virtual community build social relationships through their participation in online games. Empirically, several aspects in the context of virtual community are still not fully understood, such as: (1) What types of rules, norms, and values are grounded in virtual community? (2) How do people institutionalize their members in a virtual community? and (3) Why do they create social relationships in virtual environment? The identified gap thus explains why studies have produced inconsistent findings on the impacts of online game

DOI: 10.4018/978-1-60566-014-1.ch024

play (Williams, 2003), in which many studies in the past have only looked at aggression and addiction. A more detailed understanding of the social context of in-game interactions would help to improve our understanding of the impact of online games on players and vice versa. Therefore, this article will present a case study of a renowned online game, Ever Quest (EQ), with the aim of understanding how players establish and develop social relationships. In specific, the Institutional Theory was applied to examine the social relationships among the players, and a hermeneutic-interpretive method was used to analyze the data in order to address the following general research question, "How is the social world of EQ constituted in terms of building social relationships?"

BACKGROUND OF EVERQUEST

The virtual community of gamers' environment investigated in this study is Ever Quest (EQ). EQ is the world's largest premier three-dimensional (3D) "massively-multiplayer online role-playing game" more commonly referred to as MMORPG. People are becoming more attracted to this new type of online game, which is a subset of a massively-multiplayer online game (MMOG) that enables hundreds or thousands of players to simultaneously interact in a game world where they are connected via the Internet. Players interact with each other through avatars, that is, graphical representations of the characters that they play. The popularity of MMORPGs have become evident with the introduction of the broadband Internet. MMORPGs "trace their roots to non-graphical online multiuser dungeon (MUD) games, to text-based computer games such as *Adventure* and *Zork*, and to pen and paper role-playing games like *Dungeons & Dragons"* (Wikipedia, 2004, para. 2). It is expected that online gaming will grow from a $127 million industry in 2003 to a $6 billion industry by the year 2006 (ScreenDigest, 2002).

EQ is a game that attracts an estimated 400,000 players online each day from around the globe and, at peak times, more than 100,000 players will be playing EQ simultaneously (Micheals, 2004). The game's players interact with each other inside and outside the game for game playing, game-related and non-game-related interactions, and for buying and selling game-related goods. EQ, as a game, is characterized by well-defined social structures, roles, interaction rules, and power relations. EQ, as a virtual community, encompasses all of the different kinds of virtual community. EQ is a virtual community of relationship, a virtual community of place, a virtual community of memory, a virtual community of fantasy, a virtual community of mind/interest, and a virtual community of transaction.

After its launch in 1999, EQ became a worldwide leader in massively-multiplayer online games, and it is North America's biggest massively-multiplayer online game (Micheals, 2004). Since then, EQ and its expansions[1] have sold over 2.5 million copies worldwide, and it has been translated into seven languages. EQ is one of the largest and most dynamic online fantasy worlds ever created (Stratics, 2004). The reason for choosing to study EQ is because of the incredible popularity of online gaming, which has numerous economic and societal implications.

CASE STUDY OF EVERQUEST ONLINE GAMING

The method used was a single case study to examine the unique social world of EQ. There were, altogether, 157 respondents chosen from the game, discussion forums, and Web sites. They were invited through emails to participate in the study. The case study took six months to complete. Within this approach, multiple modes of data collection were utilized, including online questionnaires, semi-structured interviews, interactions through discussion forums, analysis of documentation such as game manuals, monitoring of Web sites, and non-reactive observations/recordings of chat sessions in the game. It is useful to note that the interview protocols for the semi-structured interviews, online chats, and online questionnaire were all the same. The only difference was how it was carried out—through face-to-face interviews or through the use of information communication technologies (ICTs).

The respondents were interviewed using an established semi-structured protocol. The interview protocol began with some general questions. First, information elicited from each respondent was on how they got to know about EQ. Answers included: through friends, magazine article or gaming press, word of mouth, coworker, came with computer, family members, store display, online Web site or from Internet, and so forth. Second, further probing questioning was carried out, for example, how long have they played the game? Most of the respondents have played EQ from 1 – 6 years. Third, they were asked what attracted them to playing EQ. The answers were classified into four thematic categories: (1) the social aspects of the game; (2) the game play: (3) the characteristics of the game; and (4) generalized recreation. After asking about the general questions, the main issues on social relationships were raised for them to answer. Once saturation was reached in the answers given by the respondents, the interview efforts were halted, and the answers (in text) obtained from the interviews and online questionnaire were analyzed.

BUILDING SOCIAL RELATIONSHIPS IN A VIRTUAL COMMUNITY OF EQ

In essence, many of the respondents described the social aspects of the game, such as friendships, interaction rules, socialization, leadership skills, relationships, sense of belonging to a community, teamwork, and the different cultures. Below are examples quoted from two respondents:

Friends first and foremost. When I first arrived in (the) game, I was completely amazed at how far gaming has progressed, and continue to be amazed even still. I am a gamer to the core, playing on every platform since Atari.

I enjoy the interaction with my fellow players. I have long been a role player (pen and paper style), and EQ allows me to enjoy that same kind of group camaraderie and fun at my computer. I also am a big fan of the high fantasy genre of games.

Moreover, some of the respondents were attracted by specific elements of the game play such as questing, exploration, player versus player (PvP) combat, raiding, competition, killing, advancement, role playing, and trade-skilling. One informant even talked about progression as being an attraction:

Progression. Seeing my avatar get better skills, weapons, armor. Seeing new monsters, zones, attempting and overcoming difficult challenges and encounters.

A third attraction is the characteristics of the game itself. Respondents mentioned various features that attracted them to the game, such as graphics, atmosphere, fantasy setting, colors, storyline, immersiveness, virtual world, virtual economy, and many more. Here is a response from one informant:

The fantasy setting attracted me first...I have always been a fan of RPG (role playing game) type games because of its storyline.

Last, but not least, are the generalized recreation reasons: relaxation, addiction, escapism, self-satisfaction, ego-building, time-wasting, and others. Here is an example of a comment that was found amusing:

It's better than TV and the social aspect. Also, a compulsive competitive streak that's hard to control. I WILL beat this game damn it!

And another informant just simply had this to say about what attracted him to EQ:

Fun…fun…fun…fun!

In the subsequent questions, players were asked, "What do relationships mean in the game?" Respondents gave a variety of answers such as:

It can have so many different meanings, depending on the people involved. There are, of course, friendships, partnerships, professional relationships, mentoring. There are also people who find deeper friendships in game and have gone on to marry or move in with each other, (and so forth). Many people have found people who live near them and have in-life real relationships. Others have long-distance friendships that carry on out-of-game. Others still are manipulative and try to form "false" relationships and jump between "friends" in game.

Many of the respondents (34.1%; 31 from 91 responses) interpreted relationships to mean "friendships." According to respondents, friendships: (1) develop over long periods of time without having directly meet the other people; (2) develop with someone who enjoys your company as much as you enjoy theirs; (3) mean helping each other out; (4) mean sticking together through the hardships; (5) involve people who share the same motivations and get along well; (6) may result in friends that could feasibly last a lifetime; (7) provide good friends in the game with whom you do stuff often; (8) develop when there is something in common such as interests or goals: (9) are made up of people that you trust; many respondents just defined relationships as "friends."

Occasionally, friendships progress to the point where two people finally end up getting married. The next closest meaning given by respondents (16.5%) on relationships is "marriage." As such below is an illustration of such phenomenon,

Relationships in a game are the same as in life. Some people go as far as to get married (both in game and in life). I was a best man for my bro's wedding in EQ, then the next day he got married (in) real life (and yes, he got married (in) real life to the same girl he got married to (in) EQ life… it was cool:D.

Most "marriage" relationships remain in-game, however. Some marriages in EQ are purely for role-playing purposes, like a Paladin marrying a Druid. They serve no in-game benefit, and no one looking at the character would be able to tell he/she is married. Usually the two people plan the role-play event like a real marriage. They will find allocation for all guests can get to, get someone to officiate (the GM's or the Guides or friends can play the role of the priest/civil authority) the marriage, and multiple people bring party supplies, cake, drinks, food, and fireworks. Finding and choosing a location for guests is always important; it has to be scenic, and attendable by all races. In the game, it is perfectly legal for players to have same-sex marriage and polygamy. The process of getting married, changing names, and getting divorced is the same as a normal relationship. As one player admits:

I know of at least one pair of female toons (characters) that were married, because I was half of that pair. As with others, that marriage fell apart due to, as was said, "role-playing differences". I petitioned to have my surname changed.

Continuing with relationships, it can also mean a variety of things in the eyes of the respondents. For example, relationships can represent: (1) people you love (9.9%); (2) acquaintances (6.9%); (3) social interaction (5.5%); (4) people you met in the past (5.5%); and (5) people that keep coming back to you (3.9%). The quote below encapsulates two respondents' definitions of relationships:

They run the gamut. There are people in game whose character name I know and that's all. There are other people who I meet whenever I travel to their part of the country for coffee. There's one person who I was romantically involved with for quite a while. EQ is a social environment. Being familiar with the people you group with and comfortable with how they play their characters is important when facing new encounters. I've been lucky to meet players whose company I enjoy and prefer to be around while in game.

A few respondents (14.1%) avoided giving a definition of relationships. They felt it was not important and have not paid much attention to it, while on the other hand the game demands and rewards cooperation. Here is a quote from an informant that captures this attitude:

I avoid "relationships". It appeals to some people, but I draw the line at forming in-game friendships.

In a massively-multiplayer online gaming like EQ, there is a group of people who are "loners" or people that do not have relationships with other people, even though EQ fosters community-building and socialization among the people in it. This is not a surprise, because about 12% (15 out of 122 responses) of respondents said that they like to play solo instead of being in a guild (group). In order to succeed in the game, people have to build relationships because the tasks ahead of them required a large number of people to kill huge monsters in the game. These people cannot avoid being a loner inside the game at higher levels, but they can definitely be a loner when they are outside the game in the Web sites which do not require them to do so.

Although the following answer is amusing, the ambiguity that the respondents pointed out could do some harm in the long run for relationship-building. His response was:

But I don't get involved in things like that, because the person you think is a girl could be an old guy.

According to the players in the discussion forums, this is quite true, since many players choose to play the opposite sex for their characters instead of their true gender. It is nearly impossible to identify the true gender of a player unless you communicate with him or her through a telephone and can hear their true voice. Even then it can be uncertain, because a male voice can sound like a female voice and vice versa. Obviously in the long run, if the relationship continues, the truth will be known at least to the two parties involved.

Tolerance in this social world is demonstrated by the fact that players are allowed same-sex marriage and polygamy, situations that, while perfectly legal in this social world, are not the norm and are indeed taboo in much of the real world. Tolerance is also extended to players running a character or characters that are not their real-life gender (for example, a female elf could be played by a man and vice versa). As pointed out by Thompson (2004), video games have long allowed players to experiment with new and often taboo identities.

In online games such as EQ, almost half of the women characters are actually men—"guys who prefer to cross-dress when they play" (Yee, 2001, para 3). Motives for playing the opposite gender vary. Some of the players think that it will benefit them tremendously inside the game, as women characters are more likely to be treated better and given more help by other players. But they can also be treated like second-class citizens; when both a male and a female character have equal strength in terms of fighting and experience, the male character will usually win the hearts of the other group members to lead a raid. Yee (2001) also found that women who play male characters often "say they didn't realize how cold, hierarchical, and impersonal a lot of male-male bonds can be" (para. 6).

In summary, this study attempted to find out what players thought of the "social relationships" in the game. The players were asked about what relationships meant in the game, especially "in-game marriage", and how relationships would improve their status or performance in the game.

FUTURE RESEARCH

In specific perspective, it is useful to note that the concept of leadership has been fully established in fields such as management, psychology, sociology, and social psychology. Yet empirical investigation on the concept of leadership in the online or virtual environment is still under research and deficient (Avolio & Kahai, 2003; Cascio & Shurygailo, 2003; Kayworth & Leidner, 2002; Zigurs, 2003), and even more on the concept of emergent leadership (Yoo & Alavi, 2004). Hence, it would be fruitful for future research to examine the issue of emergent leadership in the virtual community environment in general, and also to focus on this type of leadership in the online gaming perspective by addressing question such as: "What styles and types of leadership emerge in online gaming?"

In order to develop virtual communities, it is also crucial to focus on processes, rules, and procedural formation. The formation of virtual community is based on a collective concept or group orientation. Questions such as, what purposes does it serve, how is it set up, and what rules are in place, would be equally interesting to explore. For example, if the future versions of the game will be oriented more towards powerful raiding guilds, will the category of people between guilds disappear, or will they have to make a choice to belong to one of the guilds? As the game progresses, it is anticipated that the family guilds will have similar questions to answer; they may feel that they are not valued as much, and may walk out of the game. They may join a game in which family guilds are given equal weight, or where every guild is considered as a family guild. Hence, some key questions are: (1) What are the factors that make a guild successful, and what happens to the family guilds in the future if the game is about raiding? (2) What is the future of the guild? and (3) Does it affect the social structure of EQ?

CONCLUSION

The emergence of the "online game" virtual community has enabled hundreds or thousands of players to simultaneously interact and build a relationship in this new, interesting virtual world. What is more intriguing to discover is the fact that people have developed their own rules and regulations to facilitate the structure of their social relationships among and between the players. Players as communities are simply connected and interacted via the Internet, although they may be thousands of miles apart from each other. Thus, in this social world of EQ, many players felt that *relationships* mean the "friendships" that they build inside the game. Many players acknowledge that by knowing other players, it would help them progress to a higher level in the game. In fact, players stated that by reaching a higher status in the game, it had no effect on the relations that they have established. The second meaning of *relationships* given by players is "marriage." Astonishingly, there are many couples that started their relationship as friends, got married in the game, and then moved on to real-life marriage and families outside the game. But there are cases where the marriage is only built inside the game and for the fun of role playing, thus not realistic in that sense. In a nutshell, all these findings have essentially addressed the proliferation of virtual communities in online gaming environment.

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KEY TERMS AND DEFINITIONS

Case Study: A research design that employs an in-depth or rich investigation of a phenomenon; the unit of analysis can be a single or several person/individual, organizations, or environment/ context to be examined.

Computer-Mediated Communication (CMC): Process of human communication via computers involving people, situated in particular contexts, engaging in process to shape media for a variety of purposes (December, 1997)

EverQuest: EQ was one of the world's largest premier three-dimensional (3D) MMORPG. It is a game that attracts an estimated 400,000 players online each day from around the globe and, at peak times, more than 100,000 players play EQ simultaneously (Micheals, 2004).

MMORPG: Massive(ly)-multiplayer online role-playing games or MMORPGs are virtual persistent worlds located on the Internet. They are a specific subset of massive(ly)-multiplayer online games in which players interact with each other through avatars, that is, graphical representations of the characters they play.

Online Gaming: A game that requires a connection to the Internet to play; they are distinct from video and computer games in that they are normally platform-independent, relying solely on client-side technologies (normally called "plug-ins"). Normally all that is required to play Internet games are a Web browser and the appropriate plug-in (normally available for free via the plug-in maker's Web site).

Social Relationship: Involves dynamics of social interactions, bounded and regulated by social and cultural norms, between two or more people, with each having a social position and performing a social role

Virtual Community: A virtual community is primarily a social entity where people relate to one another by the use of a specific technology (Rheingold, 1993).

ENDNOTE

1 There are, altogether, 14 expansions of EQ since its debut in March 16, 1999. The first expansion, *EverQuest: The Ruins of Kunark,* was released April 24, 2000. Since then, it has become a part of the basic *EverQuest* package, giving players more than twenty new zones, a new playable race of lizard men called the Iksar, and selling over 400,000 copies to date. The second expansion, *EverQuest: The Scars of Velious*, was released on December 5, 2000. It provides 19 more zones of content designed for level 30 characters and above, and has sold more than 300,000 copies since its release. The third expansion, *EverQuest: The Shadows of Luclin*, sold over 120,000 copies on its first day at retail, and takes players to the enchanting moonscape of *Luclin*. It offers over 28 new adventure zones, all-new items, creatures, and spells, a new playable char-

acter race, and rideable horses. The fourth expansion, *EverQuest: The Planes of Power,* launched on October 21, 2002, and unlocked the door to the most powerful deities in Norrath. It sold more than 200,000 units in its first three weeks. *The Planes of Power* introduces players to an arching storyline and epic adventures. The fifth expansion, *EverQuest: The Legacy of Ykesha,* launched on February 24, 2003. This extension broke new ground by offering numerous technical advances and improvements to game play via digital download. The sixth expansion is *EverQuest: Omens of War,* launched in September, 2003. The seventh expansion is *EverQuest:Gate of Discord,* launched in February, 2004. The eighth expansion is *EverQuest: Omens of War,* launched in September, 2004. The ninth expansion is *EverQuest: Dragons of Norrath,* launched in February, 2005. The tenth expansion is *EverQuest: Depths of Darkhollow,* launched in September, 2005. The eleventh expansion is *EverQuest: Prophecy of Ro* (February, 2006); the twelfth expansion is *EverQuest: The Serpent's Spine* (September, 2006); the thirteenth expansion is *EverQuest: The Buried Sea* (February, 2007); and the latest expansion is *EverQuest: Secrets of Faydwer* (November, 2007).

This work was previously published in the Encyclopedia of Multimedia Technology and Networking, Second Edition, edited by M. Pagani, pp. 171-177, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.11
Situational Awareness in Collaborative Work Environments

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ABSTRACT

This chapter addresses awareness support to enhance teamwork in co-located collaborative environments. In particular, the authors focus on the concept of situational awareness which is essential for successful team collaboration. Mutual situational awareness leads to informal social interactions, development of shared working cultures which are essential aspects of maintaining working relationships. First, an overview of the studies on team coordination and situational awareness support is presented. Second, a collaborative working environment is described for scientific teams in a molecular biology omics experimentation domain. Then, the results of practical case studies are discussed, as well as situational awareness support for scientific teams in collaborative environments. Finally, the authors discuss practical challenges in design and evaluation of group support systems for collaborative working environments and our multi-level analysis approach. The chapter gives new insights into how shared displays support group awareness, and how to design and evaluate interactive systems and visualisations that afford awareness in order to stimulate existing and new forms of collaboration in advanced working environments.

DOI: 10.4018/978-1-60566-264-0.ch042

Discovery is seeing what everyone has seen, and thinking what nobody else has thought

—Albert Szent-Gyorgy

INTRODUCTION

The diversity of multiple disciplines in teams positively impacts collaborative problem solving (Coughlan and Johnson, 2006; Shalley and Gilson, 2004). It is essential to analyse how such collaboration takes place in daily work practices. Team collaboration can be supported by providing an appropriate environment and a certain context (Coughlan and Johnson, 2006). However, introducing a new environment and new technologies, like multiple visualisations on a large display, may increase the cognitive load of team members and influence the way they collaborate (Varakin et al., 2004). Awareness information in such shared workspace environment is always required to coordinate team activities (Dourish and Bellotti, 1992).

The overwhelming amount of visual information on multiple displays, and the multitude of personal and shared interaction devices in new collaborative environments lead to a lack of awareness of team members on ongoing activities, a lack of understanding of shared visualisations, and a lack of awareness on who is in control of shared artefacts. The focus of our research is on the awareness support of co-located teams working on long-term scientific projects in collaborative working environments. Understanding who you are working with, what is being worked on, and how your actions affect others, is essential for effective team collaboration (Dourish and Bellotti, 1992). Such shared awareness helps getting jobs done that cannot be done by a single expert, or by experts that only have a limited range of disciplines covered. Moreover, shared awareness also leads to informal social interactions and development of shared working cultures which are essential aspects of maintaining good working relationships in a team.

Situational Awareness

Situational awareness (SA) concerns "knowing what is (and has been) going on", basically being aware of what is happening around you in the environment and having a shared understanding of the information. Before giving the extensive definition, we will first explain the importance of SA for team collaboration.

Situational awareness is expected to be an important determinant of team performance (Bolstad et al., 2005; Endsley, 1995). Especially in multidisciplinary settings situational awareness information is affected by abilities of individual members, their interaction with other team members, and the environment in which they collaborate (Bolstad et al, 2005). Various factors affect individual situational awareness formation: context (physical location, display arrangement and size, system capabilities etc.) and group aspects (communication, use of collaboration tools, team processes etc.). In order to assess SA during evaluation of collaborative interfaces or awareness displays, specific factors need to be identified relevant to a particular domain.

Situational awareness is critical in such complex multi-display environments that change rapidly and that provide a lot of information to keep up with. Recent studies (Borchers, 2006; Brad et al., 2002; Huang, 2006; Rogers and Lindley, 2004) clearly point out that people are less aware of their visual surroundings than they think they are. Data overload, fatigue and other stressors can undermine the development and maintenance of situational awareness (Boltstad, 2006). The phenomenon of change blindness shows that even if people have an accurate representation, they may still fail to notice changes (Martens, 2007; Varakin et al., 2004). Actively capturing attention at the location of the change by means of spatial cues improves the detection of the information and detection of changes. Therefore, it is of a great importance to design systems that support situational awareness and sharing of SA between team members in order to ensure that a collaborative environment supports efficient and effective team coordination and decision making.

Endsley's (1993, 1995) theory of situational awareness suggests that SA can be achieved by linking an objective state of the world to its mental analogue on three main levels: perception, comprehension and projection. Level 1 of SA—is perception of relevant elements in the environment. It is an active process whereby individuals extract salient cues from the environment. Level 2- embraces comprehension of the meaning of these cues. It involves integration of information in working memory (Salas et al., 1995) to understand how the information will impact upon the individual's goals and objectives. In this way an individual develops a comprehensive picture of the world in this way, or of that part of the world of concern to the individual. Level 3, projection, consists of extrapolating this information forward in time to determine how it will affect future states of the operating environment (Endsley, 1993). The third level of SA combines what the individual knows about the current situation with his or her mental model of similar events from previous experience, to be prepared for what might happen next.

In our research, we define SA as based on the three main aspects:

1. a person's previous knowledge and understanding of the situation, which contributes to identifying the source and nature of issues and problems;
2. detection and comprehension of the relevant perceptual cues and information from the environment, which supports comprehending multiple visualisations in their context;
3. interpretation of these and reconfiguration of understanding and knowledge in a continuous process during the group collaboration effort. This allows awareness of changes in the environment, knowing what team members do and have done regarding current events in the environment, and keeping track of work progress.

Henceforward we refer to *shared situational awareness* as to the amount of communality of the individual SA of team members on the three aspects defined above. Our research investigates the following questions: What does situational awareness mean in team collaboration? How can we support situational awareness in collaborative working environments? How can shared displays support shared situational awareness in practice? How can we design and evaluate interactive systems and visualisations that afford situational awareness in order to stimulate existing and new forms of collaboration?

Team Coordination

There have been a series of studies investigating group processes in real world situations. However, the tasks used in these studies did not address scientific teams. Still, one can be just as creative in science as in design (Johnson and Carruthers, 2006). A recent empirical study by Johnson and Carruthers provides a good overview of the relevant theories on creative group processes. Results of this work are requirements for software tools to support specific creative tasks (Johnson and Carruthers, 2006).

Other empirical studies, although conducted in real work environments, focus only on team coordination in extreme collaboration scenarios (Blandford and Wong, 2004; Manser, 2006; Wilson 2006). *Extreme collaboration* refers to collaboration within *warroom* environments where teams work together synchronously in all phases using a variety of computer technologies to maximize communication and information flow. For instance, Manser et al. (2006) investigate coordination needs of cardiac anaesthesia teams in an operating room environment. The result of their study is a conceptual framework for the analysis of multidisciplinary team collaboration in complex work environments. A qualitative study by Wilson et al. (2006) reports the impact of a shared display on small group work in a medical setting.

Applying a human-centered approach, we need to analyse the actual context in which the collaborative system will be deployed (Carroll et al. 2006; Varakin et al., 2004). An understanding of the work context will help us to design technology that supports team members in their primary task at hand, and thus leads them to communicate and interact in a collaborative environment with prolonged involvement and, hopefully, better results. It will also help us to find out how new computing technology in collaborative environments, such as large shared displays, influence scientists' work and team coordination (Hallnass and Redstrom, 2002).

AFFORDING SITUATIONAL AWARENESS IN SCIENTIFIC COLLABORATION

In contrast to domains such as aircraft or plant operation control, emergency dispatch or crisis management (Mark, 2002; Sharma et al., 2003), scientific teams are not working in life-threatening situations and are not under constant strong time pressure. However, long-term scientific projects involve high costs and therefore it is hard to recover from any errors. Shared visualisations on large displays have proven to be helpful to support group discussions because the support situational awareness (Borchers, 2006; Huang, 2006; Rogers and Lindley, 2004). Other examples of teams using a large display to enhance awareness of their activities are programming and design teams (Biehl et al., 2007).

Evolving technologies in molecular biology produce vast amounts of data. Scientists in this domain are confronted with the problem of applying methods from different disciplines when analyzing and interpreting their data, such as statistical, mathematical and machine learning techniques. Moreover, integration of the results from heterogeneous information sources is a difficult but essential part of the analysis of experimental results. Current omics experimentation in molecular biology, for example in drug discovery and cancer research, is a complex, highly dynamic and multidisciplinary task that requires teamwork (Rauwerda et al., 2006; van der Vet et al., 2007). It is essential for life scientists to design the experiment precisely and accurately to ensure the statistical validity of the data. Timely spotting outliers and abnormal patterns in a huge amount of data is crucial for experimentation (see Figure 1). Recent studies showed that there is a strong need for visualising the omics datasets on a shared display for comparing and discussion among multidisciplinary scientists (Kulyk et al., 2007; Li et al., 2005).

Presenting visualisations on a shared display in a collaborative working environment can support group discussions (Borchers, 2006; Huang, 2006; Rogers and Lindley, 2004). Looking at the statistical representations of the same data on a shared large display enables scientists to assess the quality of the entire omics experiment at a glance (Kulyk et al., 2007). The visualisations on the various parts of the display are implicitly related, in the sense that they refer to the same experiment, but currently it is not always evident what this precise relation is. To prevent team members from getting lost and to support situational awareness, the relations between various statistical representations have to be explicitly visualised. In order to afford detection of changes in visualisations and to avoid change blindness, it is important to draw team members' attention to current changes without distracting them from the discussion.

Multiple visualisations can be closely related, and therefore a change in a visualisation on one display will have to be related to visualisations

Figure 1. Scientists interacting with multiple visualisations in e-BioLab, MAD/IBU, University of Amsterdam

on other displays in a manner pioneered by the Spotfire[1] system. In our case, however, the situation is more complex. Scientists in multidisciplinary teams use discipline-related visualisations. For example, in microarray experimentation, spotting the outliers and abnormal patterns in the large data set can be done only by an expert in both statistics and in molecular biology, by analysing a combination of various statistical representations and microarray scans. Another example is when, at the microarray experiment design stage, a statistician needs to establish confidence intervals and statistical power of an analysis. However, only molecular biologists and microarray experts can assess whether it is experimentally possible in the wet-lab to increase statistical power or to avoid confounding by choosing a different experimental setup.

Molecular biology in general is a highly visual discipline (Campbell and Heyer, 2006). Visualisations play a large role in the analysis and interpretation of *omics* experiments (van der Vet et al., 2007), Figure 2. In the next section, the issue of collaborative working environments is addressed. We discuss how visualisations can support group discussions in such environments. We will also report our own experience on situation awareness support of scientific teamwork in a molecular biology context (Kulyk et al., 2007).

We argue that situational awareness can be supported in such environments by bringing relations between various visualisations in the focus of attention at any particular moment.

VISUALISATIONS AND SITUATIONAL AWARENESS IN COLLABORATIVE ENVIRONMENTS

Until recently, most of the studies in scientific visualisations mainly address the design of integrated software visualisation tools, with "single user—single visualisation" interaction. However, as a study on collaborative scientific visualisations illustrates (Li et al., 2005), the picture becomes more complex in situations in which groups of users will be interacting with multiple visualisations and communicating with each other at the same time. In genomics research, there is a strong need for visualising the large genomics datasets during multidisciplinary collaborative discussions for comparing and sharing data among scientists (Li et al., 2005). Designing visualisations for multiple use to enhance exploration of heterogeneous information is a new challenge in cooperative work.

Much of the work on situational awareness cited before is relevant but has to be adapted to

Figure 2. A scenario in which a life scientist is interacting with multiple visualisations

the specific needs of the multidisciplinary teams in omics experimentation: molecular biologists, microarray experts, bioinformaticians, and statisticians. The practitioners of the various disciplines involved in our research bring with them rich and often implicit background knowledge, as was found for scientists in general by Dunbar (1995).

The *e-BioLab* is a collaborative environment that aims to facilitate multidisciplinary teams during project meetings on molecular biology omics experimentation, with an initial focus on *microarray experiments* (Rauwerda et al., 2006). The goal of a microarray experiment is to simultaneously examine the expression level of all genes of a specific organism, in a cell type in a specific growth or stress condition. Microarray technology is currently one of the most important methods in genomics and is usually applied to unravel complex cellular mechanisms or discover transcriptomics biomarkers: genes whose expression profile can be used for diagnostic purposes or to monitor and predict cellular processes (Stekel, 2003).

In interpreting a microarray experiment in the e-BioLab, both the results of the experiment itself and those of statistical data analysis can be displayed in the form of visualisations on the large display, as in the example in Figure 2. In this way, team members can assess an entire microarray experiment. Moreover, in a multidisciplinary setup a large high-resolution display connected to online genomics resources can be used to construct models of biological mechanisms, thus enhancing omics experimentation and collaborative interpretation of the results. The largest tiled display is split into a number of displays, Figure 1 and 2. Visualisation of various statistical representations of the data on the tiled display enables scientists to assess the quality of the entire experiment at once. The visualisations on the various parts of the display are obviously related in the sense that they refer to the same experiment, but currently it is not always evident what the precise relation is. To prevent users from getting lost and to support situational awareness, the relations between various statistical representations have to be explicitly visualised. In order to enable detection of changes in visualisations and to avoid change blindness, current changes have to be put in focus of attention.

The complexity of multiple displays showing often complex visualisations can, as mentioned earlier, be reduced by employing attentive and proactive interfaces, also called notification services (Crowley, 2006). Such interfaces have to anticipate the context and provide an appropriate feedback without distracting the users from their main task. An example of such an interface for awareness and collaboration support is the persuasive displays environment designed by Mitsubishi Research Lab (Dietz et al., 2004). Such an environment can also include a *peripheral awareness display*: an information system or a graphical representation that resides in the user's environment and provides information within the periphery of user's attention (Plaue et al., 2004). Monitoring the peripheral display should cause minimal shift from the user's current focus of attention, allowing users to garner information without being distracted from their primary task. Most current peripheral display approaches use visual, auditory and tactile modalities for conveying the information. Our primary focus for this chapter is on the visual modality, since this is the main source of information in state of the art E-BioLabs. The information can be generated on the basis of multimodal cues sensed by the sensors embedded in the environment (Iqbal et al., 2005). The evaluation of such an awareness display is mainly focused on effectiveness and unobtrusiveness: the ability of the visual representation to communicate information at a glance without overloading the user (Plaue et al., 2004; Kulyk et al., 2006).

The next section gives an overview of various practical case studies on team coordination support in collaborative working environments. Our own case studies in different subdomains of bioinformatics are presented as examples (Kulyk and Wassink, 2006). We also introduce the assessment model of team situational awareness in collaborative working environments that can be used for human-centered design and evaluation during practical case studies. Finally, we discuss practical challenges in the design and evaluation of group support systems for collaborative working environments and our multi-level approach for the analysis of technology-mediated interaction. We end with a conclusion and discussion.

SITUATIONAL AWARENESS IN OMICS EXPERIMENTATION

The support of multidisciplinary scientific teams in collaborative environments is centrally addressed within our BioRange project. As in any user-centred approach, user studies and task analysis are a core activity in our research (Bartlett and Toms, 2005; Javahery et al., 2004; van Welie and van der Veer, 2003). Contextual observations and interviews are conducted to find out how such collaboration takes place in daily work practice between biologists, bioinformaticians, and biomedical researchers and how we can support them (Kulyk and Wassink, 2006). The results of our studies underline that multidisciplinary collaboration is essential in molecular biology and bioinformatics. Visualisations of experimental and biological data are used for discussing the experimental results and for assessing the progress of an experiment. Scientists expect they will profit from multiple visualisations in a collaborative environment. At the same time, they point out the danger of overwhelming the viewer with too much information. They strongly prefer to collaborate face-to-face. This is also confirmed in studies for other user groups (McCowan et al., 2003; Nijholt et al., 2006; Rienks et al., 2006) and for scientific teams (Dunbar, 1995). The results of our exploratory study have been translated into requirements for the support of collaboration and multidisciplinary teamwork in bioinformatics, as well as into profile descriptions of novices, experts and scientific teams (Kulyk and Wassink, 2006).

In order to identify the key aspects and user requirements for collaboration support in the context of a scientific collaborative environment, we also perform an extensive task analysis of the current microarray experimentation practice, based on contextual interviews and observations (van Welie and van der Veer, 2003). Use case scenarios for empirical studies in microarray experiments are provided by our project partners (Rauwerda et al., 2006). Scientists from various disciplines: molecular biologists, microarray experts, bioinformaticians and statisticians, closely collaborate during such experiments. In particular, we aim to build a detailed task model of microarray experiments. A task model of the current work situation describing phases of a microarray experiment is currently being validated with domain experts.

As the literature confirms, creative problem solving in scientific collaboration can be supported by providing an appropriate environment and a context (Coughlan and Johnson, 2006). However, introducing a new environment and new technologies, as for example presenting multiple visualisations on a large display (see Figure 1,2), may increase scientist's cognitive load and influence the way project team members collaborate (Varakin et al., 2004). Awareness information in such shared workspace environment is always required to coordinate team activities (Dourish and Bellotti, 1992). We believe that situational awareness is a very important aspect of co-located team collaboration in complex environments, as other research confirms (Manser et al., 2006) (see section 2). Especially in the multidisciplinary settings, situational awareness information is affected by individual team members' abilities, their interaction with other team members, and the environments in which they collaborate (Bolstad et al., 2005). It is essential to provide situational awareness support in collaborative environments in order to support team's coordination needs and creative problem solving.

On the basis of our current findings from conceptual studies and requirements analysis, we are performing a series of practical case studies. We are conducting a series of real-life observations during the project discussions of multidisciplinary scientific teams in the e-BioLab (Rauwerda

et al., 2006; van der Vet et al., 2007). Our aim is to get insight into how shared displays affect teamwork, and to contribute to the development of novel concepts to support co-located situational awareness in a scientific collaborative environment. In particular, we are investigating the effect of the large display visualizations on both individual and team situational awareness. We are also evaluating new designs to enhance the awareness by making relations and changes between different visualizations more explicit. For instance, during project meetings relevant visualizations on a tiled display will be highlighted and other ones will become faded. In this way, a presenter can draw the attention of other team members to visualizations relevant to the expertise of particular scientists, Figure 2. In addition, a notification of the annotations made on visualizations is essential to make all team members aware of the changes.

Concepts for SA Support in Scientific Collaboration

We are currently exploring various alternative solutions for SA support in collaborative environment for scientific teams (van der Vet et al., 2007).

For instance, a *Highlighting on Demand* interface enables the team member who is currently controlling the tiled display to draw attention of the team by highlighting a certain visualisation using a slider on a personal interaction device (for instance, TabletPC or a WiiMote controller).

Another concept is a *Memory Board* interface, which automatically stores and visualises the history of changes on a shared display, allowing team members to go back in time and retrieve a certain annotation made on previous slides or visualisations. This board serves as a peripheral display, affording memorability. It supports level 2 of situational awareness, comprehension.

We expect a supporting effect of visualisation of status information about who is in control of a display or another shared artefact on a personal interaction device. This would make every member of a team aware of who is making the changes and what changes are made. We also intend to visualise the *control interface* on a shared touch display, as well as displaying it on a personal interaction device (e.g. tablet PC). Such an interactive interface enforces sharing and thus supports coordination mechanisms and group awareness on who is currently manipulating and annotating the visualisations. It also partially resolves the potential control negotiation conflict about the annotation of visualisations and about manipulation of the shared display.

ASSESSING SA SUPPORT IN COLLABORATIVE ENVIRONMENTS

The complexity of communication processes in the co-located team and the use of a collaborative environment require the combination of a methodological approach to support situational awareness for team collaboration and a practical method to capture and analyse the dynamics of technology-mediated interactions in context. The nature of the interfaces as well as physical characteristics and affordances of the environment influence the way in which interactions occur (Fruchter and Cavallin, 2006). Therefore our approach for data analysis includes a combination of behaviour, interaction and environment analysis.

We will assess shared situational awareness of team members when we provide supportive visualizations on a shared large display. We aim at reducing disturbing factors that are considered distraction from the primary task. We intend to establish an indication of the relations between Situational Awareness, team satisfaction, group processes like decision making, and the perceived task performance. In our case multiple data collection techniques are used: direct observations to assess user behaviour based on a validated coding scheme (Biehl et al., 2007), screen capturing, video recordings, a validated post-questionnaire (Kulyk et al., 2006; Olaniran, 1996; Paul et. al., 2004), and a post-interview. Video recordings from several viewpoints combined with screen capturing of multiple displays, enables us to analyse several simultaneously ongoing interactions. In addition to the observations, post-interviews and questionnaires are carried out to obtain subjective judgements of the team members, e.g., on group satisfaction, awareness and distraction from primary tasks (Cadiz et al., 2002; Kulyk et al., 2006; Olaniran, 1996; Paul et. al., 2004). Group satisfaction will be assessed by a combined validated post-questionnaire featuring the group process and decision making (Olaniran, 1996; Paul et. al., 2004). We apply these questions to assess the perceived usefulness and impact of new *Highlighting on Demand* and *Memory Board* concepts on shared situational awareness of team members, on distraction from the primary task, and on team satisfaction with the group process and decision making process.

The three aspects of situational awareness described earlier, as well as recent related studies (Biehl et al., 2007; Blandford and Wong, 2004) are used to identify relevant factors of SA to design our questionnaire. We are adapting a computational model of shared situation awareness (Bolstad et al., 2005) to the context of our case studies. This model uses the Situation Awareness Global Assessment Technique (SAGAT)—an objective measure of situation awareness mainly based on work of Endsley (1995).

Our current observations and video analysis show that scientists tend to walk to the tiled display to inspect a specific detail of a visualisation, which indicates that they are treating the display different from a movie screen or a static projection. This points to the dynamic nature of interactions as reported in other studies (Tan et al., 2006). High resolution of the displays allows them to zoom on fine details. This indicates a high immersion, though possibly partially due to the novelty of the large displays.

Applying user study techniques and a multi-level method for data analysis will allow us to identify interaction patterns: natural ways in which team members interact with each other (behaviour patterns) and with the shared displays in the environment. Thus we may iteratively improve the design of SA support and construct a framework for the evaluation of how shared displays influence scientists' work and team collaboration.

FUTURE WORK

We will perform controlled comparative case studies on the impact of the Highlighting on Demand and Memory Board SA concepts. Our target groups for the first study are small multi-disciplinary teams (3-5 members) working on joint projects and scientific omics experiments in life science domain. We will assess shared situational awareness of team members, providing supportive visualizations on a shared large display. We aim at reducing the distraction from the primary task, and establishing relations with team satisfaction, group process, decision making process, and with the perceived task performance. Analysis of user behaviour allows us to define interaction patterns.

In the second case study we aim at assessing the long-term influence of large shared displays on team shared SA in other domain(s) and different collaborative environment(s). We will apply the adjusted measurements of shared SA from the first study. Cross-culture and cross-organizational differences might show different effects compared to the first study. The first target group for the second study are software engineering teams.

CHALLENGES IN MERGING COLLABORATIVE WORKSPACES

Although our primarily focus is on co-located collaboration in which situational awareness plays a crucial role, we also consider remote collaboration scenarios for future case studies in which *social awareness* (Röcker and Magerkurth, 2007) and *presence* (Bystrom, 1999) concepts are also of great importance. The study of Röcker and Magerkurth (2007) on the Hello.Wall display shows that people are apparently not always willing to publicly display their presence in the collaborative environment and prefer to set their own activity status. In our vision, this can be easily resolved by the abstract representation of the general current level of activity in the collaborative environment based on the level of activities of present members. Such an activity representation can provide awareness for the remote project members, and may raise curiosity and encourage them to join the team discussion remotely or even to walk to the building and take a look what is going on in the lab.

One of the future extensions on the e-BioLab environment is real-time teleconferencing in order to collaborate with other e-BioScience labs across the Netherlands. New challenges arise when we attempt to merge physical and virtual workspaces in collaborative environments. Figure 3 shows how 3D teleconferencing and natural documents sharing concepts[2] that were once presented for the future office vision, have been partially realised during the official opening of the e-BioLab.

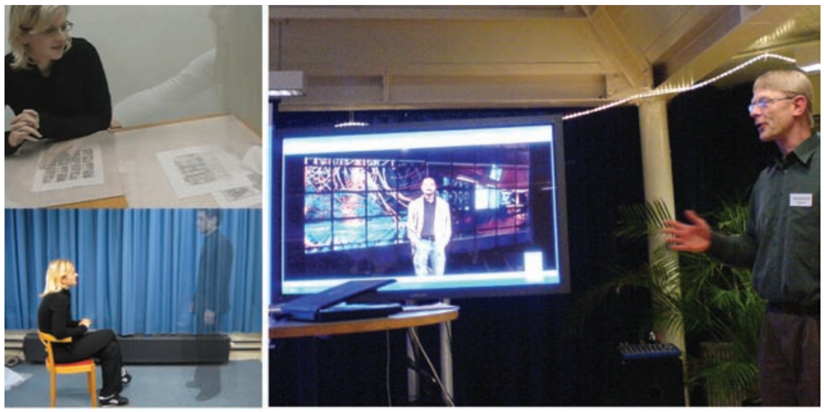
We have to explore the transfer of information between different types of displays, between the virtual workspace and the real one. Control of the shared display remains a potential problem to tackle. Our expectation is that, just as in the physical environment, team members will develop their own coordination mechanisms, negotiating about the control over the central largest shared display. The shared visualisation of the control interface on a plasma touch display currently remains the optimal solution. Sharing enforcement is shown to positively impact coordination strategies, and therefore should work for the team better then several personal controllers. Furthermore, refined evaluation techniques and measures are needed in order to adequately address these aspects of collaborative work in such hybrid workspaces.

CONCLUSION AND DISCUSSION

A new wave of advanced collaboration environments, such as collaborative interactive environments (Borchers, 2006), multiple display environments (Huang, 2006; Rogers and Lindley, 2004) and our collaborative working environment (van der Vet et al., 2007) requires new methods for design and evaluation in order to adequately address all aspects of collaborative work. This chapter presents the research on group awareness support to enhance team collaboration in the co-located working environments in the context of molecular biology omics experimentation.

This chapter aims to provide new insights into how to design and evaluate systems that afford awareness in order to stimulate existing and

Figure 3. 3D teleconferencing and natural documents sharing concepts[2] affording presence (left); official opening of the e-BioLab at the University of Amsterdam by Dr Jason Leigh from the University of Chicago (right)



new forms of collaboration in advanced working environments, as well as insights into how team members of various levels of expertise and backgrounds interact with new technologies in collaborative working environments. We present an overview of the state-of-the-art studies on team coordination and situational awareness support.

Furthermore, we discuss how visualisations can support group discussions and describe the collaborative environment for scientific teams in a molecular biology context. As a result we show that situational awareness is of a crucial importance in co-located team collaboration. We argue that SA can be supported in such environments by bringing changes and relations between multiple visualisations more in the focus of attention. We also report our results of an empirical case study and domain analysis translated into user requirements for the support of multidisciplinary collaboration of scientific teams. Finally, we discuss practical challenges in the design and evaluation of group support systems for collaborative working environments and hybrid workspaces, and present our multi-level approach for the analysis of technology-mediated interaction.

Practical case studies bring new insights into how new technology, in particular large shared displays, affects teamwork and contributes to the development of novel concepts for group awareness support. The main contribution of this chapter is the conceptual framework for studying situational awareness of multidisciplinary teams in collaborative working environments, as well as requirements and guidelines for new collaborative technologies to support situational awareness of teams based on the practical case studies. This work aims to inform the theory and practice of human computer interaction and design for collaboration support.

ACKNOWLEDGMENT

We would like to thank our collaborators Han Rauwerda, Wim de Leeuw, Timo Breit (MAD/IBU, University of Amsterdam), Tijs de Kler and Jorrit Adriaanse (SARA, Amsterdam) for their helpful feedback and for allowing us to use their lab and equipment in our studies. We also thank reviewers and other colleagues for their helpful comments and ideas inspiring this research. This work is part of the BioRange program of the Netherlands Bioinformatics Center (NBIC), which is supported by a BSIK grant through the Netherlands Genomics Initiative (NGI).

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KEY TERMS AND DEFINITIONS

Awareness: is the ongoing interpretation of representations of human activity and of artefacts (Chalmers, 2002).

Collaborative Working Environment: is a co-located shared workspace that facilitates groups during meetings. The workspace is enhanced with multiple collaborative systems and media, such as private and shared displays, tabletops, touch screens, cameras and other devices.

Extreme Collaboration: refers to working within *warroom* environments where teams work together synchronously in all phases using a variety of computer technologies to maximize communication and information flow.

Group Awareness: is the understanding of who you are working with, what is being worked on, and how your actions affect others, is essential to effective collaboration (Dourish and Bellotti, 1992).

Microarray Experiment: examines simultaneously the expression level of all genes of a specific organism, in a cell type in a specific growth or stress condition. Microarray technology is currently one of the most important methods in genomics and is usually applied to unravel complex cellular mechanisms or discover transcriptomics *biomarkers*: genes whose expression profile can be used for diagnostic purposes or to monitor and predict cellular processes (Stekel, 2003).

Omics Experimentation: is a research area in molecular biology that deals with *omes*: large or complete arrays of cell components, such as the genome (all genes) and the proteome (all proteins). For example, studies that encompass the whole genome are in general referred to as *genomics* studies, and studies that examine the expression level of all mRNAs (messenger RNA, which directs the synthesis of proteins) in a given cell population are called *transcriptomics*.

Peripheral Awareness Display: is an information system or a graphical representation that resides in the user's environment and provides information or visual feedback in the periphery of the user's attention. Monitoring the peripheral display causes minimal shift from the user's current focus of attention, allowing users to garner information without being distracted from their primary task (Plaue et al., 2004).

Situational Awareness: is the perception of the elements of the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future, and the prediction of how various actions will affect the fulfilment of one's goals (Endsley, 1995, p.36).

Shared Situational Awareness: is a reflection of how similar team members view a given current environmental situation. Thus, if a team has a high degree of shared situational awareness, we can assume they are perceiving, comprehending, and interpreting the situation's information requirements in a similar manner (Bolstad et al., 2005, p.1).

Task Analysis: is a domain-specific analysis of the current work situation, which combines such classical HCI techniques as contextual interviews, field observations, ethnography and interaction analysis (Jordan, 1996; van Welie and van der Veer, 2003).

ENDNOTES

[1] http://www.spotfire.com, last visited July 2008

[2] Amin, A., Kulyk, O., Metin, B., Schneider, J. (2004) Pervasive Office, Videoprototype presented at the Océ Design Competition, *European Symposium on Ambient Intelligence (EUSAI)*, Eindhoven, the Netherlands.

This work was previously published in the Handbook of Research on Socio-Technical Design and Social Networking Systems, edited by B. Whitworth and A. de Moor, pp. 636-650, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.12
Developing Social Skills through an On-Line Learning Environment: A Qualitative Study

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ABSTRACT

The rapid pace of social change deriving from technological and financial revolution and globalization, effects greatly people's lives. Adults nowadays need to stay relevant with their environment, to be proactive and to take important decisions that affect their personal and professional future. Thus, they need to be equipped with advanced social skills such as time management, leadership, communication, teamwork, problem solving, flexibility etc. Such skills can be developed through training programs, designed and delivered upon the Adult Education and Experiential Learning theories and principles. A central aim of this chapter is to highlight the methods through which e-learning can contribute to the development of social skills, implementing at the same time the above mentioned principles, in the context of a large organization.

DOI: 10.4018/978-1-60566-830-7.ch014

INTRODUCTION

The general goal of this chapter is to pinpoint the essentiality of social skills development through training programs which are designed and delivered according to the adult learning theories. It will also present a case study in which on line training seems to respond successfully to the learning needs of the employees working in today's demanding environments.

The chapter's specific aims are:

1. To bring out the necessity of social skills development for adults working in contemporary and complex environments.

2. To elaborate on the preconditions demanded in order for social skills to be developed in the context of large organizations.
3. To explicate the emerging obstacles during social skills development.
4. To analyze a case study which shows that e-learning can enforce and ensure most of the Adult Training and Experiential learning principles.
5. To present results demonstrating the effectiveness of developing a collaborative and creative on line learning environment.

A. The Necessity of Social Skills Development in Contemporary Complex Professional Environments

Contemporary social conditions and constant change are greatly and variously influencing adult lives, often resulting in professionals´ difficulty to stay relevant and meet their career demands. Caffarella & Lewis note that: "*In a society of constant change, like ours, learning and preparing for new challenges has become an industry targeting to all citizens and ages. Furthermore, and contrary to previous times, adult lives and choices are far more complicated and of a broader range*." (in Brockett & Knox, 1994, p. 1)

According to bibliography[1] such changes concern three major areas: social structure, financial globalization and rapid technological progress.

Constant *sociological* changes create the need for ongoing adult training and development so that citizens can face contemporary demands. Goleman (2000) supports that in times of employment instability, where the term of "labor" is replaced by the term "transferable skills" such skills are becoming of great importance allowing adults to ensure their present and future employment opportunities and progress. This means that members of the society should be armed with advanced skills in order to manage changes – both voluntary and involuntary – and must be flexible and fast learners. Furthermore, adults need to own such skills not only for surviving in today's society but also in order to lead a creative life, feeling content, utilizing a wide range of employment and personal development opportunities, and successfully encountering potential threats.

Equally the increase of competition and institutionalization of *globalization* affect the world economy. Organizations aim at decreasing costs and increasing the quality, as well as the variety of their products. Achievement of such aims can be pursued through human resources who can undertake multiple and complex roles and duties and thus should be characterized by self motivation and creativity, flexibility and problem solving skills, in order to overcome crisis and demanding work conditions (Phillips, 2006).

Last but not least, *technology* catalytically influences knowledge, entertainment, employment, economy and government. The necessity for technological conversance and new information technology practices daily entering working environments as well as the continuous data creation lead to rapid depreciation of existing professional skills and knowledge, (Meriam & Caffarella, 1999, p. 15).

Due to the above mentioned changes new working conditions are being created leading to the necessity of Social Skills for various employment roles. The term Social Skills refers to a group of skills – excluding knowledge, qualifications and work experience – that each professional should be armed with in order to meet the demands of his/her role and duties. In an attempt to clearly define the term Social Skills through Bibliography research, one often detects an indisputable core of skills containing abilities such as communication, teamwork, leadership, time management, flexibility etc. (Brookfield, 1986).

Goleman, (2000) reports some quite distinct examples in order to show the necessity of Social Skills in contemporary society:

- "In a modern technology company the group of employees dealing with the feedstock storage should carry skills such as active listening, comprehension, flexibility and cooperation within a team.

- In a medical centre, technical training and analytical skills are considered to be invaluable. However, emotional skills such as interpersonal abilities, innovation, effective leadership and cooperation with various institutions within a broader context surrounding the medical centre, are also quite important.
- In a large petrol industry, analysis and expertise are considered essential skills in order to succeed in the fields of mechanical engineering or information technology. Equally important are skills such as self-confidence, adaptability, goal setting, provision of quality service, teamwork, exerting influence, and personnel development." (p. 59).

Training and development can highly contribute in the exploitation of new opportunities and the successful encounter of potential threats. Jarvis, (1999) remarks that training can aid adults in achieving a more creative relationship with modern reality, enhancing their lives and eventually conquering the above mentioned social skills. However, which kind of training is considered to be more effective in the development of social skills? What kind of training techniques, principles and preconditions will assist adult trainees in developing social skills and consequently coping with their demanding career roles?

B. Basic Preconditions for Social Skills Development (Adulthood and Experiential Learning)

The previously described essential social skills that a professional must demonstrate in the workplace cannot be developed through the mere reading of a book or the participation in a relevant lecture. Carefully designed training should be delivered in order to cover the special training needs of the participants. Research reveals that personnel's training has not always been appropriate for the accomplishment of the above aims. Corporate training programs often target in plain knowledge acquisition using traditional learning techniques and thus their effectiveness is considered low. Sometimes organizations train their employees in leadership, creativity, change management and active listening, with seminars that are completely based in theory and lack of practice. It has been proven that such seminars have actually a negative effect rather than a positive one (Goleman, 2000).

On the other hand, the difficulty of the social skills development is a given fact, since it involves changes in a person's attitudes and behavior. It has pinpointed that laborers often participate in well designed training programs and courses, while employees working in an office environment dealing mainly with people rather than products, rarely participate in training. This is due to the fact that their development is considered difficult since it involves skills instead of technical knowledge. Their social skills are developed mainly though "trial and error" rather than the participation in a series of training events (Argyle, 1998).

Many scholars in the Adult Education field recognize that the social skills development itself as well as the nature of adulthood and the characteristics of adult learners, dictate a specialized training approach. It is noted that in order to develop social skills through training, student centered techniques must be adopted. Such techniques promote the active participation of the trainees and provide them with the opportunity to discover and mainly experience change before they are asked to put it in practice. Experiential learning and the training techniques involved in it seem to be quite effective not only in relation to the social skills development but also in regards to the profile of the adult trainee himself (Phillips, 2006).

The following factors and characteristics signal adulthood and create the need for a training design (either in classroom or through e-learning) that will satisfy its specialized conditions.

Adults participating in training have often recognized the need for it. Thus adults come in training with *particular goals*. If they don't manage to cover their goals, sooner of later they will terminate training (Rogers, 1999). Another characteristic of adult trainees is their *desire for action*. Thus, in adult training programs the trainer should share the responsibility of the training process, training goal setting and methodology with the trainees (Jackson & Caffarella, 1994). Another factor impacting the training process is the adult learner's demanding life and its *exigent obligations*. The training programme they are participating in is not their major activity. Thus they exhibit concentration difficulties especially if the training process seems uninteresting or does not require their immediate participation. When the trainer treats them as passive receivers they quite easily loose concentration and are more likely to reflect on their following day's concerns (Jackson & Caffarella, 1994).

The more important characteristic of adults that seems to mainly affect their training is their accumulated *experience*. Rogers (1999) mentions that trainees´ experiences can have a motivational function in the training process. The trainer can easily associate any matter with their personal experiences in order to maximize their interest in the training process and subject matter. In fact, such experiences should not be ignored since they depict the trainee's lives, in which they have sentimentally invested, and when disregarded they feel that their personality is being questioned.

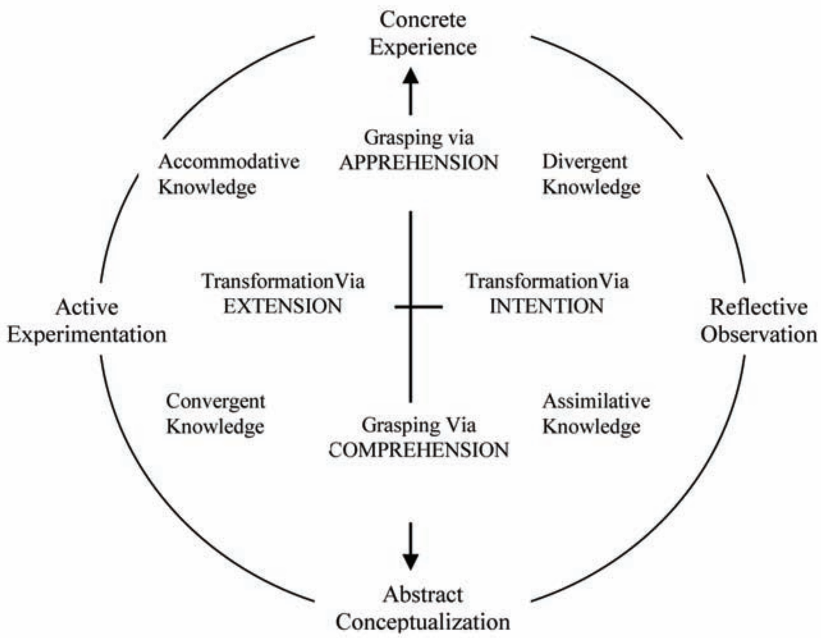
The above mentioned characteristics are immediately related to the imperativeness of the trainees´ active participation in the learning process, either by exploiting existing experiences or by creating new ones. Courau, (2000) describes active participation as one of the seven preconditions in adult learning. Noyé & Piveteau (1999) also support this position adding that the more participative the process the more effective the development and knowledge acquisition. Likewise, Piaget (in Merriam, & Caffarella, 1999) mentions the importance of the trainee's active role in the construction of his/her personal knowledge and abilities.

Freire, (in Kolb, 1984) also supported the necessity of *praxis* in the training and learning process. According to him action means reflection and participation in the real world in order to succeed personal transformation. Such learning and transformation can only be achieved through action (Merriam & Caffarella, 1999). Experiential learning seems to greatly meet the above mentioned preconditions of adult learning, since it is defined[2] as learning through experience or learning through action. Trainees are firstly exposed to an experience and then are encouraged to reflect upon it in order to develop new skills, behaviors or ways of thinking. Under these circumstances, trainees are mainly asked to act instead of listen and are motivated to analyze and reflect on their actions (Jackson & Caffarella, 1994). According to Dewey, (1997) - one of the first scholars to intensively research the importance of experience in learning – experience is created through interaction between the person and the environment. The experience obtained shapes, enriches and reconstructs the person's sentimental world.

Kolb, (1984) created a theoretical model on experiential learning known as the "Experiential Learning Cycle". According to this model the experiential learning process can be described as a cycle encompassing four learning functions: (a) concrete experience, (b) reflective observation, (c) abstract conceptualization and (d) active experimentation (p. 42). The main idea of this model is that learning results from the combination of grasping experience and transforming it into a form of knowledge. Kolb's (1984, p. 42) theoretical model is depicted in the following schema:

Experiential Learning's substantial difference from other types of active training is that all four

Figure 1. Kolb's Learning Cycle



stages should be implemented during the training process. Also, the stage of critical reflection is considered to be of great importance and if omitted the training event can not be characterized as experiential. Mintzberg (2005) studied the input of training programmes in the development of managerial staff and reached the conclusion that "although managers cannot be created in a classroom, existing managers can further develop there. Their experiences can turn the classroom into a rich arena for learning. Thus, through experiential training techniques such as Case Studies, for example, can help managers see their experiences in other contexts, while theory can help them generalize from their experience" (p. 243).

According to Jarvis (1999) developing skills– in the sense of someone being able to do something - can not be identified with memorizing theory but with an active nature of training. He supports that in order for someone to be able to do something in the workplace, she/he must have the experience of trial and error during his/her training, and to be able to experience its practical implementation. If a trainee just observes someone practicing a skill or listening to his instructions of how to go about it, it will not ensure its successful practical implementation from the trainee. Mintzberg (2005) comments that "“Transmission” is not the most important part of training but just a part of the process. Learning does not flow like electricity. And learners should no more be seen as "recipients" than trainers should be seen as "senders" " (p. 242). He also remarks that developing competencies – training for skills – is not a straightforward business. It can be difficult and time-consuming, requiring learning the basic idea, experimenting, being coached, receiving feedback and carrying that learning on (Conger 1992 in Mintzberg 2005 p. 257).

It is therefore concluded that both the nature of adulthood, which requires an active participation in the training process, as well as the importance of critical reflection upon experience, make experiential learning appropriate for social skills development. For this reason, many organizations worldwide have adopted experiential learning techniques during their in house training processes.

Extensive work has been carried out by the scholars of experiential learning, regarding its preconditions of effectiveness and the techniques which serve best its intentions.

A very important element determining experiential learning's effectiveness is *content*. Silberman (1998), argues that experiential learning programs should be selective, choosing the "need to know" before the "nice to know". They have a lean curriculum since they concentrate on the critical learning areas – those elements of the subject that provide the essential basis for building later. When the content level is kept moderate, the trainer has the time to design activities that introduce, present apply, and reflect upon what is being learned (p. 13).

A next precondition refers to the *variety* of learning techniques and approaches and the *balance* between them (Silberman 1998, p. 13). Using different learning approaches is likely to be more effective than a single approach that may work for some but not for others. Also, the trainer must design a balanced program allowing time for reflection. A program full of activities but no time for reflection will tire the trainees and will not give them the opportunity to consider how these techniques have worked for them and their skills development.

The techniques used in the program e.g. Role plays, case studies, simulations and games need to be *relevant* to the participants´ factuality and interests (Silberman, 1998, p. 128). Real experiences are deeply felt by the person who has lived it and yet easily shared with other trainees who have lived similar experiences (Mintzberg, 2005, pp. 266-267). The design and delivery of training techniques and the aims achieved by them should be closely related to the specific training *goals*. In order for experiential training techniques to be successful they should meet specific training purposes (Jarvis, 1999).

Negative feelings or conflicts may emerge during a training event, due to the experience of new situations or the relive of existing ones. Thus, the trainer should be fully *informed* of the trainee members. This will assist him/her in choosing experiences and activities that will not make participants feel uncomfortable or create an unpleasant situation for them. At the same time, the trainer should be armed with skills that will help him/her handle such situations and manage crisis within the training team (Phillips, 2006).

Another precondition for effective experiential learning concerns the *directions* given prior to a learning activity. They should be carefully though out in order to have the desirable impact on the participants (Silberman, 1998, p.131). Experiential Learning involves the effort of change and fear for such change may affect negatively the trainees. Therefore, they should be absolutely certain of the task they have to complete in order to feel confident and safe.

Due to all of the above preconditions the *learning environment* should be carefully chosen. Its role is important and should ensure an atmosphere of creativity and teamwork in order to avoid traumatic experiences. Studies showed that learning was greater and more effective within organizations with a positive environment characterized by autonomy and development opportunities (Kolb, 1984). Contrarily, when the environment is not encouraging many learning barriers emerge. Kirkpatrick (1998) clearly pinpoints the importance of the environment: "In order for change to occur, four conditions are necessary:

1. The person must have a desire to change.
2. The person must know what to do and how to do it.
3. The person must work in the right climate.
4. The person should be rewarded for changing." (p. 21).

Under no circumstances should the *reflection* upon experience stage be omitted. When reflection is ignored, the trainees cannot define what they have actually learned and achieved through the activity they have experienced (Merriam & Caffarella, 1999). T.S. Elliot writes in one of his poems "We had the experience but missed the meaning" (in Mintzberg, 2005, p. 254).

After the completion of the program trainees will return to their work place and will be asked to put into practice the knowledge and skills acquired from training. Silberman (2005) suggests the creation of an *action plan* regarding the "steps taken by participants and the obstacles they will face as they implement new ideas and skills" (p. 15). Thus the trainer should involve them in such future planning at the end of the training program.

C. E-Learning for the Development of Social Skills: How Successful Can It Be?

Although Information and Communication Technologies (ICT) were not particularly developed for the enhancement of learning, their potential over time shows that in the near future learning will be closely associated with the "e" prefix (Cedefop (a), 2001, p. 3). E-learning emerged in the early years of ICT development, in the form of Computer Based Training (CBT) or stand-alone multimedia Cds. Nowadays, many different types and approaches of technologies, tools, and ideas have arrived on the scene. Researchers are trying to identify models and theories in order to reach excellence and best e-learning practices (Ehlers et al., 2005, p.12). However, this is not an easy task. Even when examining "conventional learning" one finds a variety of theories each one attempting to explain the process of learning from its different point of view.

As far as e-learning is concerned, even the definition of the term is a controversial effort. Moreover, when researching relevant bibliography one finds more than one term: computer based training or computer assisted learning, blended learning, virtual learning environments, online learning and internet based learning, learning packages, learning management systems, are only few of them that may be connected (Coulon et al., 2004, p. 15-18). In the current chapter the e-learning term is associated to the use of technology for the support and enhancement of the learning practice during any stage of the learning experience and with the usage of any e-tool (Mayes & de Freitas, 2004, p.5).

Many e-learning implementations and designs were originally developed by computer experts and not by learning specialists. This led to the creation of non pedagogically-based learning practices, which in turn arouse many difficulties to the development of the new emerging discipline. Although such practices were not supported by educational and training principles, the field was technologically innovative and hence developed rapidly. However, after several decades of inquiry and research there now seems to be an effort to frame the several models of e-learning within certain educational principles. Such effort allows e-learning to mainly serve the "learning" part of the term, rather than the "e" part (Coulon et al., 2004, p.14; Ehlers et al., 2005, p.31, 71). More specifically, there are three basic perspectives that generate different e-learning strategies according to the assumptions about what is crucial for understanding learning. These are:

- the associationist perspective (learning as activity),
- the cognitive perspective (learning as achieving understanding) and
- the situative (learning as social practice).

The above perspectives have been respectively connected with relevant learning theories (Mayes & de Freitas, 2004, p. 7-10). The first perspective is connected with Associationism, Behaviourism and Connectionism research traditions, which are mainly based on a bottom-up approach where learning starts from small and logically ordered chunks and moves to more complex and interconnected meanings. The second perspective is based on Information Processing theories where learning takes place when new forms of understanding are built through activities. New experiences help the learner to construct new meanings and understanding upon already framed structures. The last one is connected to a Social perspective and is based on communities of practice and situated learning that is created amongst groups of people. According to Mayes & de Freitas (p.10) these perspectives are not necessarily contradicting. However, the important fact here is that every e-learning design should be characterized by one (or more) of the above mentioned perspectives. This will assist the alignment of the e-learning strategy with the specifically designed learning outcomes which can be achieved through learning practices and processes.

As mentioned previously, the development of social skills in the contemporary professional arena is of great importance; however certain limitations and boundaries can lead to non effective training interventions. Such boundaries can be of practical nature (time, place) and may create substantial difficulties during the learning experience (lack of or limited participation, training effectiveness etc). Important obstacles such as distance between the seminar room and the working environment may be aroused. Such obstacles may be overcome with the exploitation of e-learning tools and their particular training advantages (flexibility of time and place, collaborative constructed knowledge, development of best practices in real-life cases etc.). The approach of the research presented in the current chapter, has mainly adopted the Cognitive and Situative perspective, and at the same time it attempts to incorporate the adult characteristics and experiential learning principles and preconditions described earlier, in order to overcome the mentioned barriers.

The program design proposed in the current research embraces the theories of adult education and experiential learning, wishing to support more effectively our learners and provide them with suitable learning experiences. More specifically, the fulfilment of the adult characteristics and the effective learning principles mentioned in the chapter's earlier stages is succeeded through the following:

1. **Adult learners come in training with *particular goals*.** In the proposed design of the e-learning program trainees are asked to clearly and openly state their personal training needs to the rest of the team. These statements are marked on a separate discussion board accessed at any time during the learning event. At the same time the board with their mentioned needs help participants assess their progress during training.
2. **Adult learners have a *desire for action* (praxis) related to their real life context that will provide them with new experiences to reflect upon.** Their training program has been enriched with several practical ideas for implementation in their everyday working place. Participants are asked to share, discuss and reflect upon these ideas. The added value of an e-learning environment is that even if trainees being in their own environment they can simultaneously participate in a learning event. Thus, they do not experience the gap between real life and training which makes their contributions more specific and their discussions more effective.
3. **Adult learners live demanding lives and have *exigent obligations***. Although the training program has a weekly curriculum, flexibility is assured through the absence of definite deadlines. Also, group discussions amongst trainees are arranged on certain times; however, opportunity for feedback is given, even for the latest submissions, allowing them to work at their own pace.
4. **Adult learners come to training with accumulated *experience* and existing beliefs**

and ideas. The designed activities are based on their personal structured concepts and give opportunities to reflect upon their assumptions and life decisions. The e-learning environment allows them to think and rethink over their assumptions and observe their progress.

5. **The training process should refer to the participants' real life events.** The learning activities require participants to share personal working experiences and events, and propositions regarding best working practices, processes etc.
6. **Experiential learning needs extended duration to contribute effectively to ones personal development.** The e-learning environment gives the opportunity to participants to keep in touch with the subject matter, their tutor and their colleagues for as long as they wish.
7. **Experiential learning should be followed by an action plan for implementation in the work environment.** The e-learning environment gives the opportunity to participants to prepare an action plan on a calendar and stay in touch with it and with their personal learning goals, even when they return to their workplace.

The principles analysed above and the related actions taken into account in the design of the course are clearly connected with the socially mediated constructivist perspective to e-learning (Muirhead, 2002). According to Mayes & de Freitas (2004) the cognitive perspective views learning outcomes as an interaction between new experiences and the structures for understanding that have already been created (p. 9). This is connected with several of the above principles (2, 4, and 5). Also they state that new forms of understanding are gained though activity, which is also reflected in the experiential learning principles we tried to turn to advantage in our design. Participants work to discover broad principles and construct meaning through their experiences. All these can be achieved in a collaborative environment where trainees share what they gain during the learning process.

Moreover, some of the basic principles of this overall design derived from Anderson's ideas on freedom and social presence. To succeed and gain the participation of employees to a project with no extrinsic motivation, we should give them maximum freedom and flexibility and at the same time offer them the greatest opportunity for learning, participation and communication (Anderson, 2005, p.1). With the e-learning method participants obviously gain flexibility of space and time. With lack of fixed deadlines they also have freedom of pace. As far as freedom of media is concerned, many usability constrains can appear that may hinder the learners. Yet, a significant effort to find new and flexible ways to learn is possible, using alternative tools. Freedom of access was an important success of the presented e-learning project mainly due to the fact the banking organization in which it took place, made the application available through the internet, meaning that no extra cost was added to neither the participants, nor the organisation. Freedom of content can also be achieved. Although participants in this project, did not have the opportunity to change the instructional style, they had alternative choices over where to post (blog or discussion forum) and if it should be public or not. They also had several opportunities to enrich the content by adding some of their favourite material relevant to the subject matter. Finally, freedom in creating relationships was an immense benefit for the learners. New and close friendships were generated amongst participants and partnerships initiated in order to perform stress-release activities, followed by briefing to the non participant members of the team, regarding their experience. Some of the trainees chose to be more discreet in creating relationships and opted for posted messages in discussion forums restraining from closer contact.

D. The Case Study: A Collaborative E-Learning Environment in the Context of a Banking Organization

D1. Description of the E-Learning Course Provided within the Organization

The designed e-learning course presented here is provided to the employees by the banking organization they work for. The course theme is "Stress Management" and is available to all staff occupying clerical and non managerial positions. Most of them are graduates of management or financial university degrees and have a good level of ICT skills. However, they have limited prior e-learning experiences. They are positioned in quite demanding posts, with many customers to serve and need to deal with multi tasks simultaneously.

The e-learning course's goals are to:

- Understand the definition of stress and how it affects their lives.
- Realize their stressors and symptoms of stress that they personally experience.
- Develop their self-awareness in regards to stress.
- Identify the stress release techniques that suits them best and implement them in their everyday professional and personal lives.

The duration of this e-learning course is four (4) weeks. Each week deals with a particular subject matter (**Week 1**: Defining stress, **Week 2**: Basic stressors, **Week 3**: Fundamental stress symptoms and **Week 4**: Effective stress management techniques).

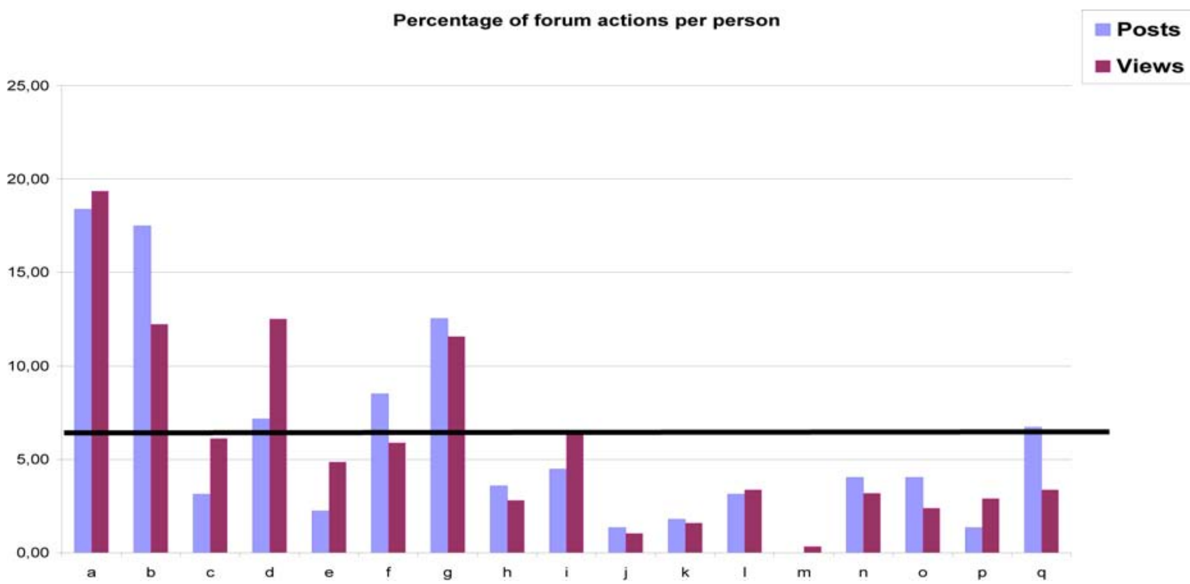
The structure of the program and the main area where the activities are held is a Moodle Virtual Learning Environment[3]. The main technologies used for the set of activities proposed are: Discussion Forums, Wikis and Blogs. The Moodle site provides a unifying accessible space which learners can visit in order to be informed about the program, the activities and the study resources. Through the same space they can access discussion forums, the wiki application and a blog facility. Especially for the blog facility, which is embedded in the Moodle application, its affordances are bounded if compared with usual blog providers, and it is preferable to use a more convenient one for related activities. Moodle also provides a suitable place for building communities with several communication facilities (one-to-one, one-to-many, many-to-many) and content management tools (building wikis, databases, glossaries etc.) that can serve fully the socially-mediated constructivist approach (Moreno, et al., 2007, p. 893).

Some other key issues that have informed the design derived from Goodfellow's report on Computer Mediated Communication and the lessons that were learned about it in the OU (Goodfellow, 2006). The main purpose of this e-learning project was to give an opportunity to participants to work together and stay in touch with the subject studied in a more interactive and long-term way, than the one-day classroom seminars. A major issue that also arose was the amount of workload that would be added to their existing demands of their personal and professional lives[4].

D2. Data Collection

The data presented and analysed was collected during a pilot phase of the course. In this phase 20 participants were randomly selected and invited. The data collected by Moodle and used in the analysis below were the logs of the group's actions (views and posts) regarding resources and forums. Also, an open-ended questionnaire was distributed at the end of the program, which participants anonymously filled out. This aimed in evaluating their learning experience. Lastly, all the discussions held in the forums were available for analysis.

Figure 2. Percentage of forum use (posts, views) per participant



D3. Data Analysis

Analysing data gathered from a case study is a difficult task and many pages of information and remarks can be collected. In the current case study focus is given on analysing the users' log files and on cross examination of these findings with the statements of participants presented in their evaluation questionnaires.

a. Forums

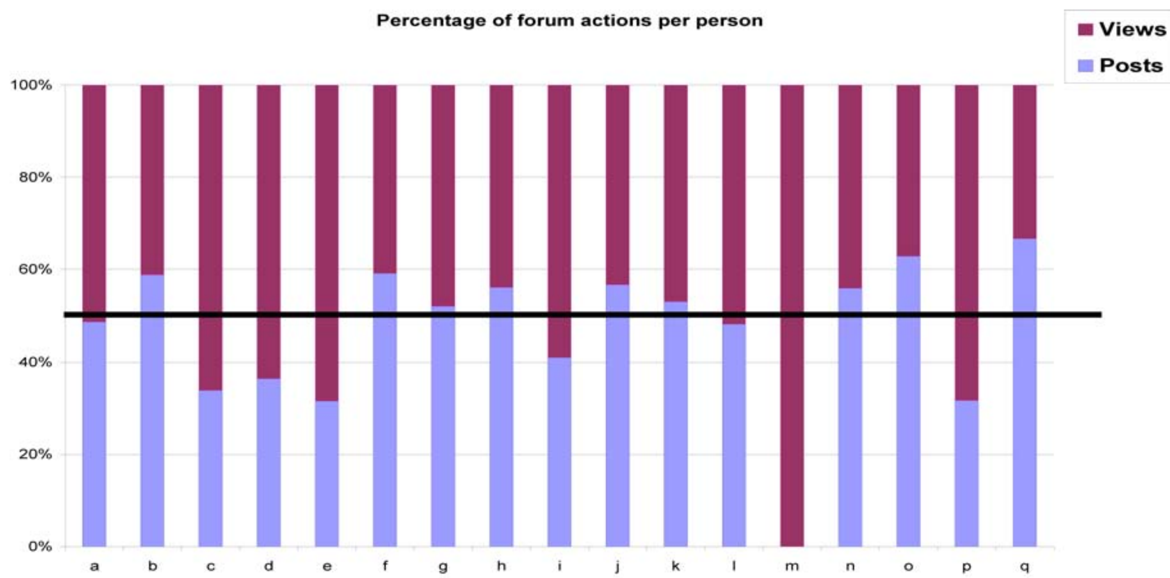
The use of forums was one of the most interesting and indicative aspects of the study. The forums' log files where processed in two different categories as shown in Chart 1.

The horizontal line in the Figure 2 indicates the average forum use. Amongst the group members one can find participants with very high activity, as well as participants with average or low activity. However, the following interesting point is detected: there is a great variety of behaviour when comparing percentages of posts and views. More explicitly, there are participants with similar patterns of access and postings, others with similar patterns only and those that have either a higher preference in access or others with a higher preference in postings. Even though one would expect the percentage of views to be higher or similar to postings, this is not the standard case. Moreover, those with the greatest difference (higher percentage of postings compared to views) are those who are employed in the bank's branches. This fact could be an indication that participants who are branch employees accessed the site in a more "effective" way. On the other hand, those participants that are occupying positions outside the bank's branches (e.g. Headquarters, administration and support positions), have a more frequent access record, even though such access was made just to check out whether other participants were posting something or to just browse the site.

The above results are depicted in Figure 3. The horizontal line indicates the dominant behavioural pattern for each participant.

The most frequently accessed forums were the ones serving introductions amongst participants. The forums created by the participants themselves in order to include information they personally gathered in relation to stress, were also, frequently

Figure 3. Percentage of forum use comparing post actions and view actions per participant



accessed. The highest activity was reported during the fourth week's forums. Such finding could be predictable since during the fourth week the most valuable and interesting topic was discussed and analysed: the basic techniques used to manage stress. However, this high level of activity was not focused on accessing the fourth week's relevant recourses and advices on stress management provided by the training programme itself. Instead, participants entered forums in order to discuss their personal experiences and methods that worked best for them in their stress management pursue.

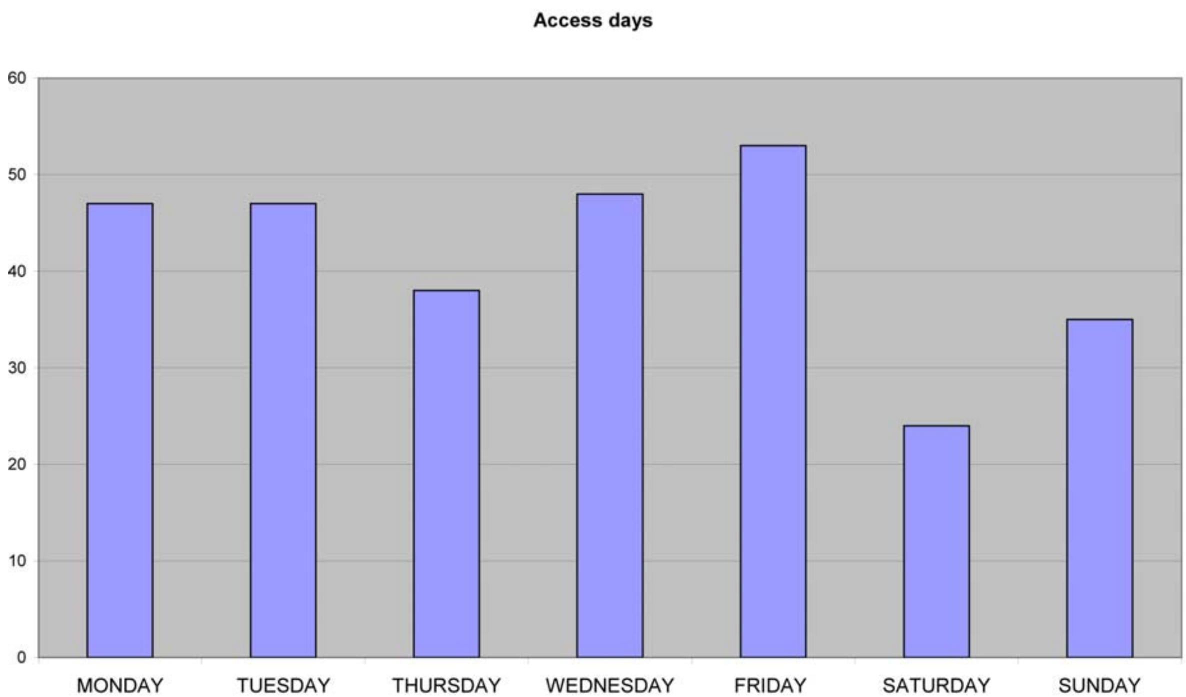
b. All Actions

An interesting finding concerning the evaluation of log files is that the actions taken from participants occupied in positions other than the bank's branches (e.g., headquarters, support and administration) are of greater quantity than the actions taken by frontline employees positioned in branches. Such finding could indicate that work pressure and work load is greater in frontline positions, thus hindering participants' learning process and progress. Moreover, the average site use by female participants was double in quantity compared to use by male participants.

It is worth mentioning that even though the most interesting and important recourses (articles etc.) provided by the training programme, were available during the fourth and last week of the learning event, they were least accessed by the participants. However, the forums of this particular week were the most accessed ones (as mentioned earlier). On the other hand, the most frequently accessed recourses were those of introductory remarks, first theoretical approaches to stress and the database with advices and ideas to managing stress.

A description of access in relation to each weekday is presented in the following graph. One can see that weekends are the least popular regarding the participant's preferences. It is also indicative that trainees with children never accessed the site during weekends. This may be interpreted that the course is considered by them as strictly professional concerning solely their

Figure 4. Percentage of participants' access in weekdays



career, while weekends are dedicated to personal interests and family members.

c. Questionnaires

One of the findings emerged from the questionnaire[5] analysis is that participants need to see adult education and experiential learning principles and techniques implemented in e-learning training.

More specifically, all of the participants mention (directly or indirectly) that the main benefit gained from the course was the opportunity to interact with colleagues. They also report that their greatest payoff was their active participation and the substantial role given to them in the construction of knowledge through the learning process. An example supporting such evidence is that the first question, dealt with the course content and the trainees' views regarding it. Participants' answers did not focus on evaluating the content provided in the internet but on the fact that they had many opportunities to contribute to learning, to create their personal knowledge and to taking action (praxis).

Their answers regarding details about the actual knowledge gained include peer learning as one of the greatest course advantages and they consider interaction as a main factor of developing their self-awareness. Only one third of participants mention details regarding actual knowledge gained. It seems that their main criteria for measuring the course success is the attitudes developed towards themselves, other participants and the subject of stress.

Additionally, in the second part of the questionnaire, participants opt for even more praxis and communication opportunities amongst them. This is also indicative of their priorities, especially if their answers are associated with the many drawbacks of the system's usability and efficiency.

It is also important to analyse their answers given to those questions concerning the differences participants detected between this e-learning procedure and other more traditional classroom courses attended in the past. Their answers can be classified in three categories. The first category is related with the opportunities given for experiential learning. The second category is related to access and flexibility of the course that gave them the opportunity to involve themselves in further critical thinking. Finally the third category is related to the opportunities given for interaction amongst participants. These three categories of answers are aligned with we described earlier as important preconditions for adult learning, and from their answers it is obvious that the program succeed in providing them.

Answers to the question relating to problems and difficulties participants faced during the training event, are associated with two major barriers: a) lack of time and plurality of professional or personal obligations, and b) system difficulties regarding access or limited experience on dealing with similar technologies. These answers completely agree with the adult learner's profile prescribed earlier in the chapter (high level of obligations, limited time, difficulty with changes and new technology etc).

D4. CONCLUSION

Change in practices come real slow in large organisations, due to the fact that the work environment learners return to is not supportive enough to help them retain their progress (Mintzberg, 2004, p. 242, 257). In this framework we tried to present a case study in which e-learning seems able to enhance the learning processes and to help adults overcome obstacles restraining them from effective training. The necessary prerequisites for the design of the e-learning course derived from the Adult Education and the Experiential Learning theory.

The necessity for employees´ social skills development, whether they are working in a large or a small organization, has been proved to be a critical factor for a company's advancement. However, such skills development is a quite demanding project. Contemporary rapid financial changes do not allow for a student centered training culture, when it comes to personnel's development. Hence, it is accustomed to encounter poor and superficial learning practices in order to manage more efficiently budgets regarding human resources training.

Through the case study presented in this chapter one may conclude that such difficulties maybe overcome by the implementation of e-learning practices which seem to greatly support the social skills development of a company's human capital. The current research findings have shown that the appropriate exploitation of e-learning tools, along with a student centered approach, may assist substantially the field of adult education.

The most innovative element of the programme presented is considered to be the fact that participants were given the opportunity to meet colleagues from various posts within their banking organization and to develop precious relationships and rapport with them by exchanging personal thoughts, experiences and critically reflect upon their fears and barriers. What was mainly constructed is a supportive community.

For trainers, the benefits can also be great. For example as it is referred in Goodfellow's report it is itself an opportunity to radically alter conventional distance-teaching relationships (Goodfellow, 2006). It is obvious that such an effort can contribute positively to the organisation and its training results, to the people and the strengthening of relationships and finally to the educational practices adopted and developed.

Assuredly, the restricted scale of this case study allows ample room for future research. A larger scale investigation should be performed in order to gain sound proof of its actual efficiency, especially in regards to the trainer's work load. At the same time the trainees' working conditions should be further examined preparative to the discovery of whether their participation is regular and effective. Even though the research showed that both front line and administrative personnel intensively participated, their in between average gap was considerable. Finally, the creation of standardized activities will greatly assist in the exploitation of the current research's findings.

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ENDNOTES

1. Jarvis, P., 1999, Merriam S., Caffarella, R., 1999, Goleman, D., 2000, Brocket, R., Knox, A., 1994, European Committee, 2000
2. According to Jarvis, P., (2004) "Experience" is defined as the subjective cognition of a present situation, cognition which is generated only though reflection of previous experiences.
3. Available at www.moodle.org
4. At the Appendix of the chapter a part of our design is described according to Salmon's e-tivity model
5. The questionnaire is available in the Appendix

APPENDIX

Name of e-tivity	**Stress- actuation or disease?** ***Explore what stress really is, what hidden or not stresses you.***
Purpose	Participating in this e-tivity you will have to opportunity to explore the different ways researchers have interpreted stress and how it works in your body, mind or behaviour. Identifying the stressors that affect you, you will increase your self-awareness. You will have the opportunity to exchange views, ideas and experiences concerning stress and self-test your personality.
How many participants	15-20 participants
Structure	The activities will run over tow weeks and will have the above time plan **Week 1: introduction and understanding of stress** 2 hours – self introduction and orientation towards stress 3 hours – three theories concerning stress **Week 2: stressors** 1 hour – the main stressors 3 hours – personality type 1 hours – stressors at work
Associated media and other resources	Moodle platform will be used as single a access point for discussion forums and resources to read. Also as a wiki application provider. Vox will be used as a blog provider, because of its flexibility on levels of privacy. Using it participants can choose which will view their posts. Thus, it is possible for a group to make blogs and write posts that can be seen only among them. This fact will serve the purposes of the course. Short readings concerning 3 different approaches to stress (300-600 words each), personality type A-B (300 words) and work-related stressors (300 words). Two embedded self-tests, created with Moodle tools, to give the opportunity to participants identify their personality type and try the Holmes & Rahe inventory concerning stress (Ross & Altmaier, 1994, p.138-139). Wikipedia, as a recourse of contradicting theories and views over a single thing (in this case personality type).

Student actions	**Week 1** **Introduction**: Students are expected to introduce themselves in a specific discussion forum, intended for it. They will be asked to introduce themselves by saying their position in the organization, anything they want to say about themselves that will help others know them better, and if stress was a person-hero, object or animal, what exactly would it be. Also they would be asked to comment at least two others introduction messages. (1 hour) **Orientation to the course**: Students are advised register to Vox blog provider and announce their url to the course team in order to make their blog available to them. A group of blogs which can be seen only among them is created. Then participants are asked to read the course learning intended outcomes and write a post on their Vox blogs a stress experience they had in the past and their thinking when they decided to register to the course. Finally they should write their own aims for the end of the course. In the end they will have the opportunity to read back and see whether they have succeeded their goals. (1 hour) **Approaches to stress**: Participants are asked to read short texts that present three different approaches to stress (Ross & Altmaier, 1994, p. 1-7). Then in separate discussion forums they are asked to find an example of their stress experiences and try to interpret it through these three different approaches. Also, concerning the second approach they are asked to fill in an inventory and discuss their results. (3 hours) **Further reading:** a set of resources are available to participants if they wish to find more about these approaches and they are asked to add any more information or articles they have found and are related to the discussion. **Week 2** **Basic stressors:** Participants are encouraged to “brainstorm” on a wiki what stresses them. After several contributions a discussion concerning the categories of stressors begins in a discussion forum. (1 hour) **Personality type:** Participants are asked to fill in a self-test to find out which personality type they are. Then they read a short article concerning the basic characteristics of A-B personality types and discussion concerning their results begins. Because personality types are a subject under much controversy, after the discussion, they are asked to access wikipedia and the find related article. They are asked to read the discussion tab of the article and discuss their findings. (3 hours) **Stressors at work:** Participants are asked to re-read the wiki, where the e-moderator should have organized their contributions to different categories of stressors (physical, social and occupational) and have added some notes concerning occupational stressors. Participants are also asked to add any information they have found on their searches concerning stressors at work and discuss their findings (optional) (1 hour). During the 4 weeks of the course they are encouraged to keep posts in their blogs (either public or private), about their thoughts and behaviour concerning stress and evaluate their own progress.
E-moderator actions	The e-moderator during these two weeks should: • Help participants with any technical problems they face. • Respond in queries concerning the subject of study whether they are expressed publicly or individually. • Give clear guidelines during the activities concerning the intended outcomes ad encourage participants’ involvement. • Participate in discussions, comment blogs and moderate the wiki activity, in order to show participants the affordances of communication tools and strengthen the sense of being important. • Give feedback to discussion forums and pose more questions in order to help participants broad their views on the subject they discuss. They should be challenged to reveal their assumptions concerning stress, their personalities, their position etc. The above actions could occupy him-her 1-2 hours everyday of the course, according to students’ participation.
Evaluation	To evaluate the activities above three main directions are taken: • Evaluation of participation, in terms of quantity and quality. • Assessment of broad conceptual understanding: qualitative content analysis on their contributions in discussion forums and blogs • Assessment of participants’ interest and view: Feedback from participants concerning the several parts of the activity, which of them were helpful, difficult, interesting, etc.

Evaluation Questionnaire

Questions concerning the content of the course:

1. Which part of the course content you found most interesting? Explain why.
2. Which part(s) of the course you found most tiresome? Explain why.
3. Were there any parts of the course that needed more clarification? If yes, describe them.
4. What have you learnt from this course?

Questions concerning the training method:

1. Which characteristics of the course were mostly effective in helping you learn the subject matter?
2. Which characteristics of the course you consider to be the most difficult?
3. In which ways this course was different compared with other conventional seminars you have attended?
4. Which of the above differences you consider difficult in regards to your personal learning experience?
5. What is your opinion of your tutor? Did she have a positive or negative role regarding your personal learning experience? Was she inconsistent in any way?
6. Did you find any limitations in relation to your participation and contribution to the course in general? If yes, please explain the reasons.

Questions concerning the implementation of the system:

1. Do you consider any future difficulties in regards to the participation of other colleagues or the implementation of the system? If yes, plese describe them.
2. According to your personal experience from the participation of the program, do you have any suggestions regarding changes on future implementations?

Please add any comments you may have:

This work was previously published in Online Education and Adult Learning: New Frontiers for Teaching Practices, edited by T. T. Kidd, pp. 183-201, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 5.13
Social Networking and Schools:
Early Responses and Implications for Practice

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ABSTRACT

Although social networking has been enthusiastically embraced by large numbers of children and young people, their schools and colleges have been more cautious, and often concerned about the implications for online safety. Social networking used by young people is considered here as part of a trajectory of online practices which began with personal Web sites in the mid 1990s and continued through the use of interactive services to the networking sites familiar today. The response of the education system is examined through interview and anecdotal evidence, and with reference to a growing body of research in this and allied areas. It is concluded that social networking has initiated a series of practices which cannot now be abandoned, and that the challenge for the education system is not control or abolition but the inclusion of social networking appropriately within teaching and learning.

DOI: 10.4018/978-1-60566-208-4.ch002

INTRODUCTION

If the placing of a research tender can be seen as indicative of the maturity of a topic for study, then the recent award of a contract by Becta, the UK government agency for ICT in education, to research current in-school and out-of-school Web 2.0 experience is an indication that social networking is a relevant area of study for those seeking to understand educational practices in the UK. The researchers at the three Universities involved (www.lsri.nottingham.ac.uk) will be faced with a range of responses from the education system to the social networking sites that form a key part of current Web 2.0 practice.

Young people of school age frequently use social networking sites in the way that their counterparts of ten years ago used personal Websites: to provide an online representation of themselves and their views and interests, and to communicate with others who may share these preoccupations. Schools and other educational institutions have responded in different ways to this; often by banning such activity but occasionally in a more enlightened way. This chapter will describe how this has happened, outline the positive affordances of social networking for education, and will then suggest a more constructive response from schools and colleges.

SOCIAL NETWORKING AND YOUNG PEOPLE

Social networking has developed rapidly since 2003 and its use by young people has been characterised by successive waves of enthusiasm and ever-changing allegiances. Early alliances with MySpace have given way, for the most part, to institutionally-based networks such as Bebo or culturally-marked sites such as Facebook. At the time of writing, MySpace is seen by many young people in the UK as being more appropriate for younger children, with Bebo having a strong presence within youth in educational institutions and Facebook mostly catering for the late teen and young adult middle class user. This breakdown should be seen as a snapshot in time, however, and, during the period in which this chapter was written, the increasing take-up of Facebook by young professionals has led to a slowing down of its adoption by school-age youth.

It is interesting to note the differing degrees of anonymity in these systems, with the early and largely-anonymised MySpace giving way to Facebook and its supposed use of real names at all times. The youngest children of all have only recently begun to use social networking through systems such as Club Penguin, recently purchased by Disney in a sign of the financial potential of this area of the online market.

Making assumptions about the relative standing of different social networking sites can be a difficult process. Sites which are seen as of great importance and are sought-after one year can then be demoted the next, as is to be expected with a medium which is closely linked with other areas of youth interest such as music and fashion. One of us is an experienced social networking user and explains further, taking issue with some of the assumptions in the popular and academic press.

I'd say MySpace has a particular type of teenage interest, not younger. Also, it focuses on more arty people to a certain extent – ...[there is a] music function, and there are video and other places to display your own work. It also lets you modify your page to make it look how you like, …but personally I find that extremely annoying. I don't like how you cannot read information about people, because it's in a ridiculous font or too small, or because of the photo behind it all due to someone's bad coding. That's what I like about Facebook, you can easily read what people have written about themselves. The day that Facebook changes that is its downfall!

Also, Facebook is much more institutionalised. It used to be the case that you had to have a school, college or university email in order to have an account on it. They've changed that now. It's based around schools, colleges and Unis and where you come from, different networks. (Alder, 2008)

In addition to these wide-ranging general social networking sites, users have the opportunity to align themselves to owned social networks such as Friendlink.

Friendlink is a place for young Quakers (members of the Religious Society of Friends) to meet and greet. It is a forum for discussions, with sections for general chat, creative writing, poetry, role play and so on, and an online forum-based games area. Most of the members know each other outside of the forum in real life, but some are from across the world, and are attracted to meeting other young Quakers.

Friendlink differs from Facebook as it is aimed at a specific group, young Quakers, though it does accept others. It is worth examining further not because of any intrinsic importance in itself but as an example of a different style of social networking site, and to which one of us (Alder) belongs. It is also forum based, and although there are places for socialising and putting photos of events and so on (all screened from the public eye), there are many heated discussions about topics that would not be as greatly fought out on places such as Facebook. Although almost all participants come from a Quaker background, there is no common theme in what is believed, and diverse views are represented: Quakerism varies greatly in different countries, having no set beliefs or ways of worshipping. In a sense, where Facebook is more about the individuals and their lives, and is the impression that they wish to give to others (by the use of profiles with photographs, background information, personal profiles and so on), Friendlink is much more about the individual person's beliefs and what they think about particular issues. Although there are spaces to catch up about people (such as *Something that made you smile today* or *Things to love and hate today*), much of Friendlink is about events or current issues that people want to ask about, and apart from groups on Websites such as Facebook, there is no other counterpart to this activity, at least not within a focused community such as Quakers.

In addition to the social networking sites themselves, users have the possibility to add functionality through add-ons. In many cases these are merely intended to amuse, such as the wide variety of virtual gifts possible on Facebook or the aquarium to which friends can contribute fish bought with virtual currency. In other cases, the add-on may add real information, such as the various maps that show cities visited by the site owner, or new communicative possibilities as in the chat add-ons like Twitter.

Unlike many previous online activities, such as personal Website ownership, there seems to be little evidence of gender or indeed sexuality bias in uptake of these facilities. It is striking to note the rapidity with which change has taken place in this area, as is evident from a reading of a New Scientist article published as recently as September 2006. In this article (Gefter, 2006) the emphasis is still mainly on blogging, an activity which seems increasingly arcane and outdated just a year or two later. The essential stance of the article is that, for young people, blogs have replaced diaries, Flickr has replaced photo albums (but did young people ever have photo albums?) and social networking sites have replaced email. The latter is perhaps the most contentious statement, and others might argue that social networking site conversation is more likely to have replaced instant messaging and that email continues on parallel tracks, but data for this supposition is almost impossible to obtain without large-scale research, and these speculations must therefore remain just that.

Gefter notes in particular the acquisition by News Corporation of MySpace, at the time "ranked number one Website among US internet users, receiving more hits in a one-week period than even Google" (Gefter, 2006: 46). Gefter characterises blogging as essentially a female occupation, although no data is given to justify this apart from the fact that the majority of LiveJournal users are female (or claim to be). As Gefter recognises, the aspect of blogging that comes closest to later social networking sites is the ability to link blogs together into communities of readers and writers. She also makes the key point that, unlike previous communicative online practices such as chatrooms and gaming, the use of social networking sites is not usually anonymous. Gefter's assertion that online and real-life friends are the same is unproven but can be supported anecdotally.

...young people on social networking sites are interacting for the most part not with strangers, but with friends from their real life. Thus their online social life doesn't detract from their real one, as the two are simply different manifestations of the same network of friends. (Gefter, 2006: 47)

Most young users would agree and would stress that their Facebook interactions build upon and enlarge their face-to-face social activity, and may indeed support these real-life meetings.

Not everyone lives online, but most of my immediate friends have Facebook. Certainly it could never replace a real life social life, though in some cases use of the Internet does replace actual going out. However in the majority of cases, it's a great place to arrange events or meeting up with friends. It's very easy to keep track of how many people can come to a particular event, and who you have invited – you can also keep complete tabs on who knows what about the event. Another great use for it I and others have found is that through the networks and also the groups, I've got back in touch with people I was friends with in primary or middle school, and also people that I've met through different things. I find it much easier to find people there than by, [using] say, MySpace or Bebo. (Alder, 2008)

It is also striking to notice how quickly users can change patterns of uptake and social networking practices. Gefter asserted in a conveniently neat turn of phrase that "MySpace connects individuals through friends, Facebook through schools, LinkedIn through professions, and LibraryThing through books" (Gefter, 2006: 48). While such a division seems attractively tidy, it is also unconvincing and has not stood the test of time. In the UK, Facebook, for example, has become the social networking site of choice for young working middle class adults, with LinkedIn more used among formal consultancy partnerships.

Other writers have presented a more nuanced picture of the gendered dimension of social networking. Research by Danah Boyd at the University of California-Berkeley indicated what she termed the "significant cultural resonance" (Boyd, 2007) attached to social networking sites, even though their impact had lessened among the group she studied. Exploring the implications of these sites for youth identity formation, Boyd locates them in what she terms networked publics.

I argue that social network sites are a type of networked public with four properties that are not typically present in face-to-face public life: persistence, searchability, exact copyability, and invisible audiences. (Boyd, 2007: 2)

This is a useful theoretical framework for an area where theory is largely missing. Persistence and searchability are certainly relevant to the comments of the user quoted earlier, although evidence for what Boyd terms a complication of the ways young people interact and for the ability of social networking to "fundamentally alter social dynamics" (Boyd, 2007: 2) is harder to come by. Boyd reminds us that the persistence of online discourse permits not just asynchronous communication but also the extension of the life of a discourse without limit. Searchability is one of the key drivers of online communities, but replicability is a more hidden aspect which Boyd reminds us about: by use of the ability to copy an original identically, there is no visible difference between the copy and the original. Boyd's concept of invisible audiences inter-relates with her other factors, since persistence, searchability and copyability are all open to these unknown participants.

Boyd's main data came not from Facebook but from the earlier market leader: MySpace. Her two year ethnographical study focussed mainly on urban youth, the majority of them aged from 14 to 18 years. Among her target group, Boyd found users and non-users of MySpace, but almost all had an opinion about it and knew of it, making it, she says, "the civil society of teenage culture" (Boyd, 2007: 3). Her early users were characterised by a high degree of technical knowledge, exploiting their capabilities with CSS or HTML to do more with their MySpace pages than was intended by the site developers. In this way, these early pioneers echo the practices of many of the first young Website owners in the mid 1990s, who have been described by one of us as "technological aesthetes" (Abbott, 2001). The practices of these early MySpace users, and their tendency to help each other and copy and paste code from tips sites, bears remarkable echoes of the Website owners of ten years earlier.

Boyd's main emphasis is on young people's use of the social networking site, the creation of their digital identity – or digital body as she describes it – but she also considers the effect of these practices on home life. Interactions with formal education are less relevant to her research, although she relates a telling story of the reaction of one school to a student applicant whose MySpace profile seemed to present a different picture than that presented by him at interview. Boyd sees school as the structure from which young people seek to escape by creating online spaces and representations, at a time when young people seem to less likely to be outside away from parents than were previous generations. Much of this discussion is US-centric, relating as it does to problems of mobility in a context where public transport may be non-existent or perceived to be unsafe, but a degree of the same concerns exists in UK and European cultures.

Boyd's conclusions include reference to the dilemma facing educational institutions that seek to decide whether to control, support or ignore social networking.

…we need to figure out how to educate teens to navigate social structures that are quite unfamiliar to us because they will be faced with these publics as adults, even if we try to limit their access now. Social network sites have complicated our lives because they have made this rapid shift in public life very visible. …They are learning how to navigate networked publics; it is in our better interest to figure out how to help them. (Boyd, 2007: 23)

Beer (2006) has suggested that Boyd's networked publics can also be seen as part of a second media age (Poster, 1996) and sees the demise of artefacts such as Top of the Pops as part of the same process. Beer's central focus of interest is music and the extent to which it is now mediated through social networking, but his discussion of issues such as ownership versus free access or the tension between "various capitalist interests and localised interfaces" (Beer, 2006: 4.3) can be seen as a variant on the education system's concerns about parallel issues.

It is worth considering in passing the extent to which social networking can be accurately seen as youth-oriented any longer, especially as this chapter is being written as Saga Online is launched, in order to offer social networking for the over 50s. It can be a risky business to suggest that social networking is mainly for young people, as BBC Technology Correspondent Rory Cellan-Jones discovered after he described what happened when he suggested in an online article (Cellan-Jones, 2007) that social networking was not for over 30s. He received a great deal of response, including suggestions that the important thing was to have lots of friends – not to know who they were – and someone else set up a *Befriend Rory Cellan-Jones* group. Other more thoughtful responses suggested that Facebook was being used, for example, by lecturers to keep in touch with students overseas. He surmises that "it seems that the virtual worlds… are just a way of managing a thriving real world social life" (Cellan-Jones 2007), a conclusion very much in line with that of Boyd quoted earlier.

Tentative taxonomies of this use put forward in the 1990s included the division of personal Website owners into Technological Aesthetes, Community Builders and Professional Activists (Abbott 1999; 2001). Later work on the use of guestbooks and interactive fora on Websites has highlighted many of the issues that have now come to the fore in the use by young people of social networking sites (Abbott 2005). This developing line of research has highlighted some key methodological and ethical issues associated with this phenomenon, and these have also been explored by one of the current authors (Abbott & Seale 2007).

THE RESPONSE OF THE EDUCATION SYSTEM

Much of the response from the educational system to social networking has related to the real or perceived risks. These risks may relate to current dangers from online predators or be related to concerns for the future of young people who are inadvertently creating a permanent record of youthful indiscretions (Rosenblum 2007), much as the student quoted by Boyd did when his MySpace page came close to causing his rejection by a prestigious school.

Rosenblum titles his article *What anyone can know* and this is in many ways a summary of the concerns of authority figures and institutions. He indicates in some detail the risks associated with posting personal data online in this way, although he recognises that a more guarded approach to sharing information will inevitably result in "some chilling effect on the fluid, no-holds-barred ethos of these sites" (Rosenblum, 2007: 40). In addition to his recognition of the ways in which Internet-based information is both persistent and accessible, Rosenblum also notes the increasing trend for "prospective employers, government agencies or businesses collecting market data" (Rosenblum, 2007: 41) to have the right to view and make use of this information.

Some social networking sites have responded to these concerns by offering extra privacy options. For example, on Facebook users can choose to let people see only their limited profile, so they are unable to view more personal information such as phone number and address, or even photos. It is possible to control how much anyone sees, even if they are designated friends. These privacy controls, however, are fairly low-profile on the site and do not seem to be widely used, even after the recent announcement that Facebook sites would be searchable with Google (BBC News, 2007).

Schools have been more concerned about online safety than identity theft, probably in reaction to the scale of public and perceived concerns. Discussions with young people who use Facebook, especially those of Sixth Form age, have shown that some have teaching staff in their online friends group and vice versa. However, it seems more common for staff to not accept friend requests and to keep their social life separate from their work. This is no new issue of course; there has always been a difficult line to draw between older students and staff at social events such as graduation celebrations. Identity theft, however, or inadvertent revealing of information that may in future cause problems, is an issue that seems little recognised by schools or by many students.

…an entire MySpace generation could realise, when it is much too late to intervene, that the cyber personae they spawned in adolescent efforts to explore identity have taken on permanent lives in the multiple archives of the digital world. (Rosenblum, 2007: 49)

Early responses to social networking from schools have been negative for the most part and have revolved around control or prohibition. Many schools have used their filtering systems to block access to sites such as MySpace, Bebo and Facebook. Others have reacted punitively towards pupils found referring to their schools or teachers on these sites. Some educational institutions have ensured that use of social networking sites has led to dismissal or expulsion, but others – although not many - have supported the practice and incorporated it into their pedagogy.

As understanding of the potential of these networks develops, there are signs of a more mature and enabling attitude on the part of a growing number of educational institutions. There is evidence for this in the increasing understanding of the interactive possibilities of institution-based online networks which aim to link together learners, teachers and carers/parents. Although some use of these systems is low-level and mechanical and involves for the most part the maintenance of records, management of homework and registration of attendance, in other cases real interactivity and discursive use is beginning to be recorded. These developments take place against a policy shift in the use of digital technologies by schools, with current Government diktat favouring the "harnessing" of technology (DfES 2005) over its use to free learners to learn, despite the parallel focus on personalised learning.

A number of short anecdotal case studies arising from the personal experiences of both authors of this chapter may go some way to giving examples of the range of responses of educational institutions to social networking.

- Two years ago, a part-time Masters student chose to write a dissertation about the uses of social networking by students at the independent school where he was employed. He began by interviewing his students and discussing the topic with them, but his efforts were overtaken by events when his school featured in a national Sunday newspaper. It transpired that some students had made comments on Bebo which were highly derogatory about some members of staff at the school. The Masters student himself was relieved to note that he featured in only benign descriptions.
- A student at a prestigious music college set up a Facebook site which included discussion of the college and comments from other students. The next time that the student arrived at the college, he was escorted from the premises by security guards, on the orders of the college administration.
- At least one educational institution in the UK has threatened staff with dismissal after they commented on their place of work in postings on their own and their friends' Facebook sites.
- The social dynamic between teacher and students is changing, as both may appear in the same Facebook group. Whilst some institutions and employers would see this as acceptable, others would be most concerned and would consider it to be an example of unacceptable informality between staff and student. In many ways, this is merely the latest manifestation of a developing pattern, and submission of homework by email has sometimes led to an informalising of teacher-student dialogue as would be expected on that medium. In many schools, the decision for these contacts to occur via school email accounts is seen as keeping the discourse within a professional arena. Text contact via mobile phone between teacher and student is likely to be proscribed, but this may need to be reconsidered as handheld and mobile devices become more accepted in schools and colleges; and e-learning environments have bought online informal discourse practices into the virtual classroom.
- Some school systems have adopted a more open approach. In Denmark, the national schools network also involves parents, and all parents are allocated email usernames by the schools that their children attend. Progress reviews are held twice a year and these can be held online and are always summarised on the network. In this way, social networking has been made part of Danish educational practice.
- Researchers are beginning to explore the potential of avatar-based sites such as Second Life, where social networking can take place either at one remove or through the assumption of an online identity. There is particular interest in the potential of this approach by those working with children who have become disaffected by

school. One example of this is the Open University-supported Schome ("not school – not home"). In a depressing example of the difficulties of establishing new practice, Schome was funded firstly by NESTA (National Endowment for Science, technology and the Arts), then by the National Association of Gifted and Talented Youth and then by Becta (UK government agency), but has no current funder (www.schome.ac.uk). Of course, one aspect of the enabling of third-party add-ons for Facebook has been the opening up of dynamic links to other environments, including Second Life.

This mixed picture indicates a range of practices which highlight possibilities as much as constraints, although the unifying factor for the positive uses described is their adherence to a perspective which recognises the socially-constructed nature of most learning. A recent example of Facebook use to facilitate collaborative real-life activity arose during the making of a film during the summer vacation period. Alder explains how Facebook facilitated this activity, and demonstrates the socially collaborative nature of the process.

We used Facebook to initiate the project by creating interest, and are still continuing to do so. A lot of my immediate friends are involved with Drama, Music, and/or technical work, and I thought that I was in the best place to facilitate such a project. I started by advertising it, and laying down specific dates when we would be filming, and asked people to contact me. This wasn't the sole way of casting, obviously – I had some people in mind for certain characters! We then kept updating the group we had made to try and get extras, crew and musicians to record the soundtrack. One of the co-writers of the initial plot I had only discussed over the internet, and was a friend of a friend – I didn't meet him until after the majority of the filming was over!

I've now created another group to do with the project – the main one is for all the people that may want to be involved in being extras, musicians, or are just interested in the project as a whole, or indeed seeing the final product as their friends are involved. The other for the production crew and cast to discuss when we are going to be filming, analysing the poster campaign I'm making as part of my A2 photography work, and the trailer we have produced. We keep this group closed so that the public, as it were, don't know when/where we're filming or what is going on. All of the cast, and most of the crew of the film are on Facebook, so I can send out mass messages to all of them. Clearly we keep in contact by phone and email, but it's a good way of sorting everyone into one place and sending messages about filming and the suchlike. (Alder, 2008)

It seems likely that one of the next phases in the development of social networking will be the integration of geographical location information within handheld devices, enabling real-life meetings to take place serendipitously. Early services such as Dodgeball, owned by Google since 2005 but still only available in certain US cities, have made this possible, as has the Bluetooth capability of many mobile phones. This is perhaps what Gefter had in mind when she talked of her belief that the various sites will in the end become conjoined.

"…a meta-network linking together all the various social networking sites will emerge – and an individual's full identity, shown from all sides, will live online. …We will be more autonomous and mobile than ever, and at the same time discover an unprecedented form of collectivism."(Gefter, 2006: 48)

CONCLUSION

Social networking offers an unparalleled opportunity to education, although this is not without concomitant risk and concerns. To ignore social networking and what it has to offer to education would not only be short-sighted but would also indicate a basic failure to understand the impossibility of returned to a pre-Internet world. Social networking, like its precursors email, instant messaging and mobile phones, has changed communicative practices permanently. It is now essential that the educational establishment grapples with the implications of that change: the genie is well and truly out of the bottle and no wistful longing will put it back again.

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This work was previously published in book of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos &S. Warburton, pp. 18-26, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.14
Peer Learning and Social Interactions in an Asynchronous Learning Environment

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ABSTRACT

This chapter explores how Internet-based asynchronous communication forums utilized in teaching undergraduate courses affect social interactions and student satisfaction. Drawing from an analysis of qualitative data, such as student and teachers' perceptions, this case study reveals four key factors that affect learner satisfaction: (1) trust of people and technology, (2) awareness of how technically-mediated interactions differ from face-to-face interactions, (3) peer-based learning opportunities, and (4) integration of relevant learning materials and opportunities for social engagement. The findings suggest that when asynchronous forums are used as the principle vehicle for communication and learning, students feel less socially isolated, report a sense of belonging, and positively evaluate learning outcomes. The case study identifies asynchronous electronic forums as an effective tool for peer learning and social interactions among upper-level distance education students in Australia.

DOI: 10.4018/978-1-60566-368-5.ch017

INTRODUCTION

Electronic communication has irrevocably changed the way learners and educators approach education. Internet-based communication forums are one specific venue in today's network society enabling and facilitating dialogue across cultures, geographies and generations. This chapter explores some key issues facing developers, users, and evaluators of software for distance education. Drawing from distance education learning and teaching experiences in Australia and conceptualised within a global learning environment, this chapter emphasizes advantages and disadvantages of incorporating asynchronous electronic forums as educational technology in teaching advanced sociology subjects.

By presenting empirical qualitative data, informed by the social theory of Symbolic Interactionism, this chapter demonstrates how Internet-based social interaction technology can enhance learning and communication among undergraduates by creating a shared purpose and awareness among otherwise isolated users. The study presented here is contrasted with recent e-learning research that questions both the utility of specific communication technologies as well as the pedagogical appropriateness of their application. The overarching objective of this chapter is to provide an alternative perspective. Distance education technologies are often characterized as mediocre and supplemental tools whose primary purpose is to augment traditional classroom-based learning. In contrast, this chapter reveals how the adoption of asynchronous forums as the principal learning and communication vehicle in a senior-level correspondence-based distance education course resulted in enhanced student satisfaction. It is argued that high-quality social interactions pursued for the purpose of higher education can be attained virtually, without face-to-face interaction, although the interactions experienced may differ in a number of ways. Ultimately, while identifying and acknowledging the complexity of virtual communication, this research questions the fundamental assumption that virtual classrooms are *a priori* inherently inferior to those occurring face-to-face.

BACKGROUND

Social interactions exist and are understood from both lay and professional vantage points. In this section a sociological definition of social interactions is offered to inform and conceptualise the ensuing analysis of student-student and student-teacher interactions occurring in asynchronous subject forums. The present case study seeks to offer researchers, practitioners, and users theoretically grounded, yet concrete and tangible advice, on users' and designers' perceptions and experiences in a distance education environment. The research purpose is to inform users and planners of distance learning courses about asynchronous forums as communication, interaction and networking tools to facilitate learning and student engagement.

Social Interaction and Knowledge Society

From a sociological perspective, social interaction involves tacit knowledge, shared meaning systems and negotiated agreements about the norms, purpose and process of communicating. Classical symbolic interactionists, such as George Herbert Mead and Erving Goffman, provide a useful theoretical framework to understand social interaction as fluid, mutable and subjective. According to Goffman (1967, p. 9), "the definition of the situation" is both contingent and social. By using this theoretical approach to frame contemporary communication technologies, such as asynchronous forums, we may improve our understanding of how individuals and institutions "do" education.

Historically, learning in the modern era was a passive activity (Palloff & Pratt, 2001) where students attended geospatially "real" schools to learn objective facts, histories and skills necessary to participate in society. Today, knowledge-based economy (OEC, 1996) is redefining the purpose and focus of education specifically, and knowledge production, or epistemology, more broadly. In our new knowledge society, knowledge is no longer handed down but rather exists as an interaction between learner and environment which subsequently reconfigures both (Semple, 2000). In contrast with modernist science, which was resolved to operate under the constraints of the natural world, post-modern science and technology "is not concerned with discovering 'laws of nature', as it is [seeking] the reinvention of nature itself" (Holmes, Hughes, & Julian, 2007, p. 66). Contemporary educators, particularly in higher education, occupy social roles demanding flexibility and cultural awareness in addition to disciplinary and trans-disciplinary expertise.

"Revolutions" in communications and information technologies (Aronson, 2001) have fundamentally altered the structure of our global world economy and its social institutions. Education is one such institution. Global communication technologies have permitted the growth of global and virtual classrooms. Virtual classrooms, upon which distance education increasingly relies, transcend the national and physical boundaries of traditional classrooms (Ragusa, 2007) and create learning environments mediated by computers and reliant on global telecommunications systems.

Virtual Classrooms and E-Learning Debates

Despite the initial use of e-learning for distance education students, virtual classrooms are increasingly being used to supplement traditional learning environments. Learning environments utilizing blended, or hybrid, teaching styles incorporating traditional lectures supplemented by virtual learning have been found to be both productive and appropriate (DeCastro, Munoz, De Freitas, & El-Hani, 2008). However, lack of research on "purely" distance education delivery appears to be leaning to perhaps premature generalizations, such as the assertion that successful distance learning requires both synchronous and asynchronous communication modes in order to be successful (Yucel, 2006). A persistent theme in debates is the notion that distance education is an inferior, albeit perhaps necessary, mode to reach non-traditional and rural students who otherwise are unable to access higher education (E-Learning, 2007). According to Maeroff,

> Online learning seems to be still living down the early days. Those who thought that this was going to be a whole revolution with everybody moving courses online were so wrong. People who saw piles and buckets of money at the end of the rainbow were just misguided. It is clear now that, more than anything, e-learning benefits people who are mature, self-motivated, and looking for classes that teach various aspects of career and professional development….Also, e-learning will never, and probably should never, be the dominant method of educating students. But it will be a fixed part of the delivery system of higher education. (cited in E-Learning, 2007)

Although this may characterize perceptions about higher education in the U.S., in Australia there is a continuing trend among universities to not only move components of courses to electronic delivery, but moreover for electronic/distance learning to be the dominant method of education particularly at a number of specific universities. Statements such as, "e-learning will never, and probably should never be the dominant method of educating students" reveal deep-seated values and beliefs about the role, (in)adequacies and purpose of technology in higher education. Such values and beliefs are fundamentally connected to societal norms regarding social interactions.

Distance education implementing forums generally relies upon two types of communication: synchronized and/or asynchronised (Yucel, 2006). Synchronized forums are characterized by real-time/simultaneous communication where dialogue occurs at the same time yet is mediated by technology. In contrast, asynchronous forums utilize a static form of communication, akin to posting a message on a billboard and then awaiting others to view and/or reply.

In Australia, the introduction of asynchronous forums has enabled academics to create learning and assessment tasks that transcend traditional correspondence-based tasks characteristic of distance education. This technology has dramatically changed the structure of distance education, from a passive to an interactive learning experience (Anderson & Garrison, 1995) permitting the fostering of critical thinking skills if appropriately structured (Yang, 2005). Despite changes in practice, little research explores the use of asynchronous forums in Australia and virtually none comes from the discipline of sociology. Traditionally, distance education students independently read and completed written assignments, submit them for marking and wait for written feedback. The process relies heavily on introverted characteristics and independent work. Consequently, distance education students identify isolation as one of the principle barriers they struggle to overcome (Ragusa, 2006). Jorgensen (2002) articulates that active involvement in collaborative online learning is key to equalizing quality, cautioning "when individuals are simply receiving posted material and sending back individual work, the results are poorer then in traditional classrooms" (p. 9). Indeed, recent research shows variation in preference for online forum interaction is associated with perceived isolation (Ragusa, 2006). In sum, historically shaped structural and subjective factors work to influence the social interactions and communications of asynchronous forum managers and users both overtly, via concrete technical systems, and more subtly, via socialization and normative expectations.

Previously, research on asynchronous forums has focused on: netiquette and didactic guidelines (Buelens, Totte, Deketelaere, & Dierickx, 2007), the timing, rate and role of instructors and student perception and participation (Mazzolini & Maddison, 2007; Yang, 2005), discourse and content analysis (Beuchot & Bullen, 2005; Perrotta, 2006; Schrire, 2006; Zhu, 2006), flaming (Lee, 2005), professional development (Barnett, 2006) and meta-analyses of research methodologies to assess discussion forums (Marra, 2006). This research is mainly conducted in North America and Europe. Only van Aalst and Chan (2007) ask how collaborative computer-supported learning can be assessed, although their research focuses on portfolios of graduate and Grade 12 students in Hong Kong and Canada. The present study examines student satisfaction with learning using asynchronous forums.

Asynchronous Forums as Social Interactive Communication Environments

Surveys of large introductory courses (N=100-350 students) demonstrate inconsistency in student endorsement and satisfaction in distance education broadly and asynchronous forums specifically (see Ragusa, 2006). Differences in support services offered by Australian Technical and Further Education (TAFE) and high school environments, compared to universities providing distance education, is one element augmenting first year students' reservations about virtual forms of learning. To explore student experiences with communication technologies, this research prioritizes senior students' perceptions assuming that they have over time adapted to tertiary environments. Due to attrition rates and disciplinary specialization, advanced courses contain far fewer students than first year subjects. As such, this research offers an in-depth, case study of final year experiences and does not seek broad extrapolation from the experiences of 22 students in their senior year ("third-year" in Australia) enrolled in social theory courses (in 2006 and 2007).

The insights presented are derived from learner/educator communications whereby the only mechanisms for social interaction available were virtual, either via e-mail or through accessing the subjects' asynchronous forums. Data were gathered via surveys for two consecutive years (with a 30% response rate in 2006 and 88% rate in 2007) and student reflections (100% response rate in both 2006 and 2007) designed to explore communication and isolation issues raised by the introductory student surveys more deeply.

Students' only contact with the lecturer was by written comments returned via the post on essay assignments. Student dissatisfaction with non-interactive correspondence-based learning is expressed in a number of survey comments: such as, (1) "It was great to have to work more closely/directly with other students. This was such a nice change, especially as a distance education student" (Student R, 2007); (2) and "The online format made the subject easier to understand increasing my enthusiasm for the learning environment" (Student Q, 2007); and, (3) "The sub-forum design is excellent and I would like to see this used in other subjects. This also helped to build relationships with classmates - a rare opportunity for distance students" (Student U, 2007).

Sixty-three percent (2007) and 100% (2006) of the students agreed they would like to see the same online forum approach used in other subjects; all agreed responses to their subject forum postings helped their learning. In both cohorts, asynchronous forums were used for assessment. Unlike the predominant use of electronic communication for the distribution of information, this subject used asynchronous forums as a virtual classroom enabling students to prepare and conduct class presentations, lead and manage formal discussions with their peers and reflect on how the "tyranny" of distance may be mitigated by technology.

Four Key Lessons to Inform Virtual Interactions

To understand the pedagogical implications of electronic communication and interaction, students in both cohorts were asked to reflect on their experience of using technology to coordinate an assessment item with their peers, use asynchronous forums to lead and participate in virtual classroom discussions, and learn social theory. From these reflections, four key lessons about the complexity of virtual social interaction emerge:

1. Electronic Communication Requires Trust - of People and Technology

Identified as one of the greatest challenges was developing a working relationship "with an unseen partner and impression management, which was tentative and gradual on both sides" (Student A, 2007). To accomplish this, students "worked hard at communicating to each other, establishing and re-establishing guidelines continuously over the time committed" (Student A, 2007). While for some establishing communication norms and guidelines proved challenging, for others the limitations of technology posed greater complexities and was frequently contrasted with face-to-face interaction. Asynchronous forums possess temporal drawbacks and advantages different from traditional classrooms:

A compounding factor was the difficulty for XX in contacting her fellow team member due to circumstances beyond the control of both of us. These included technological difficulties and complications. Although we finally managed to get in touch, it should also be noted, that as distance education students, communication was somewhat slower than what it may have been had we been able to communicate face to face. For example, if one of us had an idea or a problem that needed to be discussed with the other then we would have to e-mail the other person and wait for a response, which usually wouldn't be until the following day. As such a simple question, or idea, which may usually only take minutes or a couple of hours to work through face to face, took at least a day. (Student O, 2006)

2. Interactions Mediated by Technology are Different in Kind

Interacting with people via the Internet remains different from face-to-face interactions for a number of reasons. Communication, cognitive, literary and technical skills are thrust into a public arena for viewing causing some personal discomfort: "This presentation brought my predominantly private studies, interpretations, and academic ability into the public sphere, with the potential of judgement by peers, which I felt to be the most daunting aspect of the exercise" (Student G, 2007). Second, that one may never meet those with whom one is working/conversing is an unusual reality for some:

One of the challenges of this project was to work with another person who lives too far away from me to meet face to face…the distance factor was definitely a challenge. This was resolved by my partner and I contacting each other by phone, *but this was still a challenge for me. (Student B, 2007)*

…juggling a full time job and then a second shift as wife and mother, followed by a third shift as student. I was often very tired by the time the books came out; The challenges faced once the presentation was launched were entirely different, now it was a race against the clock to check the forum for a response, formulate a reply and have it posted in order that there was time for other participants to respond and develop a dialogue. I feel that my partner and I were able to overcome the problems of distance and timing to coordinate a comprehensive presentation that facilitated the learning of our fellow students (Student F, 2007).

The main challenge is distance, not knowing the audience I am addressing and not being provided with the knowledge gained through non-verbal communication. Not being able to sit down and communicate thoroughly. Found it difficult to communicate effectively over phone and net. Nothing beats real life one on one formal communicating. As responses are not instant you as a student and a worker have to juggle work and study, sometimes they don't correlate as well as you like and have to wait for an answers or other students have to wait for your reply, which doesn't always lend itself to effective communicating (Student N, 2006).

On the positive side, I met a new person from a totally different world who was similar in age with similar commitments trying to better her life. Having two people work on the same subject is positive as it gives different perspectives and ideas. This assessment was definitely an achievement in that I have never done one with this format (i.e. a forum discussion). Having positive input from fellow students and the lecturer was also encouraging. (Student M, 2006).

Holding logistical issues constant, interaction and communication norms themselves become subject to review. As one astute student deduced:

This project has enabled us to gain an insight into both Symbolic Interaction and electronic forms of communication. The greatest difficulty encountered in this activity has been, ironically, interpretation. Electronic communication is a difficult medium in which to express ideas and concepts. It is made harder when comprehension is not equal amongst participants…Examples are good, if used academically and with a full understanding…Symbolic interaction concerns the negotiation of shared meanings, and, as the discussions emphasised, such a negotiation is often a very precarious business. This is the greatest assistance of these discussions: it has been made patently clear that people use their past to interpret their present and future…Distance and communication issues have made writing and contributing to a joint venture a difficult undertaking. Different approaches to work and time constraints have been equally constricting. However, it has been a positive experience.

As a peer of this student identified, often being challenged can be daunting: "I felt with the discussion that everyone knew a lot more than me which challenged me to read more...this exercise emphasized the difference between distance education and face to face – there are definitely negatives!" (Student M, 2006).

3. Electronic Communication Technologies hold Potential for Making Distance Education less Individualistic

As noted, isolation, both physical and social, is a prominent barrier to distance education students' success. This research shows communication technologies hold great potential for substantially altering distance education experiences: "It [the asynchronous forum] was a different method of studying from my prior experiences and it was nice to feel like the class was learning together instead of just individually" (Student C, 2007). The creation of virtual classrooms that prioritise meaningful interactions offers an example of how technology can facilitate peer-based collaborative learning. As Student D (2007) notes:

I believe that the sheer ability to work with a 'distant' partner…has been a success as life tends to get in the way of doing things like this. XX and I had some excellent exchanges and discussions via e-mail, instant messaging and telephone and I believe we communicated and coordinated this assignment as well as we possibly could. I am pleased that when I couldn't understand something – I was able to consult with XX and with other classmates via the forum.

The multiplicity of technologies available, combined with a positive approach, can assuage demands facing distance education students who also are employees, parents, etc: "Interaction with my project partner held some challenges as we quickly found out that we worked different hours which allowed us to rarely work jointly, however, this was overcome by constant daily e-mails and openness" (Student E, 2007). This experience proved to be common as nearly every student mentioned competing life demands and put forth their opinion about the flexibility, or inflexibility, of communication technologies.

4. Electronic Communication Forums hold much Potential for Greater Perceived Relevance and Engagement in Learning Tasks

A common question from students is the relevance of subject material to their lives and careers. In this subject, learning and practicing PowerPoint software offered a tangible skill for use beyond the classroom. Surprisingly, although only a minority of students had past experience and some approached the task with trepidation, not one negative comment resulted. Student E (2007) stated, "It provided me with an opportunity to present an assignment in a unique style, one that I am not familiar with, instead of another long winded essay." By listing the achievements gained ("allows recounting of subject material; allows structured interaction; maintains a high level of precision and accuracy; always encouraging trying something new and succeeding (hopefully); putting together a comprehensive power point presentation; overcoming communication difficulties"), Student N (2006) shows us how learning outcomes from AOF compare with those of traditional classrooms. As Student S (2006) commented, "I found that the online discussion was really helpful - most times when I was unclear of an aspect of a topic somebody online was able to clarify and give examples - very good way to learn this topic." Yet, to achieve successful outcomes, electronic interactions require different strategies:

Being used to working in isolation requires adjustments when asked to work with another person, and I don't believe that we allowed ourselves enough time to cover the 'space and time' aspect, given that we are both in the workforce. The greatest achievement was that we managed to present one presentation, which I believe appeared interesting, and on time. The exercise showed me that I am capable of undertaking new ventures (learning Powerpoint), and work under pressure, rather better than I had previously thought. (Student H, 2007).

Along with learning technical skills, electronic interactions permit the exchange of different types of social engagement. Specifically, written dialogue has potential to be far more detailed and personal than traditional classroom communications: "The discussions gave me a much better understanding of sociological theory and enabled me to apply the theories to everyday life" (Student W, 2007). While in some cases this has negative consequences (Ragusa, 2007), it also holds great potential for developing deeper learning and critical thinking:

I actually got more out of the group forum discussions than I thought I would. I was apprehensive *initially about a group assignment and hosting a forum, but found the support of my peers, their willingness to participate and their honesty so rewarding…I felt I received the support I needed from my peers on the forum" (Student I, 2007).*

Learning to work in a discussion group and being totally fascinated how a project can come together via e-communications. The amazement that questions you created can create such thought provoking material from people all over the country – not because they have to but because they were genuinely interested…I feel creating this is a gratifying achievement" (Student L, 2006).

All participants of the 2006 cohort strongly agreed they were "encouraged to think critically about the subject." Still, the key to fostering a nurturing environment lies in the structure and management of technology. Asynchronous forums themselves do not create positive communication environments. Comparing this subject to another, Student J (2006) notes, "I made the point to another student that this is the first "discussion forum" that I have had the opportunity to debate/discuss issues at length." Student T (2007) states, "The forum leadership and discussion was thoroughly enjoyed as it assisted in learning the various themes involved and compared our learning with others."

According to Student K (2006), "Of particular use is the discussion format. It is only there that we can see whether our statements have been clear, or if we have a correct understanding of the topic." Structuring asynchronous forums as "safe" environments to explore the complexity and multiplicity of ideas is particularly suitable for social sciences and areas where ethics and "facts" demand analysis and critical thought. Student O (2006) notes this learning objective was best achieved through academically guided peer discussions:

Both of us found the varying opinions of all of the discussion participants somewhat fascinating and even more enlightening. The discussion was extremely beneficial to our learning in that it gave us a clearer perspective of the varying viewpoints of our fellow students. Having this interaction with them allowed both of us to ponder many issues in relation to the theory which they otherwise may not have considered. We gradually gained more confidence to participate in the discussions with our peers…We both found it a little challenging and intimidating when we attempted to respond to the opinions of classmates, without sounding condescending or too light-hearted. As it turned out many of the participants were able to apply life experiences to the responses, and this in turn meant that the discussion was led into other aspects that were surprising.

Continuing the practice of offering situated "knowledges" (Harding, 1992), whereby researchers let "the researched" speak on their behalf, this final student quote echoes well the main points:

Some students made insightful and fascinating comments that had not been raised in any book I had read. It was good to learn Powerpoint, I found that once I started putting in pictures and messed about with settings, it was hard to stop… Another thing that really impressed me was how well the class was able to discuss the subject with maturity and manners. Distance education was possibly of great assistance as the passionate few did not dominate a verbal discussion and there was no authoritative presence 'correcting' students with different opinions. Most students submitted different, sometimes very different opinions on the forums… Receiving a forum posting was rather like getting a personal e-mail, and gave me a rather revelatory sense of fellowship or community with my classmates which I have not otherwise experienced in distance education. Distance education is quite an isolated experience with most interaction of ideas occurring between oneself and the reading materials rather than with other people.I found that some who may have known the subject the best *were not the most effective communicators. The two skills (understanding the subject and being able to communicate ideas about the subject) were neither inclusive nor exclusive to each other, just totally separate skills. I concluded from this that it is more important to be able to communicate clearly a little of what you have learned, than to learn much and not to be able to communicate any of it. (Student P, 2006)*

Comparative Evaluation of Learning Outcomes

Overall, experiences of the two cohorts show that asynchronous forums are valuable learning tools. Empirically, on a scale of 1 (very strongly disagree) to 7 (very strongly agree), subject evaluations confirm this finding. Evaluations for the 2007 cohort are presented in the charts in Figure 1 on the left and exist in contrast with the 2006 cohort evaluations for the same or similar items depicted in the charts on the right hand side. As the charts demonstrate, all students completing the evaluations reported they agreed, strongly agreed or very strongly agreed that the subject, learning materials and assessment tasks utilizing asynchronous forums were beneficial to their learning.

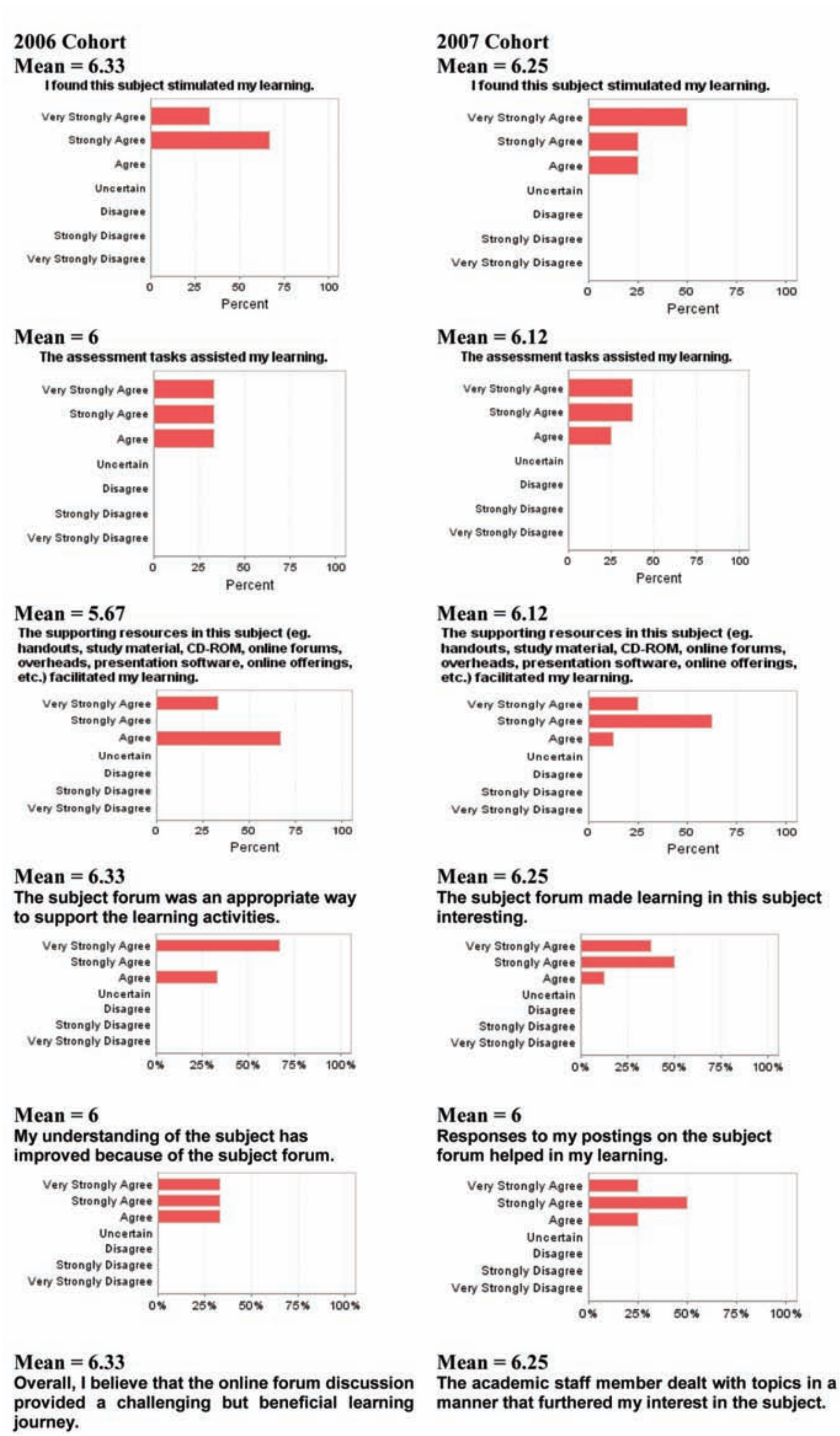
These evaluations demonstrate widespread support of asynchronous forums in these two cohorts where they were used for both supporting and assessment tasks. However, as detailed in the next section, the qualitative nature of this research warrants caution in generalizing the findings. Still, the general lessons learned are noteworthy and may serve as guidelines for future users and developers of asynchronous forums for distance education students.

FUTURE TRENDS

In discussing what it would take to have an education revolution in the U.S., Robert Zemsky, a member of the U.S. Department of Education's Commission on the Future of Higher Education, asks: "How many distance-education courses do exactly online what we do on the classroom? We did not want it to be that way. E-learning was supposed to be the different space, not the replicated space" (cited in E-Learning, 2007). Although the research results presented in this chapter cannot endeavor to explain Australia's progress towards an education revolution, it does contribute evidence towards viewing virtual learning as indeed a "different space." However, what appears to remain the same at this point in time are some educational institutions' stereotypes and norms about what constitutes quality education. In Australia, as elsewhere, social change is occurring in relation to the nature and praxis of education. Future research should focus on the parameters of this social change, noting resistance as well as adoption of educational technologies while paying close attention to how social expectations impact interactions.

Despite distance education students' embracement of social interaction technologies, such as asynchronous forums, and request for them to be more widely adopted as noted in this research, uptake by individual academics has been exceedingly low in parts of Australia over the past several years due to perceptions of heightened workload. In response to changing student needs in a technologically-driven society, some Australian universities have institutionalised interactive technology by requiring all subjects to operate using a Sakai platform. The imperative for all teachers and learners to socially interact using communication technologies demonstrates a distinct change from correspondence-driven learning and supports Lynch's (2002) identification of communication cues and interaction opportunities as key criteria differentiating traditional classrooms from online

Figure 1. Evaluation items comparable across two cohorts



learning environments. Large-scale change points to the need for new methods of planning, evaluating and altering how distance education delivery is conducted and affected in this new social structure and raises many questions including: What new skills are required by learners, administrators and teachers? How does electronic learning differ from face-to-face? What equity and social justice issues accompany different communicative abilities and technical access? These and other questions highlight ethical considerations about ownership of ideas, privacy, identity and the infiltration of personal lives into public spaces which all require further exploration.

CONCLUSION

Electronic communication forums, specifically asynchronous forums, are arguably better planned and executed when communication norms and expectations are made explicit. This research has provided firsthand accounts of asynchronous forum users from two senior courses an Australian university. Conceptualised within a sociological framework prioritising users' perceptions and experiences with asynchronous forums as a vehicle for peer learning and social interaction, the findings support the claim that asynchronous electronic forums can be used effectively in among upper-level distance education courses. By focusing less on the technical structure of electronic communication forums in favour of analysing users' experiences with asynchronous forums as social interaction tools, with potential to bridge demographic and socio-cultural divides (multigenerational, multinational, multicultural, geospatially disparate, etc.), this chapter identified and evidenced four key lessons for future users, planners, and evaluators. These lessons reveal asynchronous forums hold potential for generating positive learning experiences, particularly among small cohorts of senior students. Incorporating well-structured asynchronous forum assessment tasks into distance education develops life skills: such as, greater technological competence, leadership and critical thinking, making abstract theories and subject information relevant by encouraging application and connection to everyday life, and working to assuage the social isolation some students experience by fostering group solidarity, integration, and dialogue with peers.

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KEY TERMS AND DEFINITIONS

Asynchronous Forums: An Internet-based electronic communication environment, which permits users to post messages for some or all of the members to view. Messages remain posted until a forum moderator removes them. *Asynchronous* refers to the static nature of the environment. Postings are done one at a time, anonymously or not, and offer a written electronic record of the communications conducted.

Knowledge-Based Economy: A phrase used to describe economies in which information and knowledge hold greater contributing power to the economic welfare of nations than in industrial societies.

Network Society: A term used to characterize the changes in a society brought about by the Internet communication technologies and in which individuals and groups organised around digital information networks.

Peer-Based Collaborative Learning: A teaching and learning strategy which places emphasis on group work and interactions among students in contrast to traditional teacher-centered learning.

Social Interaction: The exchange of verbal and nonverbal communication in a society. Within the social sciences *Symbolic Interactionism*, stemming largely from the works of George Herbert Mead and Erving Goffman, is a theoretical tradition that studies the relationship between "self" and society.

Situated Knowledges: A view of social reality put forth by the feminist social philosopher, Sandra Harding, which argues that our social position in the world affects, and creates, the types of "knowledges" and worldviews we experience. In other words, what we think and believe is "socially situated" and socially constructed.

Sub-Forum: An online communication environment that exists as a subset to a larger electronic forum.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova & R. Fiordo, pp. 181-193, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 5.15
Harnessing Web 2.0 for Context-Aware Learning:
The Impact of Social Tagging System on Knowledge Adaption

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ABSTRACT

We present an empirical study investigating how interactions with a popular social tagging system, called del.icio.us, may directly impact knowledge adaptation through the processes of concept assimilation and accommodation. We observed 4 undergraduate students over a period of 8 weeks and found that the quality of social tags and distributions of information content directly impact the formation and enrichment of concept schemas. A formal model based on a distributed cognition framework provides a good fit to the students learning data, showing how learning occurs through the adaptive assimilation of concepts and categories of multiple users through the social tagging system. The results and the model have important implications on how Web 2.0 technologies can promote formal and informal learning through collaborative methods.

DOI: 10.4018/978-1-60566-826-0.ch007

INTRODUCTION

The World Wide Web (WWW) gained extreme popularity during the late 1990s due to its simple architecture and design (Millard & Ross, 2006). The 1990s version of the WWW, now dubbed as Web 1.0 (O'Reilly, 2005), is characterized as "read-only" Web. Web 1.0 efforts included content management systems, fixed directory structures and portals that used client-server architecture. In stark contrast, Web 2.0 is characterized by user-generated content (e.g., blogs, photos), communities of users (e.g., social networks), peer to peer networks (e.g., Napster), and content syndication (O'Reilly, 2005). While the exact definitions of Web 2.0 is open to debate, it is important to note that web applications have evolved into collaborative user-centered rich internet applications (RIA). The implication of this evolution is significant considering its possible impact in a variety of domains ranging from healthcare (Kaldoudi *et al.*, 2008), marketing (Parise & Guinan, 2008), e-Science (Fox *et al.*, 2007) and education (Ullrich *et al.*, 2008).

The traditional WWW has been a strong medium for development of the e-learning tradition. The use of traditional web as a teaching and learning medium has led to the development of traditional learning management systems (e.g., WebCT and Blackboard) and also more adaptive intelligent tutoring systems. But, research on the use of Web 2.0 technology for teaching and learning is limited (Ullrich et al., 2008). The features afforded by Web 2.0 are in line with educational theories such as constructivism, exploratory learning, and connectionism, making it extremely interesting instructors, learners and designers. Ferdig (Ferdig, 2007) describes four theoretical aspects of Web 2.0 that make it suitable for pedagogy. He argues that Web 2.0 technologies: (a) provide an environment for scaffolded learning (with teachers, peers or an intelligent system), (b) support collaboration, cooperation and shared work resulting in active student participation learning, and (c) provide constructivist learning environments by encouraging students to actively publish, revise and comment on others' content. Alternatively, (Ullrich et al., 2008) provide technical, social and cultural characteristics of Web 2.0 that make it useful for pedagogy. These include the support for individual creativity and exploratory behavior, usability aspects such as desktop-like interactions, technological aspects such as the use of light-weight architectures and easy modifications, and multiple modes of access (e.g., PC, mobile devices).

Though researchers have claimed the potential usefulness in using Web 2.0 technologies for educational purposes, there are very few studies that explore how Web 2.0 technologies can be effectively incorporated into the public education milieu. One possible reason could be relative newness of these technologies. But, it is interesting to note that several for-profit companies have strongly encouraged their employees to write blogs and develop internal wikis (Ajjan & Hartshorne, 2008). Another reason could be the instructors' lack of knowledge or interest in using these technologies or tools in the classroom. Ajjan and Hartshorne (Ajjan & Hartshorne, 2008) use a survey based study to investigate faculty interest in using Web 2.0 technologies in the classroom in a large public university. They found that faculty members are generally aware of the pedagogical benefits of using Web 2.0 technologies. But, more than half of the respondents did not plan to use any Web 2.0 technologies in their classrooms.

Researchers have explored the development and use of Web 2.0 technologies in a variety of domains and tools. One domain that has received attention for Web 2.0 technologies is e-Science projects. Pierce et al (Pierce *et al.*, 2008) developed outreach tools as a means of creating communities of like-minded researchers. This is an e-Science venture aimed at outreach activity of broadening the participation from minority institutions. Fox et al (Fox et al., 2007) examine the usefulness of tagging and social bookmarking for identifying and building keyword-based profiles that can be used for "collaborator match-making services". The system, called Minority Serving Institution-Cyber Infrastructure Empowerment Coalition (MSI-CIEC) incorporates online bookmarking and tagging for researchers. Mason and Rennie (Mason & Rennie, 2007) report on the development and use of a range of Web 2.0 technologies that supported the development of a community in Scotland. The social software helped in community interaction, ownership and pride about the local landscape and learning about the local tourist locations.

With respect to the use of Web 2.0 technologies for education, most research reports have focused on design and development of tools. Others have argued about the opportunities for using these tools (Alexander, 2006). Kaldoudi et al (Kaldoudi et al., 2008) describe a problem-based learning approach using wikis and blogs for supporting medical education. The authors contrast the lecture-based tradition in medical education with the active, exploratory learning approach that is afforded by Web 2.0 technologies. The authors describe a wiki-blog based system that supports collaboration among medical experts, support strong instructor presence, helped in continuous monitoring of student activities and provided tools for student inquiry. Takago et al. (Takago *et al.*, 2007) describe the ineffectiveness of their e-learning system designed for teaching engineering design. The original design was assembled from independent software components and provided static web content. The new Web 2.0 based redesign is based on analysis of students' learning activities and helps students publish revise and exchange information. It also helped instructors (and peers) track the progress of the students to give them constructive feedback. Synchronous Learning Environment with Web 2.0 (SLEW) is another application developed with AJAX technology. SLEW is a synchronous distance-learning application that supports dynamic interaction, knowledge sharing and interaction between teachers and learners (Lin *et al.*, 2007). SLEW uses Web 2.0 technology and YouTube API to develop instructional courses for distance learning.

Web 2.0 technologies also face several potential disadvantages. One of the more explored aspects is the challenges Web 2.0 technologies pose for security and privacy (e.g., (Ahern *et al.*, 2007); (Lam & Churchill, 2007)). Recent studies have shown that users are often not sure about the available privacy choices and often are not in a position to make well-informed decisions (Ahern et al., 2007). The openness of Web 2.0 systems is also another potential disadvantage for new users. Bhattacharya and Dron (Bhattacharya & Dron, 2007) discuss the challenges of effectively integrating Web 2.0 technologies for pedagogy. They organize the challenges into the following categories: technical challenges confronting the instructor and students, devising effective mechanisms for monitoring the students within and outside the classroom, and learner assessment processes. The authors do not provide any insights about how to overcome these challenges.

The possibilities for using Web 2.0 technologies for pedagogy are endless. But as we can see from the literature, these technologies are still new and there is limited research on how they can be applied to improve context-aware learning. More empirical studies are required to evaluate the challenges in using Web 2.0 in the classroom or at home on a longer-term basis. In this chapter, we will focus on a popular Web 2.0 technology called social tagging. We will first briefly discuss its history and characteristics, followed by a description of an empirical study that investigates how social tagging systems may directly impact concept development. Finally, implications to long-term learning are discussed.

SOCIAL TAGGING SYSTEMS

Social tagging systems are major Web 2.0 technologies that have gained popularity in recent years. A popular social bookmarking Web site is called del.icio.us (http://del.icio.us). Users register and personalize their own collection of bookmarks in their own page. Each bookmark is accompanied by a short description, or tags, of the contents of the site that the bookmark leads to. Users can also see the tags that other users create, search for bookmarks with certain tags, or browse the collection of bookmarks created by other users. Social bookmarking web sites therefore allow a new form of collaborative information discovery and sharing. Users can quickly set up a social bookmarking page for a topic of interest; learn from others who have similar interests, and discover new topics or subtopics and their connection to other users.

Alexander (Alexander, 2006) describes the increasing role of social bookmarking in pedagogical applications. He explains their importance in information search and discovery, acting as an "outboard memory", helping in finding collaborators with similar interests and self-reflection on patterns by evaluating one's own tag clusters.

Additionally, it also provides interesting opportunities for evaluating student (or group) progress by tracking their bookmarks and tags. In addition to publicly available social bookmarking systems such as del.icio.us, specific applications have been developed to support user needs in different environments. Examples include the PennTags project (http://tags.library.upenn.edu/) and the Harvard H2O project (http://h2o.law.harvard.edu/index.jsp). The PennTags project helps online library users at University of Pennsylvania to tag and organize their favorite library resources. The H2O project at Harvard law school creates an online venue for communities to create and exchange ideas through online interaction and discourse.

One major reason why social tagging becomes popular is that people are becoming less satisfied with the Internet being used as a large information database, from which users can retrieve facts easily through powerful search engines. Instead, people are increasingly relying on the Internet to explore and comprehend information, and to share experiences and socialize among other users. The major difference is that Web 1.0 aims at deriving powerful algorithms to index massive amount of information, but Web 2.0 aims at deriving semantic structures among these information that are pertinent to real-world information tasks imposed to real users. For humans, this distinction is not particularly prominent because the human cognitive system naturally conjoins the two functions as we process information. As we will elaborate later, when a person learns to index a new object, such as when learning that a four-leg animal is a cat, the person tends to naturally encode contextual information and classify the object in certain mental categories. When the person encounters an object in the future that is known to be a cat, he or she can then infer only that it has four legs, but also that it meows, has fur, etc. The formation of these mental categories therefore not only allows the cognitive system to capture the structure of the contextual information related to the object, but also allows the cognitive system to capture the similarities and differences across structures in the environment. This is arguably the process that humans can perform much better than computers, and the reason why Web 1.0 fails to satisfy the needs of users. We address this point later in the chapter.

Instead of relying on mental concepts and categories to exploit contextual information, search engines, on the other hand, often rely on automated indexing software to determine the information content of web pages. For example, software such as web crawlers will visit hyperlinks in multiple web sites on the Internet and develop a list of keywords that appear on each of the web pages to which these hyperlinks connect. Eventually, a large database consisting of a master list of these keywords is created. When a user enters a query in the search engine, the words in the query are compared with those in the database. The results of the search are all of the web sites that have been listed under the keywords in the database that match the query words, and the links to these web sites are returned in the order that is determined based on frequency of visits, certain usage histories in the past, location of keywords in the documents, number of other sites that link to each of these web sites, or other features that are believed to increase the likelihood that the information returned from the search engine will match the information goal of the user. Information accessed by this kind of indexed retrieval is often just an *ad hoc list*, with no internal organization at all. Therefore, the fundamental problem with this kind of simple indexing and retrieval is that it does not capture the natural structural relationship among these web sites based on their information content. Although many online systems do provide classification information such as subject headings in book-selling web sites such as amazon.com, or topics or directories links in search portals such as Yahoo.com, one has to keep in mind that these categories are created by the humans, presumably someone who believe these classification is general enough that they could help users to find information more efficiently. Search engines by themselves, are not very good at generating these classification. In other words, the major drawback of the simple indexing and retrieval in Web 1.0 is that it does not allow users to directly learn the context under which the information naturally appears, thus preventing users to develop the natural structural relationship and classification of information based on the informational structures that naturally exist in our environment.

Social tagging systems, on the other hand, allow collective indexing of the massive information space based on the subjective interpretation of the information in the web pages by different users. Human indexing not only allows better representation of semantics at the level that other humans can easily understand, it also allows multiple interpretations by people with different knowledge background and information needs. The major drawback, compared to automated indexing, is the lower speed of processing. However, this drawback seems to be well compensated by the massive volume of users as they provide metadata to the web sites that they find useful and are happy to share with others with similar interests. Indeed, results show that although users may have diverse backgrounds, the dynamics of tags are found to stabilize quickly as the number of users increases (Cattuto *et al.*, 2007; Golder & Huberman, 2006). This is perhaps one of the most fascinating aspects of social tagging as well as other Web 2.0 technologies, as demonstrated by the success of Wikipedia and other similar open-source projects.

With the increasing popularity of social tagging systems, many are hopeful that they can potentially promote learning about social events, beliefs, or concepts that go beyond knowledge acquired from textbooks or formal instructions in classrooms. Although many are hopeful that Web 2.0 technologies may provide a revolutionary way of learning, some researchers question whether this kind of informal learning may only lead only to superficial knowledge acquisition – accumulation of bits and pieces of facts by collective indexing without necessarily developing the deep structural networks of knowledge acquired in formal learning environments. Indeed, most recent studies on social tagging systems have focused on user motivation for contributing to different web sites (Sen *et al.*, 2006)or aggregate usage patterns in specific web sites across a specific period of time (Cattuto et al., 2007; Golder & Huberman, 2006). To a certain extent, many of these studies have treated social tagging systems as a form of technology that provides more meaningful indexing of information than automated indexing by search engines. To our knowledge, no empirical study has been done to investigate how the interactions with social tagging systems may potentially influence higher-level cognitive structures and promote "real" learning beyond indexing of information. To illustrate this point, we will first review the ideas of distributed cognitive systems before we present our study that directly test how social tagging systems may directly influence learning.

Social Tagging Systems and Distributed Cognitive Systems

Social tagging systems are excellent examples of distributed cognitive systems (Fu, 2008; Hollan *et al.*, 2000; Hutchins, 1995; Zhang & Norman, 1994). In contrast to the traditional definition of cognition, a distributed cognitive system encompasses all flow of information among individuals and the resources in the environment. The idea is that when one examines the outcome from the distributed cognitive system, one cannot easily attribute the outcome to any isolated component of the system. In fact, the basic premise of a distributed cognition framework is that behavior arises out of the interactions of the components of the system. The functional unit of analysis of behavior in a distributed cognitive system should include all elements that bring themselves into coordination to accomplish some tasks, and any isolated analysis of its parts is insufficient to understand how the system works. A classic example is the demonstration of distributed memory systems in the cockpit by Hutchins (Hutchins, 1995), who showed that the encoding and retrieval of critical information by pilots rely on various displays inside the cockpit as much as individual memory. In addition, information from the external environment provides more than simply a cue to internal memory, but provides opportunities to reorganize the internal and external representations in the distributed cognitive system.

Under the distributed cognitive systems framework, the current analysis of social tagging systems will focus on the intricate interactions between internal and external representations of concepts, tags, and documents as a user is engaged in as they interact with the system. Figure 1 shows a notational diagram of this theoretical framework. Multiple users have their internal representations of the world, as they interact with the social tagging systems and consume information on different web pages. These internal representations partially reflect the different background knowledge of different users, as well as differences in their information needs. These internal representations will influence how they interpret the information in different web pages, the tags created by others, as well as the tags they will create to associate with the web pages that they visit. To a certain extent, these internal representations are shared among others through the external representations (tags) of the information content of the web pages. It is not only the case that users may contribute tags to different web pages, but the interpretation of tags created by others may also influence their own internal representations as some forms of knowledge adaptation. The major characteristics of this distributed cognition framework is that: (1) both internal and external representations may influence the search and interpretation of the web document, and (2) the understanding and interpretation of the web document may influence both the internal (concepts) and external representations (tags).

Tagging, Schemas, and Knowledge Adaptation

Researchers in cognitive science have proposed different representational structures to capture the properties of our general knowledge of objects around us, and one prominent representational structure is called a schema (Rumelhart & Ortony, 1976). Schemas represent our concepts of objects such as their attributes and their categorical relationship. For example, we know that houses have rooms, can be built of wood or stone, serve as human dwellings, and are a type of building. The importance of the category information is that it stores predictable information about instances of a category, such that when someone mentions a house we have a rough idea of the object being referred to. Note that schemas represent knowledge at an abstract level, in the sense that they encode what is generally true rather than what is true about specific instance.

One important property of schemas is that there are default values for certain schema attributes, which are presumably developed from our past experiences. This provides schemas with a useful inferential mechanism. Many studies have been conducted to confirm the psychological reality of schemas. For example, Brewer and Treyens (Brewer & Treyens, 1981) conducted a study in which participants were told that they were in an office. After a short period of time, participants were asked to recall objects in the office. Results showed the participants were much better at recalling objects that can typically be found in an office than those that are not. In addition, participants mistakenly recalled objects (such as books) that can typically found in an office, but were in fact not in the specific office that they were in. These studies show that when given a hint to what the object belongs to, people will utilize their existing knowledge to infer the other "hidden" attributes of the object.

As people interact with their environment and acquire more experiences their schemas may be

Figure 1.A distributed knowledge representations framework in a social tagging system (reps = representations).

modified to make sense, or used to make sense of the new experiences. This process of knowledge adaptation can be traced all the way back to the Piaget's (Piaget, 1975) developmental model of equilibration of cognitive structures in children. According to Piaget, there are at least two processes through which new experiences interact with existing schemas. When new experiences are modified to fit existing schemas the process is defined as assimilation. In contrast, accommodation is an adaptation process of knowledge acquisition that changes the schemas in order to fit the new experience, or the person creates an entirely new schema in order to accommodate new data that does not fit any of their existing schemas. Through the process of assimilation and accommodation, people can adapt to new experiences that they obtain from their interactions with others, such as when they discuss, share, or exchange information.

Consider the case when a user is browsing for information related to a broad topic of interest, such as when one is interested in knowing more about facts or events related to the independence of Kosovo. We called this kind of *exploratory learning* an ill-defined information task (as opposed to well-defined task in which a specific piece of information is needed such as looking for the address of a hotel, see Chin, Fu, & Kannampalil, 2009; Fu & Pirolli, 2007), in which one only has a rough idea about what they are looking for, and the information goal itself will be refined throughout the search process. During the search, social tags created by others can be utilized as useful cues to select and navigate to the documents pertaining to the topic of interest (Marchionini, 2006; White *et al.*, 2007). Through this process of *exploratory search-and-learn*, the user gains a better understanding of the topic through the enrichment of internal representations of concepts relevant to the topic (either assimilation or accommodation, or both). The user may then create their own tags for the web documents based on their own understanding as well as the existing social tags, and may choose to perform another cycle of exploratory searching and learning, refinement of concepts, and so on. *In other words, through iterative exploratory search-and-learn cycles, the interactions between internal concepts and external tags gradually lead to sharing and assimilation of conceptual structures as more and more people assign social tags to represent ideas* *or concepts that they extract from the massive amount of web documents.*

Applying the above framework of knowledge adaptation to social tagging, we have three specific predictions on how social tags may influence knowledge development. First, the ability to predict based on category membership is presumably the major utility of tags that are assigned to a bookmark. Tags invoke certain internal schemas of the user, and these schemas allow the user to predict what information is "hidden" in the web page that the bookmark leads to. It follows that the higher the "quality" of tags (in the sense that they allow better prediction of the underlying schemas), the higher the efficiency of the user in finding the right information. Second, given an information goal, when there are more high-quality tags that match the existing schemas of the user, the existing schemas of the user will be richer through the process of assimilation. Third, when information content is more diverse, more distinct schemas will be developed through the process of accommodation. We will formalize these processes in the next section.

A Formal Model of Social Tagging under the Distributed Cognition Framework

To formalize the analysis of social tagging, we will present a probabilistic model of exploratory learning behavior as users interact with a social tagging system. The formal model allows not only allows precise predictions on behavior, but also provides clear characterization of how different components and processes influence behavior. The model assumes that people will naturally categorize web documents as they go through and comprehend them (with the tags helping by adding additional features), and *the reason why mental categories (schemas) are formed is that this is an adaptive response to the inherent structure of the stimuli from the external world to our minds that allow humans to predict features of new objects better*. Tags assigned to documents are just another set of features that allow us to predict the unobserved contents of the documents, and with the formation of mental categories, the tags will not only inform the user what they literally refer to, but also other unobserved features of the documents.

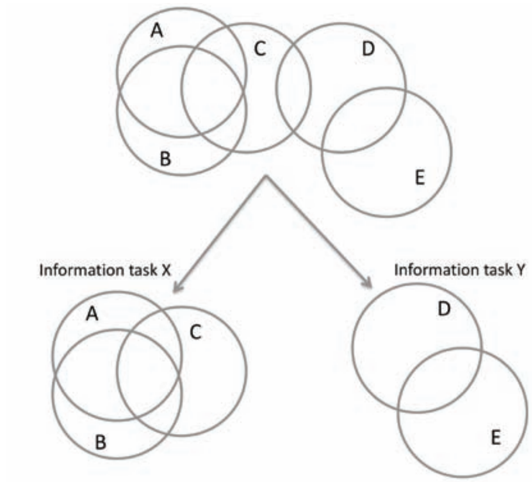
Assume that a user has a set of schemas *S* and a set of semantic topics *T*. The information goal is to predict whether topic T_j (some useful information) can be found by following a link with tags *G*, i.e., the user is trying to estimate this probability: $P(T_j|S,G_k)$ when deciding on links, which can be broken down into two components based on the distributed cognition framework. One component predicts the probability that a particular topic can be found in a given schema, and the second component predicts the probability that a given set of tags are associated with a given schema:

$$P(T_j \mid S,G) = \sum_m P(S_m \mid G)P(T_j \mid S_m)$$

(*Equation 1: Likelihood of finding topic T_j given schemas S, and tags G*)

In other words, to predict whether topic T_j can be found in a particular document, one can first estimate $P(S_m|G)$: the probability that the document with tags G belongs to a particular schema Sm. This estimate depends on how much the internal and external representations match each other: The higher the match, the better is the model able to predict to which categories the document belongs. It also provides a measure of the "quality" of tags, as it indicates how much the tags may help invoke the set of schemas in the user. The second estimate $P(T_j|S_m)$ is the probability that topic T_j can be found in schemas S_m. This estimate therefore depends on the relationship between the topics and the schema. The overall probability $P(T_j|S,G_k)$can then be estimated by enumerating the product of these two probabilities over all mental categories.

Figure 2.Notational diagrams showing the original information space (top), and the information space for relevant topics for information task X (left) and Y (right). Each circle represents a topic.



Assimilation: Enrichment of Mental Categories

If we assume a set of schemas that people may have, one can first estimate the prior probabilities for each of these schemas, and calculate how likely a tag created by a user is created based on a particular schema by the Bayes theorem. Specifically, if $P(S_m)$ is the prior probability of schema S_m, and $P(G|\ S_m)$ is the conditional probability that tag G belongs to S_m, then we can obtain $P(S_m|G)$ by:

$$P(S_m \mid G) = \frac{P(S_m)P(G \mid S_m)}{\sum_m P(S_m)P(G \mid S_m)}$$

(*Equation 2: Probability that a document with a tag G is created from schema S_m*)

To estimate the prior probability, one can assume that there exists a prior probability for any two random objects (e.g., documents) to belong to the same schema in a particular (informational) ecology. The higher the value of this prior probability, the lower the likelihood that any two objects will belong to a new schema. For the current purpose, we assume that a prior probability that any two web documents belong to the same category for a particular information task. The prior probability therefore depends on the general structures of the information distribution and the information goal. For example, the top of Figure 2 shows a notational diagram of 5 topics (A, B, C, D, & E) in a given information space, and these topics have some levels of overlap in their information contents. Assume that for information task X, topics A, B, & C are relevant. The information space becomes highly overlapped (bottom left of Figure 2). However, for information task Y, topics D and E are relevant, and the information space contains topics that have low overlap. Therefore given the same information space, information task X will have a higher prior probability that any two relevant documents will belong to the same schema, but for information task Y, the same prior probability will be lower.

The conditional probability $P(G|S_m)$ can simply be estimated by the ratio of the number of members in schema S_m that contains G and the total number of members in G, i.e.,

$P(G|S_m)=n/n_m$

(*Equation 3: Probability that a tag belongs to mental category m*).

When the user is browsing different documents and their corresponding tags, estimates of how these tags may come from any of the existing schemas can be derived by calculating the value of $P(S_m|G)$ for each m. The schema that has the highest value of $P(S_m|G)$ can then be selected, and refined based on Equation 3. As more and more documents are processed, the new experiences will be assimilated with the existing schemas of the person and the existing set of schemas will be enriched through this process.

Accommodation: Formation of New Mental Category

It is possible that a person may encounter a new piece of information that does not fit into any of his or her existing schemas. In that case, the existing schemas need to be adjusted to accommodate for the new piece of information. This decision was based on the value of $max[P(S|G)]$, where G represents the contents and tags of the document and S represents the set of existing schemas, and the max operation is performed in the set S. Specifically, a new category will be created only if

$$P(R_{new}) > max[P(R|S)]$$

(*Equation 4: New mental category*)

i.e., the probability that the document belongs to a new category is larger than that for it to belong to any of the existing schemas. If this condition is met, a new schema will be created. The accommodation process therefore allows new schemas to be formed from new experiences.

Assigning Tags to a Bookmark of a Web Document

Given an existing tag G_k, the model will calculate the value of $P(G_k|S_m)$, where S_m is the category to which the current document is assigned according to Equation 3 & 4. The model will assign this tag G_k to this document only if

$$P(G_k|S_m) > \tau_{threshold}$$

(*Equation 5: Assigning an existing tag*)

Where $\tau_{threshold}$ is a free parameter to be estimated from the data. A new tag is created only if any of the tags associated with the documents in category S_m is larger than the maximum of $P(G|S_m)$ for all existing tags, i.e.,

$$P(G_{new}|S_m) > P(G_{max}|S_m)$$

(*Equation 6: Assign a new tag*)

Note the model does not predict which particular tags will be used, it only predicts how likely existing tags will or will not be used based on the relationship between the tags and the predicted mental categories formed.

EMPIRICAL STUDY

The main purpose of the empirical study is to test to what extent interactions with a social tagging system will directly impact knowledge adaptation. In addition, precise protocol data was collected to verify the predictions made by the model, which specifies both the assimilation and accommodation processes that underlie knowledge adaptation. A set of exploratory learning tasks was chosen. In all tasks, undergraduate students were given a rough description of the topic and gradually acquired knowledge about the topic through an iterative search-and-learn cycle. Students were told to imagine that they wanted to understand the given topic and to write a paper and give a talk on the given topic to a diverse audience. Two general topics were chosen: (1) "Find out relevant facts about the Independence of Kosovo" (IK task), and (2) "Find out relevant facts about Anti-aging" (AA task). These two tasks were chosen because the

IK task referred to a specific event, and therefore information related to it tended to be more specific, and there were more Web sites containing multiple pieces of well-organized information relevant to the topic. The AA task, on the other hand, was more ambiguous and was related to many disjoint areas such as cosmetics, nutrition, or genetic engineering. Web sites relevant to the IK task have more overlapping concepts than those relevant to the AA task. The other characteristic is that because the AA task was more general, the tags tended to be more generic (such as "beauty", "health"); in contrast, for the IK task, tags tended to be more "semantically narrow" (such as "Kosovo"), and thus had higher cue validity than generic tags.

Participants

4 participants were recruited from the University of Illinois. Participants were undergraduate students and all had extensive experience with general information search and the del.icio.us Web site. Participants were randomly split and assigned to one of the tasks. From their self-report it was obvious that they were unfamiliar with the given topics. Participants were told that they should explore all relevant information to learn about the topic using either the search function in del.icio.us or any other Web search engines, and should create tags for Web pages they found relevant to the topic and store them in their own del.icio.us accounts. Participants were told that these tags should be created for two major purposes. First, to allow them to re-find the information quickly in the future; second, to help their colleagues to utilize the relevant information easily in the future for their search purposes.

Procedure

Each student performed the task for eight 30-minute sessions over a period of 8 weeks, with each session approximately one week apart. Students were told to think aloud during the task in each session. All verbal protocols and screen interactions were captured using the screen recording software *Camtasia*. All tags created were recorded manually from their del.icio.us accounts after each session. Students were instructed to provide a verbal summary of every Web page they read before they created any tags for the page. They could then bookmark the web page and create tags for the page. After they finished reading a document, they could either search for new documents by initiating a new query or selecting an existing tag to browse documents tagged by others. This exploratory search-and-tag cycle continues until a session ended. All tags used and created during each session were extracted to keep track of changes in the shared external representations, and all verbal description on the Web pages were also extracted to keep track of changes in the internal representations during the exploratory search process. These tags and verbal descriptions were then input as contents of the document.

One week after the last session, participants were asked to come back to perform a sorting task. Participants were given printouts of all web pages that they read and bookmarked during the task, and were given the tags associated with the pages (either by themselves or other members in del.icio.us). They were then asked to "put together the web pages that go together on the basis of their information content into as many different groups as you'd like". The categories formed by the participants were then matched to those predicted by the assimilation and accommodation processes in the rational model.

RESULTS

Participants on average created 88.5 bookmarks (IK1=93, IK2=84) and 379.5 tags (IK1=392, IK2=367) for the IK task, and 58 bookmarks (AA1=52, AA2=64) and 245 tags (AA1=256, AA2=234) for the AA task. Participants in the IK task created more bookmarks and assigned more tags than those in the AA task, but the average number of tags per bookmark is about the same (4.3 tags per bookmark) for the two tasks. As expected, finding relevant information for the AA task is more difficult, as reflected by the fewer number of bookmarks created. Given that distribution of information was more disjoint in the AA task (e.g., there is little overlap of information between web sites on skin care and genetic engineering), the results were consistent with the assumption that the average rate of return of relevant information was lower for the AA task then the IK task.

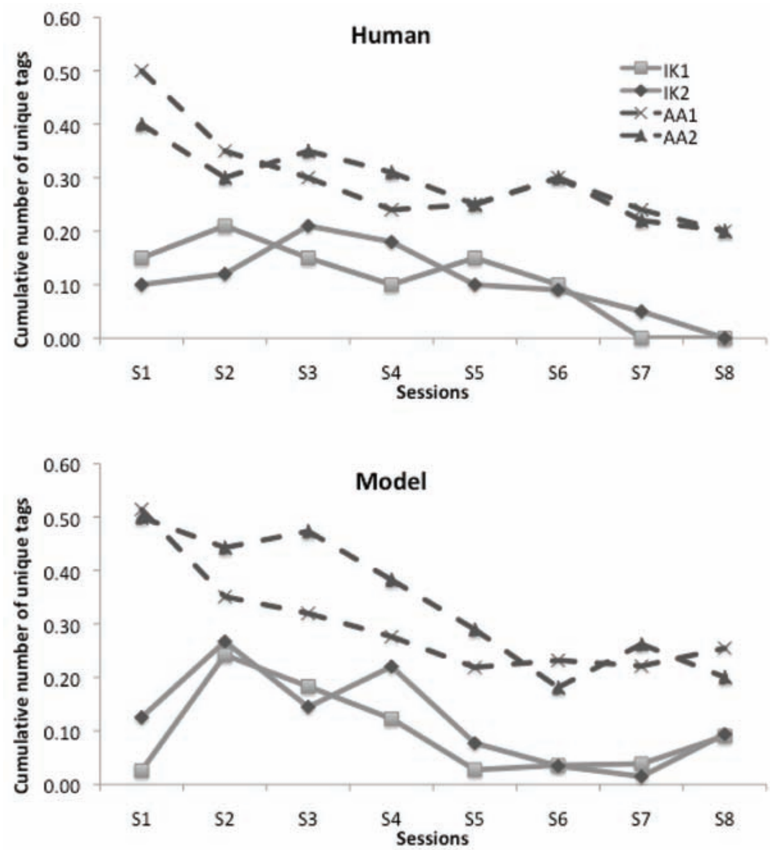
Figure 3 shows the proportion of new tags created by the participants (left) and model (right). Perhaps the most interesting pattern was that even though participants assigned fewer tags, but the *proportions* of new tag creation over total number of tag assignment were higher in the AA task than in the IK task. This was consistent with the lower rate of return of relevant information in the AA task, and this lower rate was likely caused by fact that the existing tags on del.icio.us was less informative for the AA task. Indeed, concepts extracted from the documents by the participants in the AA task were more often different from the existing tags than in the IK task, suggesting that the existing tags did not serve as good cues to information contained in the documents. The general trends and differences between the two tasks were closely matched by the model (R^2=0.75). Again, the major mismatches were found in the first sessions, where the model tended to under-predict the creation of new tags, especially for the IK task. A model that randomly assigns tags was created and compared to performance by humans and model. Chi-square tests show that both human and model performance was significantly different from the chance model ($p<0.01$), showing that they are significantly above the chance level.

Formation of Mental Categories

One core assumption of the rational model was that the assignment of tags and the selection of links were both based on the set of mental categories formed from observing existing tags assigned to documents that they processed. It is therefore critical to verify that the set of mental categories formed by the model match those formed by the participants. To do this, correlations between the mental categories formed by the model and the participants were calculated by constructing "match" tables for each participant and model. Items that are in the same category will be given a value 1, otherwise a 0. For example, two possible categorization for the set {a,b,c,d,e} are {ab}, {c,d}, {e} and {a,b,c}, {d,e}. In that case, their correlation can be calculated as r=0.102 based on the match table.

The major determining variable for mental category formation in the model is the value of the coupling parameter, *c* (see Equation 6). This was set to 0.6 for the IK task and 0.3 for the AA task to best fit the data. Because the information distributions are more disjoint for the AA task, the value of the prior probability of P(S) was set to a higher value. Table 1 shows the number of categories formed by each participants and model, as well as their correlations. As predicted, participants formed more categories in the AA task, reflecting the structures of the information sources. However, as shown earlier, participants in the AA task had lower rate of return in their information search, suggesting that they spent more time looking for relevant information. Although the number of categories formed was higher in the AA task, the quality of these categories (in terms of how much they help in finding information) was lower than those in the IK task (results shown next). The correlations between the participants and the models were high in both tasks, suggesting that the model roughly formed similar mental categories as participants, even though the inherent information structures were different between the two tasks.

Figure 3. Proportions of new tags created over total number of tags assigned across the 8 sessions by the students (top) and models (bottom).



DISCUSSION

From our knowledge, the current study is the first that shows social tagging systems not only can facilitate dissemination of information, but can also induce cognitive changes such as concept formation and knowledge assimilation. The current results also show that social tagging systems have the potential to facilitate not only collaborative indexing of the massive amount of information, but also as a means for social exchange of knowledge structures, and thus has the potential to promote formal or informal learning of diverse topics and the development of common schemas

Table 1. Number of categories formed by each participant and model, and the correlations of the partitions of the categories of the models and the students calculated using the match tables.

	#categories (Students)	#categories (Models)	Correlations of the partitions
IK1	6	6	0.71
IK2	5	6	0.68
AA1	12	13	0.59
AA2	10	11	0.67

or understanding within or across different communities. Given the direct impact on the development and refinement of mental schemas, it is not hard to imagine that social tagging systems could also impact collaborative activities that involve higher-level cognitive processing, such as problem solving, decision making, or creative designs. Indeed, many innovative ideas were generated by the sudden realization that knowledge structures in disjoint domains are relevant. It seems that we have only started to harness the potential of socio-technological systems, especially in the area of education.

The formal model was developed under the assumption that humans adapt their knowledge schemas through the assimilation and accommodation processes as they explore the Internet and comprehend knowledge extracted from web documents. The model, developed under the distributed cognition framework, was successful in providing good quantitative predictions on the emergent behavior of four different individuals across an extended period of time. The model shows how internal representations slowly assimilate to the external informational distribution through the processing and assignment of social tags, and how individuals create new tags based on their internal representations. The dynamic interactions between internal and external representations captured by the model has also highlighted the value of the distributed cognition framework, as they imply that isolated analysis of either the distributions of external tags or cognitive mechanisms of the user will unlikely lead to good characterizations of the dynamics that emerge from socio-technological systems.

The formal model also provides direct design guidelines for future social tagging systems. For example, the formal analysis of the current distributed cognitive system can be implemented as software tool that facilitates extraction and exchange of mental categories for different groups of people who have different expertise in different domains. Can tags, for example, be organized by mental categories extracted from experts in different fields in ways that facilitate knowledge transfer? Will transfer or exchange of knowledge at the fact, concept, and category levels facilitate innovation because they encourage re-structuring of existing knowledge structures? The del.icio.us system in this study was a general-purpose social tagging system. The current results suggest that social tagging systems can be specialized for different purposes. For example, to facilitate context-aware learning, perhaps the systems can be combined with knowledge engineering software that extracts and classify knowledge according to top-down domain knowledge to facilitate knowledge adaptation.

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This work was previously published in Educational Social Software for Context-Aware Learning: Collaborative Methods and Human Interaction, edited by N. Lambropoulos & M. Romero pp. 98-113, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 5.16

Entering the Virtual Teachers' Lounge:

Social Connectedness among Professional Educators in Virtual Environments

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ABSTRACT

As communication and connection are essential instruments for professional educators, this chapter seeks to examine the effectiveness of an online "virtual teacher's lounge" in the framework of offline communities. Essentially, an online discussion forum for educators is evaluated for the purpose of determining whether the forum provides a "space" conducive for the development of a community of professional educators as benchmarked against an understanding of offline community formation and existence. The foundational works of Ferdinand Tonnies, James Coleman, and Ray Oldenburg are used to develop 12 characteristics of community—as understood in the context of social communities. The study finds that online communities closely resemble offline communities in structure and interaction, but only for select participants. The participants observed demonstrating or facilitating the characteristics of community comprise around 10% of the total number of users participating in the analyzed discussions.

DOI: 10.4018/978-1-60566-826-0.ch010

INTRODUCTION

As globalization continues to bring more individuals to computer-medicated communication (CMC) of interaction as found in the phenomenon of the Internet, the education community must continue to embrace the technologies that exist to better address social, pedagogical, and professional needs. The United Kingdom has looked to technologies as cornerstones of recent educational reforms (Selwyn, 2006). It is only reasonable for the educational community, speaking in general terms here, to purposefully explore the latest technological innovations as possible means of assisting in communication for the purposes of professional development, collaborative support in pedagogical and social contexts, and for the discovery and connections of important content expertise. These tools can prove to be the connecting points between education professionals on opposite sides of the globe and around the literal corner. The challenge is to properly determine the most important and effective methods to allow educators the opportunity to effectively use resources and time to best meet the needs and demands of the 21st century.

This chapter examines significant developments in the specific context of the communication needs of professional educators as met by naturally-forming virtual environments. The primary question asked is whether virtual environments can serve the social needs of educators – essentially becoming virtual teacher's lounges, or more generally educational "third places" (see Oldenburg, 1991). This question is addressed through a primarily qualitative study, examining a single naturally forming educational community in an online environment.

The included background section creates a framework in which to evaluate an online discussion forum and its efficacy as a social community of professional educators. This chapter will review the sub-questions of the research –12 characteristics – in terms of analytical findings and synthetical conclusions. Conversational analysis and general observational techniques are employed to accomplish this study's goals. Further analysis of context illuminates other areas of interest as part of this study's execution.

BACKGROUND

The true nature of community promotes copious debate; or specifically, debate centers on whether community exists today as it once did, whether it will ever exist as it once did, and whether community has dynamically evolved and has therefore adopted a new meaning (Bauman, 2001; Putnam, 2000).

As the 1998 edition of the Dictionary of Sociology notes, "the concept of community concerns a particularly constituted set of social relationships based on something which the participants have in common — usually a common sense of identity" (Marshall, 1998). Identity is an important component of the formation of and participation in community. The perception of self, the subsequent behavior, and the juxtaposition of self with others all are vital concepts to understanding community (Bauman, 2003; Turkle, 1995). Community really can be considered a relationship between identity and the formed relationships with that identity.

George Hillery notes in Definitions of Community: Areas of Agreement in Rural Sociology (1955), "there is one element, however, which can be found in all of the concepts . . . all of the definitions deal with people. Beyond this common basis, there is no agreement" (Marshall, 1998). So communities are built upon relationships among individuals, aside from specific interests, geographical proximity, or necessity. None of these elements are present in agreed-upon definitions. This is particularly important for the pursuit of an understanding of computer-medicated communication (CMC)-based community formation.

Offering a different perspective, Zygmunt Bauman (2001) argues that the sense of community depends upon a community not knowing it is a community. This community must evolve "naturally" and not be artificially manufactured. Once realization occurs, then community is no longer pliable and that real community becomes something entirely different (Bauman, 2001, pp. 10-13). Grossman et al. actually attempted to fabricate such a community in an urban educational environment (2001). However, forced construction does not a community make.

Turning to an analysis of community, Bauman separates communities into two basic types: aesthetic and ethical. Aesthetic communities are formed as temporary, often based on an "idol." Membership in these communities remains noncommittal. Ethical communities, on the other hand, are communities that are based on rules, allowing members to experience security, safety, and certainty (Bauman, 2001, pp. 59-73), thus creating stronger ties.

Marshall's (1998) focus is on the distinction between community and society, which is important in this discussion. This distinction is made through sociological terms, coined by Ferdinand Tönnies in 1893, Gemeinschaft and Gesellschaft (Harris, 2001). The former denotes community — focusing on relationships based on family and close face-to-face ties. Elements in such a community are an attachment to place, concern over ascribed social status, and elements of homogeneity. Gesellschaft refers to society and general association, denoting the concepts of urbanism, industrial life, mobility, heterogeneity, and impersonality (Marshall, 1998).

For the purpose of this discussion, this study looks at communities as self-forming informal units of interaction – of the more ethical community type as Bauman defines them – where individuals have social connections on multiple levels in a stable and securely established conduit of communication. This can be best summed up by Ray Oldenburg's description of the "Third Place." This is the pub house, the bar, the bowling alley, the church meeting hall, or any place where informal relationships are continually reinforced. The Third Place exists outside of family and work (the first and second places, respectively). And for the purpose of this discussion, the Third Place can actually not be an actual place at all.

Oldenburg, in the *Great Good Place* (1997), describes the problem of place in America as manifesting in "a sorely deficient informal public life." He argues that America must revitalize its informal connections — dubbed "The Third Place" — a generic designation for a great variety of public places that host the regular, voluntary, informal, and happily anticipated gatherings of individuals beyond the realms of home and work." This Third Place is community, the informal connection among individuals on personal common interests and issues. Home and work are the first two "places," according to Oldenburg. These first two places remain a large factor of a person's identity. The existence of the Third Place is in decline (Oldenburg, 1997).

Oldenburg describes the Third Place as having the following elements: escape/ time-out from daily duties, neutral ground, "leveler," conversation, accessibility/accommodation, regulars, low profile, playful mood, and a home away from home. These aspects are implied to be unique to the third place. Oldenburg sums up that "(t)hird places that render the best and fullest services are those to which one may go alone at almost any time of the day or evening with assurances that acquaintances will be there" (Oldenburg, 1997). The Third Place is the home away from home (and away from work) – the place where people know they are accepted, feel comfortable, and interact informally with those they care about.

Another relatively recent concept in the realm of community, and relevant to this study, is the concept of Social Capital, focusing on beneficial relationships (mutual and singular).

Social capital has been defined as "features of social organization such as networks, norms and social trust that facilitate co-ordination and co-operation for mutual benefit" (Putnam, 1995). As individuals and as groups, people desire interaction with one another for specific benefits, whether these benefits are economic, social, political, cultural, psychological, physical, or even educational.

The actual formation of the social capital theory arose out of a need to reconcile the differing approaches of economists and social theorists with regard to individual motivation – one explaining it in terms of gain and the other in terms of complying with norms (Coleman, 1988; Bourdieu, 1983). A theory was necessary to demonstrate the effects both social expectations and individualistic drive have on an individual's choices and actions (Coleman, 1988).

The informal third place becomes very important in light of social capital. The benefits are not merely confined to Putnam's list of characteristics (escapism, neutrality, playfulness, conversational, community-feel, etc.), but rather may directly rely upon more social advancement-related reasons. People need interaction that indirectly or directly has positive effects on their development. They gather valuable tools, form valuable relationships, and establish long-lasting relationships to their benefit.

Talja Blokland found that those socially less advantaged could glean much from the "urban elite," provided there exists "informal rather than institutional relationships" and that success depends on "specific characteristics of reciprocity and mutuality of neighborhood networks across race and class" (Blokland, 2002).

This is a challenging time concerning informal connectedness. Putnam sees the great influence of the Baby Boomer generation as changing the way people interact in American society. There is a debate of which came first: the decline in community and subsequent use of technology or the use of technology in lieu of more traditional means of connecting with others. This issue has a great effect on this paper as the question arises as to whether people can experience connectedness — the macher/formal or schmoozer/ informal types as Putnam describes — in a seemingly disconnected environment (Putnam, 2000). However, as Lerner notes and Oldenburg reiterates, there still exists a "Problem of Place in America" where the small town (informal) cannot be revitalized, so a new community structure must evolve to take on integrated community needs in the "quest for community" (Lerner, 1957).

This research has established concepts surrounding community, community formations and the relationship to a third place (as defined by Oldenburg) and social capital (as defined by Putnam and Campbell). This study now turns to Etienne Wenger's Communities of Practice.

In the last two decades, Wenger (with the help of Jean Lave) developed a theory set exploring the concepts of learning and organizations and their convergence. He rooted this theory-set in a concept called communities of practice. In short, these particular communities contain "members (who) regularly engage in sharing and learning, based on their common interests" (Lesser & Storck, 2001). The theory's application travels from the commercial/ business world to the world of education as it looks at learning as a social process (with deep roots in John Dewey). Community members seek to learn from social groups in addition to collectively developing the social rules for engagement as pertaining to practice among its membership.

Grossman et al. (2001) looked at the semi-natural formation of an educators' community in a secondary school among history and English teachers. This project sought to put these groups of teachers together to accomplish two primary activities in the context of professional development: the development of pedagogical practice and of professional content knowledge in view of the two disciplines. While seeing some success in the discussions that developed, the researchers noted that the discovery of constructed professional communities saw less success than was initially anticipated. Merely providing time and resources does not meet the basic needs of community formation among professional educators. There is a mysterious element, very social or intellectual in nature that addresses this gap in effective formation.

The classical examination of social learning theories includes primarily face-to-face communication methods as the necessary component. More recently, a re-examination of this theory set has allowed for the discussion to expand to include other media such as e-mail and discussion forums. In fact, not only do these technologies provide a means to grow communities of practice but these media can actually be the primary facilitation for the development of entities (Lesser & Storck, 2001).

Regardless of medium or method, the initial development and further cultivation of communities of practice are directly related to the exchange of social capital. Members exchange social capital in the form of trust, mutual obligation, and language. Through structural (connections between members), relational (connections among networking processes), and cognitive (shared context and codification of meaning and processes) dimensions, communities of practice evolve.

This is the primary benefit of an examination of communities of practice: to examine as how a group of teachers develop methods and means to improve their practice as teachers (Wenger, 1998). In the context of informal social exchanges, researchers can use the relational dimension as discussed above to further solidify discussions on social capital and Oldenburg's work. The above is provided to develop a framework for teacher communities, but the use of the communities of practice model (or the work of Grossman) is primarily devoted to exploration of professional communities as they develop the practice pertinent to them. This research explores the nature of the social exchanges of participants in communication avenues and whether these exchanges support the construct being applied of communities (yes, professionally labeled but social in nature).

Concerns have arisen over the direction of community (see Bauman, 2003, and Giddens, 2002, for discussions on negative aspects of the globalization of community) with the advent of the Internet. The Informational Revolution is here (see Putnam, 2000). So how effective can virtual environments be in helping to establish or progress community?

Manuel Castells (1996) notes that the technological innovations that brought into being the Internet and virtual networking were conceived to solve a problem concerning connecting individuals. Suddenly, the world is connected and geographic boundaries are no longer impeding the formation of global communities.

Virtual communities as Castells defines them are "like Howard Rheingold('s) self-defined electronic network of interactive communication organized around a shared interest or purpose, although sometimes communication becomes the goal in itself." He notes that virtual communities may be formalized systems (like Bulletin Board System (BBS) or hosted conferences) or be spontaneously formed. In either case, the communities are ephemeral from the point of view of the participants —where users can move in and out as necessary. Virtual community participants are described as either transitory or electronic "homesteaders" (Castells, 1996; Ward, 2002),

What is unusual about CMC in general, and virtual communities specifically, is there exists a many-to-many relationship (Castells, 1996). This provides for many touch points for interests and individualism. It also makes it difficult to account for the many different informal virtual communities in existence as individuals can pass casually from one informal community to another without completely attaching.

Howard Rheingold, like Hammon (1998), has suggested that virtual interactions and relations overlap in to the real/physical lives of those participating. Face-to-face meetings were common among Rheingold's compatriots in the 1980s, spending their evenings sharing information and experiences in online environments and some weekends gathering for picnics to see who actually was the individual behind the virtual identity (Rheingold, 1994).

Some studies show that more than half of participants in newsgroup discussions not only begin long-lasting relationships in online environments but also continue off-line relationships with these online friends. Other avenues of communication are employed (postal service and telephone), and over time these develop into long-lasting personal relationships. Social bonds become redefined. Thomsen et al. sums up that newsgroup relationships "typically serve as catalysts for long-term and meaningful relationships" (1998).

Furthermore, evidence demonstrates that physical co-presence is not necessary for "intimate quality interactions" (Thomsen et al., 1998). As he also notes — as do Steven Jones (1998), Ray Oldenburg (1997) and Howard Rheingold (1993) —the various CMC technologies "have sprung out of the need to re-create this sense of community that participants join and become involved with the express purpose of re-establishing social bonds.". Suddenly virtual communities become Oldenburg's "Third Place," where bonding relationships can be established through the exchange of informal social capital.

The cyber-community becomes the connection to the real world for the Web-surfer. As Steve Jones surmises, Internet users have strong attachments online (1998, p. 5), thus it is a real experience. As Markham (1998) notes, "All experiences are considered real so therefore virtual is a misnomer." The gravest of subjects becomes a real exploration using online community tools to interact with other real participants through virtual communication lines.

Research on virtual communities in the context of professional educators has been limited. This is likely due to the fact that the world of virtual communities is completely reliant upon the only recently birthed CMC modes, such as the Internet. Obviously, because it is recently formed, there is a small window of time for exploration.

Selwyn (2000) provides one such exploration into the world of teacher-based virtual communities. This study examined the SENCo community (a communication group of Special Educational Needs Coordinators for schools in the United Kingdom). As a result of the government's push for the use of "virtual communities" as part of its educational reform practices, the researchers began to question if these virtual communication avenues truly accomplished the goal of connecting educators in communities from geographically disparate locations. The format of these communications followed what has been called discussion forums but also can be called e-mail list-servs (or e-mail groups that get archived in online environments).

Selwyn (2000) found that participants certainly did exchange in three of the four communication purposes (information exchange, empathetic exchanges, virtual respite), but the deep connectedness of community (the fourth) was not as prevalent. One more note here in this study is the emergence of some 24 participants who essentially became the hard-core users. These participants contributed some 50 percent of the message analyzed.

A distinction in this community formation is the imposition of the creation of community (as in Grossman's study above) by external forces as opposed to the natural evolution of community.

As discussed earlier, Coleman, Oldenburg, and Tonnies provide the foundation of what is understood about social communities (close-knit, naturally forming, and homogenous). An understanding of online communities can be found in works by Howard Rheingold, Steve Jones, Sherry Turkle, Robin Hammon, Stephen Doheny-Farina, Nathaline Bowker. Wenger's work moves toward understanding the formation of professional communities, but his work focuses on how communities of professionals share meanings so as to articulate, develop, and refine processes and knowledge to assist in practice. Selwyn attempted to look at the viability of these communities in the context of government-identified educational groups (identified with a job function), but does not see the arrival of communities online in that form or under those conditions. What is missing here is an understanding of teacher social communities and specifically teacher social communities online.

Taking these findings, one may synthesize a full picture of the potential of educator communities in online environments. Research notes communities are naturally forming, often informal, social groups. These groups are built on conduits of communication and social connections. Norms for behavior are established as part of a collaborative process, where individuals agree through negotiation on proper processes for group functioning. Participants gain membership – and thus are enveloped into the system of trust – in the group. Community is strengthened by the participation and efficiencies developed.

The development of understanding as related to problems, the contributive nature of participants, characteristics of movements of information, the development of tools, and professional language features all are uniquely identified in the communities of practice theory set (Wenger, 1998). The study here looks at the social exchange features of Coleman, Tonnies and primarily Oldenburg. These comprise the main drives of design for the study as the informal social and non-professional purposes of community formation of these (and primarily Oldenburg) present the type of community attempting to be analyzed/ identified.

This synthesis of understanding of community is the foundation for proceeding in this study, where in the section following, the study investigates online interactions for efficacy of community.

RESEARCHING ONLINE COMMUNITIES

The research, undertaken as part of this project, works to answer the question of whether online social communities created and maintained among professional educators constitute an informal community as earlier defined.

This is the construction of the design of this project: a positivist approach employed in a simple research question accompanied by interpretations/ analysis of the gathered textual data for attaching deeper meanings to the associations. Simply put, the analysis of unsolicited textual submissions proves to be too complicated for a simple quantitative mode of enquiry. A more inductive approach is necessary for such meaning-rich data that employs analysis of numerical representations of social phenomena (Kuikin & Muill, 2001).

To determine the nature of exchanges among professional educators in virtual spaces, these exchanges must be analyzed in light of a model for an off-line, informal community. The study uses Ray Oldenburg's descriptors of the *Third Place*, Ferdinand Tönnies' *Gemeinschaft*, and the discussion of social capital as the basis of this benchmark off-line community (and thus the impetus for the identified categorizations to be used in the study). These together form the necessary picture of informal community: close-knit, supportive, mutually beneficial, and connected. Deliberately excluded from this group is Wenger's notions of community in the context of professional communities. These chosen sets used for constructing a model for interpretation comprise an image of exchanges of the purely informal variety for the purposes of social interactions, not for the development of professional practices.

In order to gauge the community existence in this project, the study employs the 12 community characteristics gleaned from the works of Oldenburg, Coleman, and Tönnies, to create the following questions and guide conclusions.

- Is the virtual space a location for participant escapism?
- Does the locale provide an area of neutral ground for all participants?
- Do all members have equal access to participation?
- Does conversational-style communication dominate the environment's discussion patterns?
- Are there "regulars" in this environment?
- Is there evidence of playfulness in this virtual space?
- Does this place act as a "home away from home" for the membership?
- Is there an obvious attachment to place among the place's membership?
- Is there evidence of a concern over ascribed social status among the place's membership?
- Are there elements of homogeneity – via beliefs, interests, or backgrounds – among the space's membership?
- Does the "community" exert self-regulation? Is there evidence of a contract (explicit or understood) for membership governing behavior and participation?
- Is there evidence of an exchange of ideas for the development of individuals?

These questions then are transformed into the coding-based categories for examining the relationships and the interactions contained within the chosen community.

To answer the outlying question of what types of exchanges occur in virtual communities of professional educators, the study selected an online teacher community (primarily consisting of a cost-free discussion board area so as to remove boundaries of limited access). A particular weekday was selected, and every electronic discussion (and preceding discussions with the same attached date) active on that particular weekday was then gleaned for analysis. In essence, a random sample of discussions was then used for answering the basic questions posed as part of this study. The participants in this online community are primarily educational professionals or para-professionals.

The sheer volume of the available discussions led to the consideration of limiting the analysis. However, all discussions were included, with the one exception of limiting very long threads to no more than 100 posts. This limited the ability to analyze previous discussions, but many of these proved to be the "game-like" discussions and appear to not have impacted the study.

The other limitation to note here is elaborated upon and developed further later. This relates to the notion of what has been categorized as the "regular user." The limitation of this study identifies a group of users in such a category, but the number identified here and its relevance does not speak to the actual occurrence of "regularness" in quantifiable terms. In other words, the 30 identified "regular users" do not speak to how many users are actually represented by this group. In some respects, this is an intrinsically focused number and categorization so as to identify further characteristics and understandings of those more identifiable as regulars in an online forum.

In consideration of the above, this study's primary approach for data collection and analysis are now described.

All discussions posted to or created within the 24- hour period (12 a.m. EST to 12 a.m. EST of the following day) are saved as text files. Some of the actual discussions contain multiple pages (possibly as many as 30 pages). If so, then all discussion posts within the most recent 100 posts are gathered. On average, some 10 topics are "active" (i.e., have been active on any given day) per a forum. The resulting discussion threads from the 25 discussion forums were imported into QSR International's NVivo 7's software interface for organization and analysis. At this point, the coding of the data proceeds.

The following categorizations provide the guiding aspects for the coding of the data gleaned from the forums (based on the guiding theoretical discussion questions as noted above): participant escapism, neutral ground, equal access to participation, conversational as dominant style, "regulars," playfulness, home away from home, membership attachment to place, social status a concern?, homogeneity (as in identified perceived like-ness in areas of interest, professional or vocational identification, ethnic affiliation), self-regulation/ contracts, and idea exchange for individual development.

The number of occurrences and the level of adherence to these concepts are examined. Further in this phase, the additional peripheral statistics are gathered to develop contextual understandings of the posters. Finally, additional information on posting policies, FAQs and other Web site provided information on the forums are gathered to use toward answering the questions posed. This document review is used to complement the interpretation of the gathered data from participation.

All data gathered is used to form an analysis of the actual interactions contained within these randomly selected in the study. Primarily, the method of analysis involved the specific examination of these discussion threads in isolation and the collection of additional peripheral information as related to the governance and structure of the forum and general data on users.

PARTICIPANTS AND PLACE

Below is a provided background of both nature of the "place" where these discussions occurred and the participants in this study.

The forums pre-created, as repositories for organizing potential discussions, can be divided into three primary types: those as related to professional needs, those as related to social needs, and those as related to the management of the discussion forum itself. For example, the forum has established sub-areas for each broad level of education (elementary, secondary, etc), for types of activities (classroom penpals, postcard exchanges, behavior management, etc.), and for specialty areas (like Montessori education, special education, pre-service teachers). The other areas range from exam preparation to general game and chatting sub-forums. Some of these areas remained quite professionally focused (like the exams area) while others were exclusively non-professional (like games and chitchat). Others oscillated between these two general characterizations depending on the specific subject/ topic.

The greatest number of active threads took place in the TeacherChat forums on the day of collection (comprising discussions geared toward social and professional needs). What is misleading here is that we arrive at this conclusion because of an accounting of the amount of threads active, not the actual amount posted in each thread. This point is revisited and further elaborated upon below. Regardless, we can draw some conclusions.

The highest number of active discussions occurred in the Elementary Education sub-forum of the TeacherChat Forums (with 16). The next highest number of active discussions in a sub-forum appeared in the New Teacher Sub-Forum of the TeacherChat Special Interest Forums. Following closely behind are the Games and the ChitChat sub-sub-forums (both of the TeacherChat Forums/ Teacher TimeOut Sub-Forums) and the Teacher TimeOut Sub-Forum main area itself. These discussions will be examined in more detail below. The ChitChat area proves to be the most active area during the discussion analysis period.

These users are primarily participating in discussions about a specific professional need (like Elementary Education) or they bear participating in social engagements (like ChitChat and Games). This very differentiation – a divide between the professional and the social - becomes a hallmark of the analysis of this forum *world* in the following sections.

As the nature of this study remains quite observational where interaction is intentionally minimal, all data illustrative of the participating users' backgrounds is gathered from public sources, primarily from the users' member profiles. Here, the location, the age, the overall posting record, and the particular vocational (or personal in some cases) interest of the poster (with some other background details) can be gleaned. With the exception of the posting history, all details remain optional for the forum members, thus only a sampling can be provided of the types of users posting to this forum. The count of non-responders is included with each demographic below. This sampling still remains illustrative and enlightening.

Out of the 301 users who participated in the discussions, around 86% of the users listed a location (a specific state, a province, or a country). Primarily users reside in the USA, with Canada and Australia representing much smaller segments. Within the United States, California clearly is the most common origination point for users (with 22% of the total United States-based users living their offline lives here). Other states with relatively high counts of participants include Florida, Michigan, New York, New Jersey, and Texas.

The next piece of data involves age of the participants. This piece of data is not used to draw specific conclusions, as there are some issues with this piece. First, users may not be honest about their ages when listing this in a public forum. Next, the users who reported ages may be more inclined to do so as these users may be more representative of the younger segment of the user group. With these caveats, reported ages are examined. The users who chose to include a birth date in their profiles comprise 22% of all users, with users including birth date in their profiles tending to be younger (with those aged 30 and below comprising 71% of the total). The oldest recorded was 66 while the youngest was 20.

Next, an understanding of vocational and professional pursuits or personal interests can be quite helpful in understanding the users posting to this forum. The data gathering process identified 50 different types of professions or affiliations. Several users noted in-between affiliations ($4^{th}/5^{th}$ grade, for example). Even with these in-between affiliations, a clear pattern emerges. The first, second, and third grade teachers (not counting in-betweens) comprise 18% of the overall user group. Also interesting to note, 22 (or 7%) of the users identified themselves as students (or college students in teacher education programs).

Elementary Education rises to be the most identified profession. This is corroborated through an examination of the actual postings and active discussions (discussed below and above respectively).

With general understandings of the place and the participants, the below sections detail the analysis and synthesis of this research undertaken and the constructed broad categories of results:

The Participant Divide: Regulars and Non-Regulars
Regulars and the Role of Expert: Professional Assistance
Regulars and the Online Playground: Social Interaction

The Participant Divide: Regulars and Non-Regulars

This research discovered a distinct divide between two groups of individuals: the Regulars and the Non-Regulars. The question of "regulars" really relies on the notion that there exist those who frequent and feel attachment and affection for this "place" — enough to participate in the discussion, enough to be present more than a few times, enough to move from a new member to a prodigal member to a fully engaged member (Oldenburg, 1997).

A small portion of the posting community was responsible for a large portion of the actual posts analyzed. This aspect is a reinforcement of Selwyn's findings (2000). The selected group (a group of 30) became the identified "regulars." These regulars (as coded by the schema "Regular_(number)") acted as experts, asked questions of one another, enjoyed each other's company during reflections, during hard times and stressful situations, and through silly and nearly meaningless conversations. These regulars embraced new and relatively unknown members graciously.

While this might seem to be an obvious conclusion, the questions surrounding this could multiply. Before we assume many conclusions, we must be skeptical and honest about this particular study. The very restrictive nature of this study – in initial and natural structure and the specific employment of methodological approaches in research design and execution, limits our generalization of findings. This study has identified that there is clearly a separation between regular and non-regular, but it cannot be so easily relied upon quantifiably as reported. Keeping this limitation in mind, we can draw some tentative conclusions – to be explored in other studies employing other approaches.

Posting rates overall proved high in this group of regulars – both in the posts in the analyzed documents and in the overall posting rates in each of the regulars' board histories. Additionally, two of the essential components of becoming a regular are to establish trust and to act decent. These 30 live up to this set of standards (Oldenburg, 1997).

The challenge in this question is that 30 users became regulars in this virtual space. Two hundred eighty one did not. The specific numbers can be held in suspect but the actual comparison should be accepted. The types of discussions in which these two groups participated are illustrative of the needs being met for each. The regulars participated heavily in light discussions while the non-regulars did not and chose rather to participate in those discussions that proved serious and focused often on professional questions and issues. This is further elaborated upon in other questions below.

Further reflections should be made, referring back to Soukup's criticisms, of whether the actual nature of these interactions (among Regulars) can be considered along line with off-line interactions. Would the nature of the actual discussion forum actually impact the results of these interactions? In addition, would these take place in MOOs, MUDs, MMPORGs, etc as noted by Soukup? What role does the nature of this forum (asynchronous, textual posting) play in the development of these interactions between Regulars? In short, would these Regulars still be the same type of "Regular" we see here and how would the environment impact that? This impact could only be gauged by revisiting this study in other technological settings (in Second Life for example).

Another note to make here is the further unknown group that participates in this forum to some extent: that of the lurker. This individual explores content – presumably personal and professional – potentially to answer not only questions (like in the case of licensure questions, issues on behavior management or on the organization of instruction) but also to merely enjoy the conversations (in a potentially a voyeuristic way) of the participants. Can this group – the great unknown – be considered part of the "community?" Is their undefined benefit making them any less as compared to their Regular comrades? Do they feel that they are part? Moreover, potentially, could we even say that some Regulars actually could function in this role

Regulars and the Role of Expert: Professional Assistance

Social status as a component of Tonnies' Gemeinschaft (Marshall, 1998) plays a large role in this discussion. The complexities have yet to be revealed, but the different approaches are clearly discernable. Users enjoy visual and textual notations of status in the community (based on chosen identities, expressions of professional affiliation, and posting counts). Further, some of the regulars (and even some of the non-regulars) gain notoriety in their various roles – such as a math expert, an expert on certification issues, etc. This is status and this provides identity in a world where identity is often masked.

With a large number of participants (generally speaking in terms of the life-time of the forum) never exiting "new member" status, the question arises again – what pushes one user to leave the group of thousands of nearly unknown users with monikers to users with reputations in a group of elite posters? And what pushes the lurker to a new member status?

Tonnies' Gemeinschaft (Marshall, 1998) again provides direction useful in this analysis. This group of users and this virtual space provide opportunity for users of like interests, backgrounds, or identities to congregate and share. This is the nature and often the primary purpose of online discussion forums – and this forum proves to be no different.

The affiliations of a professional nature clearly point to like mindedness in interests. The elementary contingent (self-identified in profile creation in the forum) is notable among the groups with others trailing close behind. Further, the structure of the forums themselves attracts members to specific areas for specific query types (or general discussion types). With discussions ranging from similar interests in math, music, and fashion trends to similar jobs, teaching practices, and geographic locations to level in pursuing certification, and stage in applying for a teaching job, the level of homogeneity is clear. The data confirms that the users share similar interests and congregate according to these. The similar backgrounds are often identifiable through profiles.

What would prove interesting is an exploration of the level of connected-ness (to place or to one another) experienced by these various types of homogeneity. Our understanding of community in general dictates assumptions of homogeneity. How these homogenous identities play in virtual worlds may change that further. The simple existence of these types of relationships was observed in this context.

Further in this context of professional identity enters the concept of idea exchange. The exchange of ideas (and its presence in a community) deals directly with the concept of Social Capital (Coleman, 1988). The users primarily use this forum for exchanging ideas – ideas for classroom management, ideas for projects, lessons and activities, ideas for gaining employment, ideas for studying for exams, or ideas for a nonsensical game or notion. These are all exchanges that others benefit from in one way or another.

The presence of some experts, the regulars self-identifying in these roles, provides a basis for providing the exchange of ideas. The notion that the receiver then becomes the giver is not easily discernable in this data, as the scope of analysis is limited to a specific set of discussions and time frame for many of the discussions. The four primary types of exchanges noted in the analysis include teacher practice assistance, teacher application assistance, personal advice, and teacher certification assistance. The obvious exchange for benefit exists in this environment. The true nature of the exchanges and their adherence to the understanding of social capital needs more study.

Regulars and the Online Playground: Social Interaction

While Oldenburg's Third Place has no place for "serious conversation" (Oldenburg, 1997), the online teacher community embraces such conversation. Many of the discussions center on serious questions of a personal, professional, or even pedagogical nature. This does not mean that the playful discussions do not exist; they are merely relegated to their own home in a forum entitled the Teacher TimeOut Sub-Forum.

This area is set aside for the casual discussions of light-hearted remembrances of years past, word and get-to-know-you games escapist in nature, and general social discussions that enter the realm of laughter as participants play games of who would be kicked out if this were a reality television show. The playfulness of discussions is present, just often contained in where it is meant to be. This is an interesting natural separation – and almost naturally occurring phenomena in online discussions. This discussion forum takes time to be sure that participants know what can be posted where. Some of these understandings are explicit and some are implicit. This actually can be likened to Social Learning Theory and in the Community of Practice construct as those participating – and the more they participate – develop and build understandings of where it is appropriate to discuss X and where it not appropriate to do Y.

Oldenburg's Third Place (1997) experienced a feeling of a "home away from home" – espousing the gift of regeneration, at-easeness, and hints of possessiveness from its occupants. One of the most important roles this forum plays is that of a means for teachers to come together to regenerate. Many of the teachers (or educationally-minded participants) seek others to share frustrations and joy, but also to escape (as discussed above) and to recuperate. Discussions seeking a result of regeneration included personal issues, disappointment with students, and frustrations with parents and the profession in general. Participants note that they cannot find the answers and comfort in their workplaces that they can find in the virtual space of this forum.

These participants are at ease possibly simply because they remain anonymous. However, to be sure, these regulars also know one another and must take comfort in identity and status on the forum. These participants joined as members of this board, and they return as they find the answers they need or meet the needs they have. This is their forum and they found it.

The regulars (the 30 heavy posters) comprise a group who fit into Tonnies' Gemeinschaft (Marshall, 1998) — one where they feel an attachment to this virtual space. They have developed an identity here (and it is interesting to note that this identity is in terms of actually who they present themselves to be and how they see themselves apart from presentation in the context of the virtual space). These 30 posters return (many daily) to the forum to gain the answers they seek or the comfort they need (or maybe just because it is fun). The unrepresented group here is the vast number of people that register and post a few times or less and never return. The attachment does not appear to exist for them. They gain the answer they need and move on, possibly to never return. The difference between these two types of users proves to be the interesting question that needs to be explored.

Regardless, the regulars – the ones who return to this home away from home – possess this virtual space as theirs. What has not been clearly examined in the nature of membership in this group in the context of personal identity. This can only be determined by getting behind the screen instead of interpreting discussions. There would need to be more examination of the nature of this community formed as an exclusive community of an inclusive one.

This notion of identification and attachment with place is more definitively identified as such as compared to Selwyn's work (2000) that found little evidence of attachment to place. The difference between these two studies appears to be in motivation. In Selwyn's examination, the users were provided space with a very specific set of content to be explored and shared (very professional in nature and following a mind-set of a community of practice – sharing practice, etc) whereas this community studied is completely naturally forming and the ideas and topics have developed form the users participating. More work is needed here.

The non-regulars, the vast majority of the users in the study, obviously do not attach in the same way as the regulars identified. This is a crucial finding – these regulars have entered a different phase of interaction in this virtual environment.

In conclusion, how does this analysis answer the research question posed:

The research, undertaken as part of this project, works to answer the question of whether online communities created and maintained among professional educators constitute a community, as we understand them in the context of off-line communities.

Using the benchmarks as formed from the literature reviewed for this project, the analysis points to a complex answer. While this community of users strongly feels an attachment to place, self-regulates through informal contracts, exchanges ideas for the benefit of the individual, are homogenous in interest, have the opportunity to express social status in the context of the environment, play (at times), converse and escape the realities of the world in a neutral environment; they do this if they have moved to a status of regular (or near-regular). The challenge is in the statistic: 83% of all of the forum users have posted less than five times. This is sobering statistics that demonstrates a large number of users exist who definitively do not feel a connection in this environment. Is this environment a community for virtual members? Yes – but only for some.

The basic construction of online discussion forums for professional educators contain two primary targets of content – the discussions centered on issues of a professional nature and those discussions centered on a personal/ social nature. While the discussions themselves are organized as such, the people participating in these and moving from one to the other behave and interact in different ways according to the discussion content.

In those discussions centered on content of a professional nature – those that focus on certification issues and questions, on job applications and hiring questions and advice, on level-specific teaching methods and approaches, and on general pedagogical and professional issues – the participants contributed in very professional ways. The process here involved the query/ problem stated, the contributions of those in positions of authority on the subject (or even those that empathized) and a synthesis (or confluence of ideas) to form a best approach for the participant/initial poster. Many of these discussions proved shorter in nature, very focused, and many of those who were frequent posters acted as the subject matter experts.

In contrast, those discussions focused on more social interactions – those that focused on game-like discussions, on personal issues and celebrations, on funny stories, on past reflections, and on home life and its trials and fun – proved more interactive (as to the types of interactions), more long-lasting, containing higher levels of participation, and the presence of those that are more participatory in the forums as a whole.

These two types of interactions constitute the gamut of types of discussions on these boards. The question remains: Do these types of discussions (the process, the content, and the outcomes) effectively create environments of community for those who participate?

FUTURE RESEARCH DIRECTIONS

This study (as Selwyn's before) serves well as a frame of reference for other studies on the efficacy of community for professional educators. Selwyn's work relied heavily on government-created communities whereas this study worked with communities that arose naturally among the participants (at least one).

Further studies should examine the actual nature of these "regulars" and why they moved from the new status to member (and beyond). What is the mysterious factor that pushed the social experience from casual participant/ lurker to "regular?" Additional research into the motivations and needs of these users would prove useful in understanding the potential use of online environments for teacher interaction and community-building. Working on illuminating more details on who these participants really are and what skills they have acquired and what lives they lead would greatly expand the understanding of this mysterious factor. Specifically, more should be done on following users – if possible – through these phases of online existence. In addition, work and examination in areas of professional identification and personal and social identification as juxtaposed with this notion of "regular user" should be worked into future research in this area.

This study sought to understand informal social exchanges, but in the process found the professional development potential for such online environments (pedagogically and subject-specific). This area could be further explored as its potential for addressing the time issue and the definitive need for professional development for today's educators is undeniable. Important here is the understanding of potential policy implications – can we develop effective online professional development modules AND online avenues for professional communities (as envisioned in the Selwyn study). If so, do our notion of Regular user and our eventual understanding of the nature of the Regular user's evolution as an online persona have an impact in this venture design and implementation?

In addition, how does the impact of these lurkers – the silent observers – change the way this community should be considered? Do we then conceptualize the nature of community based on what is present (surface-level) and what is potentially possible based von assumed lurkers? Does the presumptive presence of these lurkers have implicit impacts on the types of participation or the level of personal (or professional) interactions in these environments? In addition, of course, does the actual venue of the technology have an impact here?

Other questions arise concerning the true nature of the exchange of social capital among these educators online and if the differences exist between non-regulars and regulars. Additional research in the nature of the discussions – i.e., more of a topical analysis going much further than the scope of this paper – would also bring to light an understanding of these communities.

Much works needs to be done here. This study has pointed to an unknown gap between those who participate and those who do not. This phenomenon could result in real impact on how we design and develop online communities (or online spaces for interaction) for professional educators.

CONCLUSION

This chapter, at its core, examined the development of understanding of virtual communities (based on understandings of off-line communities), established benchmarks for analysis, examined an existing community for adherence to benchmarks, and used conclusive results to further the discussion of the reality of, the importance of, and the benefits of virtual communities in the professional educational sector. This has been an untouched area heretofore and is ripe for the examination.

Upon analysis of the gathered conversational data, this study initially concludes that a select few individuals self-identifying as professional educators form communities of users in online environments much in the same fashion as off-line communities. This conclusion is based on the existence of a body of individuals (identified as "regulars" and numbering 30) who exemplify the general nature of the sought-after characteristics of informal, social off-line communities.

The limitations of this research and the restrictions on collection and data types make this a tentative conclusion that needs further solidification through other modes of data analysis. This formulation of a community appears to be anomalous as compared to the entire body of potential and registered users. Admittedly, an unknown lingers in this discussion that bears heavy weight upon the conclusions – the 30 identified regulars represent a larger body of individuals and that number is not known. The individual purposes and the self-established meanings and significances of these individuals' participation in this community was not established in this study, but would be an obvious next step for understanding the nature of the transformation persons experience in moving from casual disconnected participant to fully participating and involved member of an online community.

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KEY TERMS AND DEFINITIONS

CMC*:* Computer-Mediated Communication

*Third Place***:** The informal aspect of community, as identified Ray Oldenburg, not related to concepts of Home and Work (the first two places)

Newsgroup*:* A communication venue found in CMC where users can post messages related to actual news and general information of interest.

Regulars*:* In the context of this study, the users who posted most frequently, numbering about 10% of the total analyzed posters

Non-regulars*:* In the context of this study, these are the other 90% of users who posted in this forum who did not post frequently

This work was previously published in Educational Social Software for Context-Aware Learning: Collaborative Methods and Human Interaction, edited by N. Lambropoulos & M. Romero, pp. 169-185, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 5.17
Trust Modeling in a Virtual Organization Using Social Network Metrics

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ABSTRACT

One of the most important factors in human interaction and communication is trust. Each organization performing its quotidian tasks use intentionally or involuntary established trust relations to estimate the probability of achieving the expected results or the level of confidentiality. As in societies that evolved from real world relationship (e.g. school, office, sport activity, etc.) also in virtual communities (e.g. chat rooms, Web boards, mailing lists, etc.) trust is one of the most fundamental type of binding among the group members. In this article the trust relation establishment and evolution in virtual communities has been investigated. The presented model uses some typical parameters like node degree and centrality coefficient related to social network description and analysis. [Article copies are available for purchase from InfoSci-on-Demand.com]

INTRODUCTION

Trust and reputation of subjects has been typically assessed as a function of the quality of their response to requests coming from other members in the community. This approach is used in some organizational learning systems as, for example, *Answer Garden* (Golbeck,2005) or knowledge communities (Golbeck& Hendler, 2005; Schillo, 1999). Discussion about the different ratings that can be obtained by analyzing response quality is to be found for example in (Grzonkowski, 2005). These systems rely on ratings provided as a feedback from the subject receiving the response to a previous demand. Subsequently these ratings are combined and finally each subject calculates its own trust value. Trust and reputation measure gives an idea of the confidence one can have on the quality of a subject's responses. The disadvantage of this type of mechanism is that it needs the explicit and frequent involvement of users that issue ratings. This implies that a good reputation calculation and maintenance depends on the involvement of users and continued contribution of ratings. Less intrusive and less demanding in terms of users involvement methods are more interesting. The problem is how reputation and trust level can be measured in the absence of any user feedback for subject's responses.

The main idea presented in this work is that some information about the dynamics and formation of the virtual community network can be used to evaluate the trust and reputation values. The Internet, the electrical power grid, the transportation network as well as the social networks can be viewed and analysed as the examples of complex networks. Two important properties displayed by many of these networks are the small world and scale-free properties (Ehrlich, 2006). Small-world networks can be characterized by the clustering coefficient and the average network distance. The clustering coefficient is the probability that any two nodes are connected to each other, given that they are both connected to a common node. The average network distance measures the average minimal number of links connecting any two nodes in the network. Many regular networks have high clustering coefficients and large network distances. Random networks, on the other hand, have small network distances and low clustering coefficients (Watts, 1999). Small-world networks fall somewhere in between these two extremes as they have large clustering coefficients and small average network distances (Garton 1997). The scale-free property is defined by an algebraic behaviour in the probability distribution $P(k)$ of the number k of links at a node. When we consider virtual community all these parameters describing small-world or scale-free networks can be used to analyze the position and relations among community members.

In the article a novel concept of a trust modelling and management that addresses above mentioned problems by using the some universal measures for complex networks is presented.

In the next section the main ideas dealing with how trust can be modeled within online communities have been presented. Next, some background describing social networks analysis has been described. After that, methods for constructing community-aware trust levels assessment that enables automation of the trust level calculation process and to establish trust relations between users of a social network. This methods use a novel trust model that takes advantage of complex networks. Finally, in the last section a discussion about the presented model and directions of future work has been presented.

TRUST MODELS

Trust is a very important aspect of our life because trust is the fundamental for all bilateral and multilateral activities in human society, especially when results of our own actions are highly dependent on the actions of others. The most frequently quoted definition of the trust seems to stress the following aspect related to this notion (Gambetta, 1990; Marsh, 1994):

- Trust is subjective. Trust is the social knowledge that is derived from personal observation and serves for future personal decision-making.
- Trust is affected by some actions that cannot be monitored
- Trust is context dependant. Trust can have different meaning dependently from the context. For example, one can trust TV news when it has been prepared by X but not when it has been prepared by Y.
- Trust level strictly depends on how our actions are affected by the others.
- Trust is directed.Trust relation is always composed by two entities: trustor and trustee, so

the relation is asymmetric. A trust B does not implies that B trust A.

- Trust is measurable belief. Trust is usually associated with a value that represents the strength or degree of trust. A can trust B more than it trust C.
- Trust is conditionally transitive. When we consider trust as the recommendation factor it is partially transitive.
- Trust has a temporal dimension. Trust is derived from the past observations and trust values evolve with a new observations and experience. The behavior of B may force the A to recalculate its trust
- Trust between collectives does not distribute automatically to trust between their members. If a state A trust the state B it does not imply that all state members trust state B.

The other important idea related to trust is reputation. The most typical real life context of reputation application is when someone need to work with a new, unknown person. Then, the typical practice is to ask people with whom one already has relationship for the information about such person. Based on the obtained information one can form an opinion about the reputation of the new person. Further, a positive reputation leads to confidence or trust in the person while negative reputations to the other leads to lower confidence or social status. It is worthy to mention, that the reputation propagation in real life societies works well and it is true even in cases of large societies. The mainspring of this is related to the structure of societies where members tend to be highly interconnected and the topological distance between society members is small. This propriety is know as the Small World effect and it has been proved to be true for a many different real and virtual communities.

Trust is also very important feature of security engineering. In this context it is related to risk management, surveillance, auditing and communication. Extensive knowledge on security engineering has already been collected and analyzed by Taipale (Yen, 2005) and has been studied in the Trusted Systems (Shoillo, 1999) project, which is a part of Global Information Society Project (Shoillo, 1999) lead by the World Policy Institute (Marsh 1994). It investigates systems in which some conditional prediction about the behavior of people or objects within a system that has been determined prior to authorizing access to system resources.

Another research area related to this topic is the concept of "Web of trust" systems. This concept emerged in applications related to cryptography and is an element of such technologies like PGP, OpenPGP-compatible (PGP) or public key infrastructure (PKI). They have been defined to support the trust endorsement of the PKI generated certificate authority (CA)-signed certificates.

Finally, the most popular research area in the context of trust is called a trust metric. The aim of it is to propose a measure of how a member of a group is trusted by other members. An exemplary overview of such metrics has been prepared on the Internet community at (TrustMetrics Wiki) and it presents a brief classification and provides many examples.

There are many different metrics that are diverse in many aspects. For example TrustMail (Golbeck,2003) or FilmTrust (Golbeck 2006) propose to take advantage of a Semantic Web-based social network. Other different approaches are based on graph walking or use subjective logic to express trust level (Josang, 1999). In the PeerTrust Project (PeerTrust) a decentralised Peer-to-Peer electronic community has been considered and a proposed trust model considers only three factors: the amount of satisfaction established during peer interaction, the number of iterations between peers and a balance factor for trust. At the other hand, the EigenTrust (Kamvar 2003) algorithm has similar ideas to PageRank (Page1999) but has been used in the context of file-sharing systems. This method computes global trust for peers, where the value is based on the history of uploads. It is dedicated to support the system to choose the peers with a history of reliable downloads and to exclude the malicious peers from the network.

Although much of the previous related work presented in this article is related to trust metrics, the proposed approach differs from this work with regard to several aspects. The described in this article trust model for virtual communities takes advantage of the capabilities of the social network analysis.

SOCIAL NETWORK METRICS

The basic idea of a social network is very simple. It could be understood as a social structure made of actors which can be represented as network nodes (which are generally individuals or organizations) that are tied by one or more specific types of interdependency, such as values, visions, idea, financial exchange, friends, kinship, dislike, conflict, trade, Web links, etc. The resulting structures are often very complex (Jin, 2004). Social relationships in terms of nodes and ties among them could be used in various types of analysis. A number of academic researches have shown that dependences form social fields play a critical role also in many other fields and could be used in determining the way problems could be solved.

Better understanding of social networks requires a complete and rigorous description of a pattern of social relationships as a necessary starting point for analysis. The most convenient situation is when we have complete knowledge about all of the relationships between each pair of actors in the population. To manage all pieces of information related to social network the mathematical and graphical techniques have been used. This formal apparatus allows us to represent the description of networks compactly and systematically. In this context, social network analysts use two kinds of tools from mathematics to represent information about patterns of ties among social actors: graphs and matrices.

Network analysis uses one kind of graphic display that consists of nodes to represent community members and edges to represent ties or relations. There are two general types of situation when there are a single type of relations among the community members and more than one kind of relation. The first one can be represented by simplex graph while in the second case we use multiplex graphs. Additionally, each social tie or relation represented by graph may be directed or undirected (tie that represents cooccurrence, co-presence, or a bonded-tie between the pair of community members). Another important feature related to the social networks and their graph representation is the strength of ties among community members. In a graph it may be one of the following types: nominal or binary (represents presence or absence of a tie); signed (represents a negative tie, a positive tie, or no tie); ordinal (represents whether the tie is the strongest, next strongest, etc.); or valued (measured on an interval or ratio level).

Other basic network proprieties that can be formally described and so can constitute a good background for analysis of community dynamics and also trust modelling are as follows (Hanneman 2005):

- Connections
  - the number of immediate connections may be critical in explaining how community members view the world, and how the world views them, so it could be also important factor while modeling trust relations within community
  - the number and kinds of ties are a basis for similarity or dissimilarity to other community members
  - the direction of connections may be helpful to describe the role of the community member in the society, it can be “a source” of ties , “a sink”, or both.
- Size

    - the size of a network is indexed simply by counting the number of nodes,
    - critical element for the structure of social relations because of the limited resources and capacities that each community member has for building and maintaining ties
    - in a bigger groups more likely it is that differentiated and partitioned subgroups will emerge
    - the size of a network also influences trust relations while in bigger group it is easier to preserve anonymity and its more difficult to evaluate trust values
- Density
    - the proportion of all ties that could be present to that actually are
    - the number of logically possible relationships then grows exponentially as the number of actors increases linearly
    - in communities with greater value of density parameter it should be easier to maintain trust relations as we get more information about the other community members
- Degree
    - it tells us how many connections a community member has
    - *out-degree* - the sum of the connections from the community member to others
    - *in-degree* - the sum of the connections to the particular community member from others
    - community members that receive information from many sources may also be more powerful
    - community members that receive a lot of information could also suffer from "information overload" or "noise and interference" due to contradictory messages from different sources
    - impact for the trust relation is similar to that described in a case of density, dependently from in/out-degree when an individual has more or less information about its neighborhood
- Reachability
    - a community member is "reachable" by another if there exists any set of connections by which we can find link from the source to the target entity, regardless of how many others fall between them
    - if some community members in a network cannot reach others, there is the potential of a division of the network
    - disconnected community members could have more problems to evaluate trust value
- Transitivity
    - the transitivity principle holds that, if A is tied to B, and B is tied to C, then A should be tied to C.
    - the triadic relationships (where there are ties among the actors) should tend toward transitivity as an equilibrium condition
    - the trust relation is not strictly transitive and so this propriety not necessarily influences trust evaluation process
- Distance
    - an aspect of how individuals are embedded in networks,
    - two actors are adjacent when the distance between them is one
    - how many community members are at various distances from each other can be important for understanding the differences among community members in the constraints and opportunities they have as a result of their network location
    - community members located more far apart from each other in the community have more problems with trust evaluation than the members which are close
- Geodesic distance
    - geodesic distance is defined as the number of relations in the shortest possible walk from one community member to another

- many algorithms in network analysis assume that community members will use the geodesic path when communicating with each other
- it could be useful to find the exact trust value between two community members
- Diameter
  - the *diameter of a network* is the largest geodesic distance in the connected network
  - tells us how "big" the community is, in one sense quantity in that it can be used to set an upper bound on the lengths of connections that we study
  - the diameter value could be an important coefficient while calculating trust value
- Cohesion
  - the strength of all links as defining the connection
  - count the total connections between actors
  - more strong connection between community members should determine grater trust values
  - Centrality, Power, Betweenness
  - centrality, closeness, betweenness describe the locations of individuals in terms of how close they are to the "center" of the action in a network – though there are a few different definition of what it means to be at the center
  - the more important community member is, the more important its opinions should be, it should be also reflected while establishing new trust relations
- Eigenvector of the geodesic distances
  - an effort to find the most central community members in terms of the "global" or "overall" structure of the network, and to pay less attention to patterns that are more "local"
- Cliques
  - a sub-set of community members who are more closely tied to each other than they are to community members who are not part of the group.
  - idea of cliques within a network is a powerful tool for understanding social structure and the embeddedness of individuals
  - cliques reflects the groups of community members with strong relationship so in natural way it also influences trust relations between them

As it was depicted here above most of the typical parameters used in social networks description has more or less strict relation with trust modelling problem. The basic assumption of this work trust model is also that some of these typical for social networks parameters can be used to model some aspects of the trust.

Figure 1. Simple communication network in virtual community

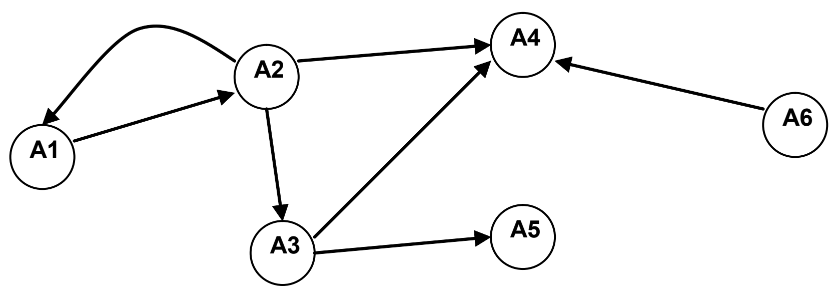

Figure 2. Example of the communication vectors for the network form Figure 1

	A1	A2	A3	A4	A5	A6
A1	-	5	?	?	?	?
A2	4	-	10	24	0	0
A3	?	0	-	?	?	?
A4	?	0	?	-	?	?
A5	?	0	?	?	-	?
A6	?	0	?	?	?	-

The numerical value of clustering coefficient can be calculated using for example following formula:

$$C_i = \frac{\left|\left\{e_{jk}\right\}\right|}{k_i\left(k_i - 1\right)} : v_i, v_k \in N_i, e_{jk} \in E$$

where:

- v_i – nodes,
- N_i – neighborhood of the node v_i ,
- e_{jk} – link between v_i and v_k,
- k_i – degree of the node v_i

SOCIAL NETWORK–BASED TRUST MODEL

In this section the framework of the novel trust model will be presented. The basic assumptions of it explain how trust and reputation have been defined in the model and how they can be used by the members of virtual community during their operations.

The general assumption for the model is that the trust value assigned is bilateral relation (A_x, A_y) between community members X and Y and its value is evaluated using three following components:

- *S* – subjective belief
- *C* – context related value
- *O* – other community members opinions

Where: *S, C, O* $\in$ <0,1> and

- $T(A_x, A_y)$ – trust level value between X and Y
- $T(A_x, A_y) = S+C+O \in$ <0,1>

Trust is explained in terms of a relationship between virtual community members. There are trustor and trustee. Where trustor is that community member who holds a belief for trust in another community member, and trustee is the trusted community member.

The model distinguishes two levels of trust modelling:

- Level 1: the trust is evaluated locally, using only knowledge of a single community member
- Level 2: the trust is evaluated using global knowledge about all community members activities

Trust model at Level 1 uses communication vectors to evaluate the context related component of trust. These vectors are a direct source of knowledge about the character of community member communication.

It should include such information like:

- a source and a destination of the communication – it is equivalent to the information about *out-degree* and *in-degree* parameter
- type of the communication (e.g. http, ftp, ping, …)
- intensity of the communication

The values from the table presented in the Figure 2. can be interpreted e.g. as the number of kilobytes of data transferred during last period t_i from the community member A2 to other entities.

Correspondent tables can be created in the context of e.g. number of ftp sessions, number of packet send between community members.

Level_1 Trust evaluation algorithm

Given:	Identifier of the trustee (A_x) and trustor (A_y), Communication vector for a trustor, V={v_1, v_2,… v_k,} Opinions about trustee obtained from other community members (T(A_x,A_1), T(A_x,A_2), … T(A_x,A_n)). Where opinions may be trust relation values send to the trustor by other community members.
Result:	T(A_x,A_y) – trust value of relation between trustee (A_x) and trustor (A_y).

The following algorithm for trust evaluation at the Level 1 has been proposed.

BEGIN:

1. Assign the subjective belief value to the parameter *S*
2. Calculate *T'* value in the following way: *T'* = 1 – *S*
3. Assign a value to the context related component *C*

$$C = \frac{v_y * T'}{\sum_{\forall i} v_i}$$

4. Calculate *T''* value in the following way: *T''*=1-*S*-*C*
5. Evaluate *O* opinion component value

$$O = \frac{\sum_{i=1}^{n} T(A_i, A_y) * T(A_x, A_i)}{n} * T''$$

6. Return final trust value for trustee A_x and trustor A_y (see Box 1).

END

Trust model at Level 2 uses some external knowledge from a point of view of a particular community member. It is assumed that there is an entity that monitor all communication within the virtual community. Let it call Social Network Monitor (SoNeMo). In relation to its observations SoNeMo can pass information about values of some global parameters describing virtual community. For example SoNeMo can calculate a centrality coefficient, eigenvector of the geodesic distances or other social network related parameter. SoNeMo has a similar role in the proposed trust model as Certification Authority in the Public Key Infrastructure has got.

Because, as it was mentioned earlier, the centrality parameter reflects the importance of the community member within its local society, centrality was selected as the main factor for context related trust component. The more important community member is, the more important its opinions should be and this will be also reflected while establishing new trust relations.

The level 2 trust model uses the communication matrixes to evaluate the context related component of trust. These matrixes are a direct source of knowledge about the character of communication of all community members.

The following algorithm for trust evaluation at the Level 2 has been proposed in Box 2.

BEGIN:

1. Assign the subjective belief value to the parameter *S*
2. Calculate *T'* value in the following way: *T'* = 1 – *S*
3. Assign a value to the context related component *C*
4. Calculate *T''* value in the following way: *T''*=1-*S*-*C*
5. Evaluate *O* – opinion component value

$$O = \frac{\sum_{i=1}^{n} T(A_i, A_y) * T(A_x, A_i)}{n} * T''$$

6. Return final trust value for trustee A_x and trustor A_y

Box 1.

$$T(A_x, A_y) = S + C + O = S + \frac{v_i * T'}{\sum_{\forall i} v_i} + \frac{\sum_{i=n}^{n} T(A_i, A_y) * T(A_x, A_i)}{n} * T''$$

Level_2 trust evaluation algorithm

Given:	Identifier of the trustee (A_x) and trustor (A_y), Normalized centrality value of the trustee I_x Opinions about trustee obtained from the other community members ($T(A_x,A_1)$, $T(A_x,A_2)$, … $T(A_x,A_n)$). Where opinions may be trust relation values send to the trustor by other community members.
Result:	$T(A_x,A_y)$ – trust value of relation between trustee (A_x) and trustor (A_y).

Box 2.

$$T(A_x, A_y) = S + C + O = S + I_x * T' + \frac{\sum_{i=n}^{n} T(A_i, A_y) * T(A_x, A_i)}{n} * T''$$

Figure 3. Example of the communication matrix for the network form figure 1

	A1	A2	A3	A4	A5	A6
A1	-	5	0	0	0	0
A2	4	-	10	24	0	0
A3	0	0	-	2	254	0
A4	0	0	0	-	0	0
A5	0	0	0	0	-	0
A6	0	0	0	34	0	-

END

CONCLUSION

The proposition of the trust modeling in virtual communities using social network analysis method has been described and discussed in this work. Integral element of cooperation within any kind of community is trust, so there is a special need for some adequate tools and models for trust management in virtual communities. Cooperation within virtual communities is very often characterized by the lack of earlier experience in a context of real world interactions. This is why it is so important to support virtual communities members with another kind of premises to build and manage trust. The several trust modeling concepts was presented. Also the basic related to social network analysis parameters were described with a special stress put on their usefulness while considering trust modeling.

An interesting possibility for future analysis will be addressing relationship between Level 1 and Level 2 trust models. Another important area of research is the comparison of impact of different social network measures on trust modeling. The comprehensive studies including experiments of trust evolution and propagation are intended as the continuation of the theoretical work described in this article.

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This work was previously published in International Journal of Virtual Communities and Social Networking, Vol. 1, Issue 3, edited by S. Dasgupta, pp. 50-61, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 5.18
Trust in Social Networking
Definitions from a Global, Cultural Viewpoint

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ABSTRACT

This chapter attempts to understand the trust in social network services, where users post their personal information online to everyone with or without any specific relationships. Many definitions of trust were examined through a literature review in electronic commerce and virtual community areas, and it was found that most of them were based on a specific relationship, such as a buyer-seller relationship. However, one concept of trust—generalized trust, also known as dispositional trust—was found to best fit the situation of social networking. Generalized trust in social networking is further discussed from a cultural viewpoint. As an example, a Japanese SNS, Mixi, was analyzed in detail. Future research direction on trust in social networking is discussed as well.

DOI: 10.4018/978-1-60566-104-9.ch012

INTRODUCTION

Trust has been conceptualized by previous research in a variety of ways ... and researchers have long acknowledged the confusion in the field. (Gefen, Karahanna, & Straub, 2003, p. 55)

There have been many studies done on the issues surrounding trust online. In a global environment, much of the recent research concerning trust has dealt with e-commerce and collaboration efforts occurring over the Internet (e.g., Ba & Pavlou, 2002; Dellarocas, 2003; Gefen et al., 2003; Backhouse, Hsu, Tseng, & Baptista, 2005; Salam, Iyer, Palvia, & Singh, 2005; Chow & O, 2006). These studies tend to define trust in the context of reliability and the predictability of the business or person to perform as expected (Gefen et al., 2003). In these definitions, the object of trust is an interpersonal relationship with either a specific person or a specific business.

Social networking refers to a category of online applications, also known as social network services (SNSs), that help connect friends, business partners, or other individuals together (Alabaster, 2006). With the relatively recent rise in popularity of social network services, such as MySpace, which currently has over 100 million accounts, users of social networking are giving out personal information to the public at large with little, if any, expectation of the future performance or predictability of another person or business. Although users seem to trust something, the definitions of trust mentioned above do not seem to be applicable to SNSs.

This study will examine trust literature for the different types of trust mentioned and see whether the current studies are applicable for studying trust in social networking. Additionally, since what seems to be being trusted by someone who posts their own personal information online to a SNS is the public at large, this study will examine if there are some differences between cultures on how much and what type of information a person is willing to share in this type of situation.

This study is important because there is not enough research involving trust in social networking or research that takes into account cultural differences in social networking. With the rapid rise of SNSs, trust is of interest to: 1) users of such applications because they may want to know more about the issues of information disclosure to the public; 2) marketers who are preparing to mine SNSs for data, because they may want to know about cultural differences in the type and quality of the data they mine; 3) academic researchers examining SNSs, because they may need a new perspective of trust.

BACKGROUND

Social Network Services

The term "social network" originates from Barnes' work in the 1950s in Sociology, and originally referred to an informal system of personal contacts that cut across organizational boundaries (Barnes, 1987). In recent times, the term is being used to refer to online applications that connect individuals with family members and friends. Using blogs, chat rooms, e-mail, or instant messaging, users of social network services (SNSs) can communicate, either within a limited community, or with the world at large (Alabaster, 2006). One of the most popular SNSs today, MySpace, had 2.4 million members in November 2004 and 26.7 million a year later (Kornblum, 2006). One and a half more years, as of May 2007, when this chapter was written, the number is 192 million (Wikipedia, 2007). This popularity, especially among teenagers, is also drawing the attention of parents and schools who are concerned about the nature of some of the pages on the site and the safety of young users who give too much information about themselves (Kornblum, 2006). MySpace prohibits users under 14, but kids sometimes lie about their ages. Still, they have probably learned a long list of important safety and privacy lessons already: buckle up; do not talk to strangers; hide your diary where your nosy brother cannot find it, and so forth, yet they have not probably learned another lesson: Do not post information about yourself online that you do not want the whole world to know (FTC, 2006).

There are certain degrees of trust involved in giving out information to the public, but as a review of the literature will show later in this study, the trust when applied to social networking is seemingly different from those types of trusts used for e-commerce and other traditional collaboration activities online. Like e-commerce sites, SNSs are a new phenomenon with limited bandwidth available for knowing or learning to trust the other party. However, unlike e-commerce sites, users of SNSs do not give out information to any specific entity, nor expect any future performance or predictability from a specific party in return. Since the core of SNSs is the fact that the contents of the sites are generated by the users, everybody in the network can view the user-generated contents; the user-generated content is the basis for the success of the sites like Wikipedia or YouTube (Brown, 2006). Therefore, it can be said that SNSs are broadcast networks broadcasting the information to the "perceived" members of the network, but unlike the broadcast medium of old, everyone can be broadcasters of the information and unlike Web pages of old, all the broadcasters are "perceivably" linked together in a network of users. Problems occur when those perceived network of close friends include agents who have less-than-friendly intentions (FTC, 2006). Knowing such, why do users of SNSs trust other users and broadcast their personal information?

Trust Online

Trust has been studied as a central aspect of e-commerce and other transactions online. There are many definitions of trust and expectations of trust available (Gefen et al., 2003). Gefen et al. (2003) have analyzed the various types of trust in creating their model for trust and TAM in online shopping. They consider that trust may be: at the heart of all relationships, or the defining attribute of relationships; a reducer of risk and social uncertainty; based on familiarity; raised by seals of approval and affiliations; and crucial in many economic activities that may have undesirable outcomes in which one party can take advantage of another party. They also provide a summary of the various types of trust studied dating from 1971 to 2002 in their article (Gefen et al., 2003).

There are many new studies of trust in e-commerce since their work (e.g., Gefen & Straub, 2003; Pavlou, 2003; Chow & O, 2006). The summary of these studies (in progress) are presented according to Gefen et al.'s (2003) categories in Appendix, Table 1. Besides e-shopping, other online issues related to trust have been studied including reputation and online buying on auction sites, word-of-mouth buying networks and feedback, privacy statements and expectations, certification services and many other things, tending to show a uniqueness of the online environment for such studies (Ba & Pavlou, 2002; Dellarocas, 2003; Salam, Iyer, Palvia, & Singh, 2005; Backhouse, Hsu, Tseng, & Baptista, 2005; Chow & O, 2006). The issue of limited bandwidth through which information can be known between the seller and the buyer and the newness of the phenomenon are often mentioned as the reasons for the interest in studying trust in e-commerce (Ba & Pavlou, 2002).

Paul and McDaniel (2004) consider how trust reduces complexity in a complex world and enable parties to collaborate on virtual collaboration teams. They consider trust as enabling complexity reduction, as aiding collaboration, and determining the effectiveness of relationships, reducing transaction costs, and facilitating learning and innovation. They further mention that trust is part of directing people that you do not see. These things come closer to the type of trust that is involved in posting on a SNS online, as they involve people you do not see.

The rest of their study focuses on interpersonal trust. Interpersonal trust includes: calculative trust, based on forming ideas about trust in an economic relationship; competence trust, whether the other party is capable of performing as said; relational trust, also called benevolence trust, or how much one party feels the other intends to do good regardless of economic incentive; and integrated trust, which is all of these forms of trust integrated and mixed together in various ways depending on the circumstance.

Table 1. Newer conceptualization of trust

Study	Trust Conceptualization	Trust Object	Measures
Anderson (2005)	Transactional Trust: A unilateral trust in the system governing the transaction, not the other party (bilateral trust). Similar to trusted computing initiatives.	System governing transaction	Conceptual
Caziera, Shaob, and St. Louis (2006)	Willingness to be vulnerable and characteristic-based trust	Buyer-seller relationship. E-business differentiation through trust	Adopted from Zucker et al. (1986)
Chow and O (2006)	Ability, benevolence, and integrity	Buyer-seller relationship before and after first-hand experience of e-shopping	Adopted from Jarvenpaa et al. (1998)
Everard and Galletta (2006)	How presentation flaws affect perceived site quality, trust, and intention to purchase from an online store	Buyer-seller relationship on Web site	Adopted from McKnight et al.(1998)
Flavián, Guinalíu, and Gurrea (2006)	Construct of honesty, benevolence and competence	Buyer-seller relationship on Web site	Perceived Web site honesty, benevolence and competence
Gefen and Straub (2003)	Willingness to depend Display honesty and willingly fulfill its commitments	Buyer-seller relationship in e-services	Adopted from Gefen (2000)
Gefen, Rose, Warkentin, and Pavlou (2005)	Trust in adoption of new IT system (eVoting)	Trust in seller/administrator of e-voting system, cultural diversity	Adopted from Gefen et al. (2003)
Geng, Whinston, and Zhang (2004)	The sustained competitive advantages of honest members over cheaters throughout the evolution of a community.	E-communities (trust-health in whole community)	Mathematical model: Trust is a function of punishment and time
Hung and Fox (2006)	Expectancy, belief in expectancy, and willingness to be vulnerable	Trust in transitiveness from a social network	Adopted from Mayer et al. (1995)
Ho and Weigelt (2005)	Personal relationships, embeddedness	Trust building game (trust creation between strangers—i.e., anonymous eBay relations with specific others	Adopted from Granovetter et al. (1985)
Jøsang, Keser, and Dimitrakos (2005)	"Reliability trust and decision trust"	Directional relationship between trustor and trustee in trust management	Reliability trust: Adopted from Gambetta et al. (1998; 1990); Decisiontrust: McKnight et al. (1996; 1998)
Jøsanga, Ismailb, and Boydb (2006)	"Reliability trust and decision trust"	Buyer-seller relationship and reputations online	Reliability trust: Adopted from Gambetta et al. (1998; 1990); Decision trust: McKnight et al. (1996; 1998)
Stewart (2006)	Trusting beliefs (similar to portal affiliation, with both sides of link examined)	Relationship between hyperlinks/Web sites as viewed by user (p. 3)	Adopted from McKnight et al.(1998)
Keat, and Mohan (2004)	Degree to which person perceives trust	E-commerce: perception that technology is trustworthy; and disposition to trust other party.	Conceptual model development
Kim, Xu, and Koh (2004)	Trust: other party will behave in a dependable manner	Buyer-seller relationship.	McKnight et al. (1998)

Table 1, continued.

Study	Trust Conceptualization	Trust Object	Measures
Lim, Sia, Lee, and Benbasat (2006)	Cognitive-based trust	Buyer-seller relationship online	Adopted from Mayer et al.(1995) McKnight et al.(1998) Jarvenpaa et al. (2000)
McKnight, Kacmar, and Choudhury (2004a)	Dispositional trust: tendency to believe in the positive attributes of others in general Alt: willing to depend or become vulnerable to general other people	General others (advice giving Web sites in this case) as opposed to specific others in interpersonal trust.	Operationalized as 1. Faith in humanity-general, 2. Faith in humanity-professionals, 3.Trusting stance
Mcknight, Kacmar, and Choudhury (2004b)	Dispositional trust (propensity to trust)	A specific Web business.	Adopted from McKnight et al. (2002)
McKnight and Choudhury (2006)	Trusting beliefs and trusting intention	-seller Relationship	Adopted from Mayer et al. (1995), McKnight (1998)
Metzger (2006)	Trust: the expectation that an exchange partner will not engage in opportunistic behavior	Relationships between buyer/seller.	Adopted from Jarvenpaa et al. (2000)
Mutz (2005)	Social trust: generalized trust in people	Buyer-seller economic behavior	Social trust is manipulated in experimental design and manipulation check questionnaire
Paul and McDaniel (2004)	Interpersonal trust, including: calculative trust, competence trust, relational trust, and integrated trust	Virtual collaborative relationship	Comparative case studies: Trust was operationalized as self-interest, ability, empathy, and integrated interpersonal trust
Pavlou (2003)	The belief that the other party will behave in a socially responsible manner, and, by so doing, will fulfill the trusting party's expectations without taking advantage of its vulnerabilities	Traditional (in a specific party), and in integrity of transaction medium (infrastructure)	Adopted from Jarvenpaa et al. (1999)
Pavlou, and Dimoka (2006)	Benevolence (goodwill trust) and credibility	Buyer-seller relationship in online marketplaces	Adopted from Doney et al. (1997)
Ratnasingam (2005)	Technology trust: derived from the security mechanisms and standardized routine business processes embedded in the e-commerce technologies Relationship trust: the subjective probability with which organizational members collectively assess that a particular transaction will occur according to their confident expectations	Relationships buyer-seller in e-commerce, technology trust in e-commerce	Conceptual
Ratnasingam, Gefen, and Pavlou (2005)	Institutional trust in electronic marketplaces	Trust of institution in buyer-seller relationship in online market	Situational normality, structural assurances, facilitating conditions Adopted from Pavlou et al. (2003)
Uslaner (2004)	Strategic trust: based on our experience with people doing specific things, Moralistic trust: a generalized humanity trust	Buyer-seller relationship	Conceptual

TRUST IN A VIRTUAL COMMUNITY

Another field of study, which deals with trust, is "virtual community." A virtual community is a group of people that primarily or initially communicates or interacts via the Internet. In a sense, a virtual community is a larger, generalized concept of social network services, which includes Usenet, IRC, chat rooms, and electronic mailing lists, among other things. A few recent studies

Table 2. Conceptualization of trust in virtual community

Study	Trust Conceptualization	Trust Object	Measures
Castelfranchi and Tan (2002)	Willingness to rely on the other party's internal (ability, knowledge, motivation, commitment, morality, social disposition) and external environment and circumstances	1. Environment and infrastructure 2. Agent and mediating agent 3. Potential partners 4. The authorities	Conceptual
Leismeister, Ebner, and Krcmar (2005)	Adopted from Gambetta (1990), and Abdul-Rahman et al. (2000): 1. Interpersonal trust 2. System trust 3. Dispositional trust	1. Another agent 2. System or Institution 3. General 'others'	Empirical: 1. Perceived Competence 2. Perceived Goodwill/benevolence
Mainelli (2003)	Trusting information given, trusting others to understand information provided, trusting individuals to act as expected, trusting others to make decisions on your behalf, entrusting others with your assets	"Financial" community	Conceptual
Radin (2006)	Derived from Putnam (2000), Thick trust: deep trust, including the assurance that the other side will not give away critical information Thin trust: a thinner trust in the generalized other	Thick trust: within dense networks of business associates, relatives, friends and neighbors Thin trust: Generalized other	"laboratory" case study
Ridings, Gefen, and Arinze (2002)	Derived from Gefen (2002): an implicit set of beliefs that the other party will refrain from opportunistic behavior and will not take advantage of the situation	The collective entity of others (generalize)	Adapted from Jarvenpaa et al. (1998): the scales reflect the multiple interdependencies that exist in a group
Shubert and Ginsburg (2000)	(Trust itself is not defined)	Buyer-seller relationship	Conceptual

on trust in virtual communities are summarized in Table 2 using the same format.

Some of the literature about virtual communities is still about buyer-seller relationships (Shubert & Ginsburg, 2000; Castelfranchi & Tan, 2002), since that is what businesses care about the most. "Leisure-Time Communities" like SNSs may not be as interesting yet for business researchers as "Virtual Communities of Transactions" (Shubert & Ginsburg, 2000) currently are. However, Leismeister, Ebner, and Krcmar (2005) suggest that the term "trust" can be classified into three types: interpersonal, system, and dispositional. Interpersonal trust is a type of trust in a specific person or organization on a personal level. System trust is not based on the trustee (the other party) but on the perceived property or reliance on a system or institution, such as a monetary system. Dispositional trust is the general attitude of a person seeking trustworthiness toward others. Radin (2006) refers to this generalized trust in people as "thin trust," and Mutz (2005) as "social trust." According to McKnight et al. (1998; cited in Leismeister et al., 2005), this type of trust has two assumptions: one presumes that others are normally trustworthy; and trusting others leads to better outcomes regardless of whether the others are really good or bad.

We will now examine the definitions of trust commonly used in these studies, and how these definitions may relate to that of the trust inherent in SNS actions such as posting personal information to the virtual community or sometimes literally to the world.

DISCUSSION

Definition of Trust in SNSs

There are many varied definitions of trust. Most of these definitions are based on a relationship that is implied in the trust. In the case of SNSs, users post personal information presumably to the members of the community, yet in most cases it is actually broadcast to everyone: friend and foe; neighbor and stranger; known and unknown. Therefore, the definition of trust dealing with a specific relationship, such as a buyer-seller relationship, is hard to use to explain the trust the users of SNSs have toward the group of people who visit their sites and read their postings. However, there are some studies dealing with more generalized trust.

Uslaner (2004) distinguishes between two categories of trust: a strategic trust based on our experience with people doing specific things, and a generalized trust that he further sub-defines as moralistic trust. The first type of trust, strategic trust, is widely found in business/economic literature since it occurs in buying and selling relationships. The second type of trust, generalized trust is also found in the literature (e.g., dispositional trust in McKnight et al. (2004a) and Leimeister et al. (2005); and thin trust in Radin (2006); and social trust in Mutz (2005)). Uslaner's (2004) moralistic definition of trust revolves around an optimistic viewpoint. According to him, "A handful of bad experiences should not withdraw us from social connections" (p. 29). In Uslaner's viewpoint, the future of the Internet may require faith in humanity, a moralistic trust. In general, Uslaner's view can be subsumed under generalized trust definitions.

The sources of trust Ba and Pavlou (2002) mention, that is, familiarity, calculativeness of costs and benefits, and values, and the types of trust, that is, benevolence and credibility, generally apply better to trust toward specific parties rather than toward the general public. Calculativeness, that is, the calculation of risk of revealing some information versus the chance of gaining other information or acquaintanceship, could explain some sources of trust on a SNS. For some users, a SNS is a place they may gain something. Carter (2005) reported at least two-thirds of the users of Cybercity she interviewed said meeting friends or creating new friends was their most important reason for joining the community. Those users may have provided their personal information to attract new people of interest to them, weighing the risks and benefits of doing so.

Paul and McDaniel's (2004) view of trust as a reducer of complexity and enabler of collaboration on virtual collaboration teams may be another aspect of trust in SNSs. Since it is almost impossible to examine all the participants of a given social network, users cannot help but trust them. According to Gefen et al. (2003), trust is the expectation that others will not behave opportunistically and take advantage of the situation, that they will be dependable, behave appropriately, and fulfill commitments, even in cases when they are dependent and vulnerable. According to Gefen et al. (2003):

(Trust is) a deep seated human need to understand the social surroundings... that people are by their nature free agents and as such their behavior is not necessarily rational or predictable… When a social environment cannot be regulated through rules and customs, people adopt trust as a central social complexity reduction strategy… By trusting, people reduce their perceived social complexity through a belief that may be irrational, but rules out needing to analyze future behaviors. (p. 55)

If trust is used to reduce uncertainty in action, the degree people try to reduce uncertainty is different from culture to culture.

Cultural Differences

There are cultural differences in how people interact with one another. Hofstede (1980; 1991;

Table 3. Cultural dimensions with selected countries

Country	UAI	PDI	IDV	MAS	LTO
U.S.	46	40	91	62	29
UK	35	35	89	66	25
Australia	51	36	90	61	31
China	40	80	15	55	118
Hong Kong	29	68	25	57	96
Japan	92	54	46	95	80

Note: UAI: uncertainty-avoidance index; PDI: power-distance index; IDV: individualism; MAS: masculinity; LTO: long-term orientation (source: based on information from Hofstede (1991))

1994) suggested that five dimensions of culture were useful to measure differences between cultures: power distance, uncertainty avoidance, individualism (vs. collectivism), masculinity (vs. femininity), and long-term (vs. short-term) orientation.

According to Hofstede (1994), the effect of uncertainty avoidance, a desire for predictability, can affect trust, and suggests the possibility of research in how information is shared online between cultures. This has direct bearing on the nature of global communications and systems. With the growth of new technologies such as social networking or collaboration tools, the importance of global cultural differences may become more prominent. The following example illustrates the effect of difference in "uncertainty avoidance" on the design of SNSs.

Japan is rated as a country with a very high uncertainty-avoidance score (see Table 3) compared to the U.S. and other Anglo-nations (Hofstede, 1991). *Mixi*, the most popular SNS in Japan with over 10 million user accounts (as of August 5, 2007), is such an example to show the difference in culture between Japan and the U.S.

Case Study of Mixi

Mixi was launched in February 2004 (Cashmore, 2006). *Mixi* (the company name was e-Mercury then) was publishing Internet content on *Find-Job*, which provided recruiting information. One day, an international student-worker suggested Mr. Kasahara, then president of *e-Mercury,* use a SNS. He was using U.S.-based *Friendster* to contact other international students and exchange information. Mr. Kasahara tried *Friendster* and thought that it had the potential to be introduced in Japan. On the other hand, he also thought the *Friendster's* concept of "connecting unknown people for a career advantage," which is probably more typical in the U.S., might not be accepted well in the Japanese culture. He studied many existing SNSs and tried to evolve a new form of SNS in Japan (Sasaki, 2007).

At that time, there were already some SNSs in Japan, such as *Orcut* (Google) and *Gree* (Rakuten). While these SNSs were more business-oriented and geared toward extending business acquaintances, *Mixi* set its strategic position in the opposite direction. As there was a cultural background in which teenagers in Japan valued being connected with "known" friends through mails on portable phones (it is actually text messaging in the U.S., but that is what it is called there), *Mixi* tried to be an infrastructure by which they can connect with those friends easily. As a result, *Mixi* did not aim at "openness" in which users will develop new acquaintances, but its main focus is on a service by which a user will write a diary and his or her friends will put in a comment (Sasaki, 2007). To assure this "closed" characteristic, *Mixi* offers some distinct features when compared to most of the SNSs found in the U.S., like MySpace.

For example, the contents of the sites constructed by users, including the personal information posted by users, are visible only to members of *Mixi*. In a sense, the broadcasted information on *Mixi* is limited to the closed community. Also, the membership to *Mixi* is limited by invitation from the members. This limits the possibility of malicious users from participating in the community. Another distinctive feature is the fact that users can see who visited their pages. Even if you are searching for some information and stumble upon somebody's diary, you leave a footprint in his/her log. The owner of the diary will see who visited the site and find your name on it, and will trace it back to your pages and check to see if you are somebody he/she knows, or are just a visitor. If he/she thinks you are a malicious user, he/she can block your access to their diaries and other pages (Cashmore, 2006; Schellong, 2006). All these features give users a greater sense of security, and therefore, less "uncertainty." There are some SNSs, such as *Oskut*, which are in the U.S. and also "invite-only;" but by far, there are more SNSs for open access in the U.S. Cahsmore (2006) thinks that the *Mixi* format will not succeed in the U.S.

It is not certain, however, if this is only related to Hofstede's "uncertainty-avoidance" dimension, or if it has something to do with the "individualism-collectivism" dimension. Japan is a collectivistic culture, as opposed to an individualistic culture like the U.S. (see Table 3). In a collectivistic culture, "we," as meaning the insiders of a group the person belongs to, means that they are all trustworthy, and "they," the outsiders, are not. In an individualistic culture, "I," including close family members and a few best friends, are the only ones you trust (Hofstede, 1991). People may be friendly to others, but they are not trusted. Therefore, for those from individualistic cultures, the disclosure of information on MySpace is surprisingly open. On the other hand, for a collectivistic culture, even though the level of personal information on *Mixi* could be more open than MySpace, *Mixi* user's openness of the information does not get as much attention because it is open to "us."

One example that shows *Mixi*'s success because of its cultural orientation is the fact that younger people started using *Mixi* more than *2-Channel,* the once top young online community. A study by Web Advertising Bureau of Japan, Advertising Association Inc., revealed that the users of *2-Channel* were getting older, with about 53% of users over 30 years old. On the other hand, 62% of *Mixi*'s users are in their 20s (Sasaki, 2007). *2-Channel* is a bulletin-board type site where people talk anonymously. The anonymity gives the users freedom of speech; therefore, the discussion often becomes harsh, sometimes to the extent of a flame war. On the other hand, *Mixi* is more closed and you know who made the comments. Naturally, the comments become warm and cozy. Also, if the user limits the level of accessibility only to direct friends (*My Mixi*, or *Maimiku* in Japanese), he/she can write on very sensitive matters and get some advice from friends. This comfortableness of being there is one of the reasons *Mixi* became the fastest growing SNS in Japan.

As stated in the review of literature, at the root of social networking is a type of general trust toward the group as a whole, and people use trust to reduce complexity and uncertainty and to enable collaboration and communication. This is belief in the nature of the culture, and is reflected in the views that a person has of the society at large. This should vary from culture to culture, and according to Hofstede (1994), is reflected in the culture's dimensions of uncertainty avoidance and possibly individualism-collectivism. Consequently, what people are willing to post online may vary from culture to culture. The *Mixi* example has illustrated the difference between Japanese culture, in which SNSs such as *Mixi* try to accommodate the desire to connect to "known" people, and U.S. culture, in which SNSs are geared toward connecting unknown people for a career advantage. The issues arise in the U.S. as individual information is open to the "not trusted" public, whereas in Japan, the information is provided only in a "closed" community. In either case, the definition of trust discussed in this chapter applies to the SNSs. Knowing the success of the Japanese SNSs will lead to future development, especially with the issues raised in the U.S.

FUTURE TRENDS

There are some problems current with the rise of social networking. For users, there is the problem of not being aware of all the information they may be giving away. This problem is more typical in the U.S. compared to Japan. Because the community is "closed" to known friends in Japanese SNSs, such as *Mixi*, users do not need to reveal their real names. *Mixi* encouraged users to use their real names at first. However, it has toned down its policy since an incident when it was found that an actress who admitted past illegal activities was using *Mixi* with her real name, and her pages were flooded with harsh comments from other users (Harada, 2007). Still, some users are posting individual information without caution. Some ways to educate users to be aware of the dangers of revealing such information should be sought. In the case of U.S. SNSs, such as MySpace, the problem is more complex. As the main objectives of using SNSs are to make new friends, expand business contacts, and so forth, it is inevitable that some individual information to gain trust from other people is revealed. Some features used in Japanese SNSs may be applicable to the U.S. despite some previous thought that it might not be popular in the U.S. due to the cultural differences. For example, the "footprint" function by which the users are notified who visited their sites and in case of a malicious visitor, they are given an option of blocking the user from visiting and/or reading their blogs or diaries. An "invitation-only" function could be another possibility to limit the opportunity for malicious users to get into the community. Although it is not perfect, if combined with other methods, these features could enhance the security (Harada, 2007).

As for future research, opportunities in social networking and people's perception of trust will emerge. Such issues include:

- How much information is actually and accurately being given away/collected?
- To what extent do people trust the public and/or a specific party that requires them to give data?
- What benefits do people perceive to gain from giving away individual information?
- How aware are users of data being collected; what factors (e.g., ignorance/knowledge in cyber crimes) affect the behaviors of the users?
- What cultural differences exist in the act/behavior/attitude/perception of users?
- What effect do the reassurances from the service providers (i.e., it is not really open, you are among friends only, etc.) have on what people post?
- What role does the advance in technology play in all this?

CONCLUSION

This chapter examined the trust in SNSs where users post personal information to everyone with or without specific relationships. Many definitions of trust were reviewed and it was found that most of them were based on a specific relationship such as a buyer-seller relationship. One concept of trust, generalized or dispositional trust, may be the best to fit the online situation. Also, from a global, cultural viewpoint, Hofstede's (1980; 1991; 1994) uncertainty-avoidance and individualism dimensions were illustrated as related to the behavior and trust given to the public at large by the users of the SNSs.

Social networking is growing at a phenomenal rate, adding new features and users along the way. This phenomenon gives tremendous new opportunities for academicians and practitioners. For example, marketers will seek new ways to mine this enormous pile of data for their own use. Yet, with people growing aware of these activities, less information may be available as they try to hide their activities. Techniques to preserve privacy and gain information will increase as both parties seek to achieve their purpose. In the end, the general global perception of what should be revealed and available online may be standardized. For example, witness the effect of spam on handing out e-mail addresses online.

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This work was previously published in Social Networking Communities and E-Dating Services: Concepts and Implications , edited by C. Romm-Livermore; K. Setzekorn, pp. 225-238, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.19
Individual Differences in Social Networking Site Adoption

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ABSTRACT

This chapter focuses on detailing the role of five individual level factors—Internet self-efficacy, self-esteem, need to belong, need for information, and gender—in influencing the attitudes toward social networking sites (SNS) and the adoption of such sites. First, the growing importance of social networking sites in business is discussed, and their usage as advertising vehicles is outlined. Individual differences in SNS adoption are presented from a technology acceptance model framework. A paper-pencil-based survey is conducted and data obtained is used to test a structural model that explains the role of individual-level factors in influencing individuals' attitudes toward SNS, their willingness to join SNS, and their actual membership on SNS. Results are presented and managerial implications are drawn.

INTRODUCTION

The Internet has radically changed the way people shop, transact, bank, and communicate with others in the recent years. With an estimated 73% of all American adults now online (Madden, 2006), the impact of the Internet on communication, commerce, and society in general continues to grow. One such impact is the proliferation of social networking sites (SNS) that are particularly popular with teens and young adults. It is estimated that over 55% of online teens use social networks and at least 48% of them visit social networking Web sites daily or more often (Lenhart & Madden, 2007). However, very little research has been done to understand the process of social networking site (SNS) adoption.

The success of social networking sites and communication on such sites depends a lot on the innovation and adoption of such sites (Ridings & Gefen, 2004). With more and more businesses implementing these social networking sites, it becomes important to understand how and why people are deciding to use sites such as MySpace and Facebook (Wellman & Gulia, 1999). As with the successful adoption of any new consumer technology, the success of social networking sites also depends on numerous factors of which individual-level factors are often ignored in this area of research. Agarwal and Prasad (1999) suggest that individual differences are important in information technology acceptance and are often not included in technology acceptance

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models. Therefore, the current chapter fills the gap in literature by examining individual differences in SNS adoption from a technology acceptance model perspective.

The following section explains the concept and types of social networking sites before discussing the role of such sites in creating and adding value to businesses and their usage as advertising vehicles.

Social Networking Sites (SNS)

Social networking sites (SNS) have existed in some form or another since the advent of the Internet. Bulletin boards, user and discussion groups, multi user dungeons (MUDs), and other forms of online communities are predecessors to the present generation of networking sites like Facebook, Friendster, and MySpace. Advances in Internet technology have made it much easier for individuals to connect and communicate online through a new wave of technology often collectively referred to as Web 2.0 tools. Social networking sites are a type of online or virtual communities (such as Yahoogroups or Google Groups) with a few differences. The emphasis in social networking sites is on (1) the individual and his or her profile information, (2) the people that the individual is connected to, (3) the groups that he or she is part of, and (4) the explicit representation of relationships. These factors determine the individual's role, involvement, and usage of SNS in contrast to traditional virtual communities where the emphasis is on public discussions and the commonality that underlies the very existence of such communities. In other words, the emphasis in the case of social networking sites is on the user and his or her network of friends whereas in virtual communities and online discussion groups the emphasis is on the content generated by members. Social networking sites are about people and their network of relationships.

Networking sites can be classified into many types. For an excellent review of classifications, readers are advised to refer to Murchu, Breslin, and Decker (2004). Depending on the type of user profiles, networking sites can be either classified as business-oriented (Ecademy, LinkedIn, or Spoke) or as social networks (Friendster, MySpace, Friendzy, Meetup, Orkut, Tickle, or Tribe). However, some networks have transcended their original purposes to extend into the other category over the years. For example, Ryze was originally intended to serve online business networking purposes but members have ever since used it for dating and other social networking purposes. Members can join social networking sites in one of the two ways—via registration or via connection. In the registration-based model, individuals sign in with a valid e-mail address and the site is open to everyone without any sort of approval or moderation, whereas in the connection-based model, individuals can only become members if they know someone who is already a member of that social networking site (Murchu, Brestlin, & Decker 2004).

The usage of social networking sites has grown from 5% of American households in 2005 to over 10% in just one year. According to a recent survey by iProspect, over 25% of all Internet users visit social networking sites at least once a month (Lewis, 2007). MySpace, for example, has over 22 million members and is growing at a rate of 2 million users a month (Rosenbush, 2005). Social networking sites are not only becoming the hottest destination spots on the World Wide Web, but are also building huge databases of user information in the process. When registering with such sites, users voluntarily provide information about their choice of movies, books, television shows, radio stations, hobbies, political leanings, and music. Most sites also display users' demographics in terms of income level, location, education, and work information. Other kinds of information usually captured (and often displayed on users' profiles) include contact information such as phone numbers, e-mail addresses, and instant message ids, and personal information such as relationship status, sexuality, favorite activities, quotes, photos, conversations with friends, groups users belong to, and discussions users are taking part in. Different sites have different ways in which members can display their networks and connections with other members. Some allow members to rank their friends (Friendster and Facebook) while others allow for categorizing their friends (Orkut).

Social Networking Sites and Revenue

The business of social networking has grown into a multi-billion dollar sector even though it is still somewhat unclear as to what a viable business model should be for these sites to generate revenue. Broadly speaking, there are two operating business models for social networking sites: subscription-based and advertising revenue. Some sites, especially e-dating sites, have turned to a subscription-based business model while many social networking sites are still looking for a viable business model. Murchu, Breslin, and Decker (2004) suggest that social networking sites may be perfect vehicles for targeted advertising given the large amounts of valuable data these sites contain in terms of profile information. The success of both models requires that users register and sign up with these sites in large numbers. Therefore, it becomes crucial and important to understand usage and adoption of SNS.

Social networking sites are being increasingly used in advertising and marketing campaigns given the clutter problems associated with other advertising media, audience fragmentation and increased usage of newer media, and the threat of new technologies such as DVRs. The amount of money spent on social networking site for advertising in 2006 was $350 million, which increased to over twice that amount ($865 million) in just one year. Overall, advertising spending is expected to increase to $1.8 billion by 2010 and $2.1 billion by 2011 (eMarketer, 2006a). It is no surprise that a major share of the advertising dollars has gone to MySpace (roughly $525 million out of the total $865 in the year 2007) given that this SNS drew over 55 million unique visitors in September 2006 which is an increase from 21 million just a year before (Advertising Age, 2007).

There are also examples of how advertisers and media firms have begun to leverage the potential of social networking sites. For instance, Starcom Media Group (SMG) ran a MySpace campaign for one of its clients, Fanta®. SMG created a profile page "*The Fantanas*" that several of MySpace members added to their buddy list. Facebook features several classified and highly targeted advertisements that show up on users' home pages when they sign in. Social networking sites like MySpace make over $25 million per month in advertising (Cashmore, 2007), and it is for the same reason that MySpace was recently bought by Rupert Murdoch's New Corp.

The trend to use social networking sites for advertising and adding value to businesses is only expected to escalate given that almost half the people recently surveyed by eMarketer (2006b) claim that they would seek out shopping information including coupons and discounts on social networking sites if they were made available. Social networking sites can also let members link to other sites such as Amazon.com and attach an image of a CD they are listening to or a book they are reading or a videogame they are playing (Rapacki, 2007). This presents great opportunities for marketers to link with social networking sites and tap into the power of key influencers or opinion leaders. There are also instances where advertisers have created viral content to be transmitted by key influencers—identified by their network size and their activity on social networking sites—or created brand-related communities that members could be a part of and participate in discussions in a more advertiser-content environment (Smith, 2006).

With revenue of social networking sites tied to the number of users registered, it becomes imperative to study and understand the factors that influence adoption of SNS. Therefore, the current study focuses on individual differences in SNS usage and adoption. The following section examines literature on SNS adoption and usage from a technology acceptance model perspective.

THEORETICAL FRAMEWORK

Research Exploring SNS Adoption and Usage

The success or failure of any innovation is often linked to its ultimate adoption (DeLone & McLean, 1990; Agarwal & Prasad, 1999). This is true for social networking sites as well given that the success of both the revenue models discussed in the previous section depends largely on the number of users registered. However, understanding why users accept or reject technological innovations (such as social networking sites) is a difficult and challenging research problem (Swanson, 1988; Davis, Bagozzi, & Warshaw, 1989)

In order to better understand SNS adoption and usage, one needs to examine literature on the technology acceptance model and draw from attitude-intention-behavior models from social psychology. Technology acceptance model (TAM) suggests that the ultimate adoption of any innovation depends on two key factors: perceived usefulness and perceived ease of use (Davis et al., 1989; Venkatesh et al., 2003). Social networking sites fulfill various needs such as an individuals' need to stay in touch and keep tabs on friends, make plans with friends, make new friends and to even flirt with someone (Lenhart & Madden, 2007). Other factors motivating SNS adoption mentioned in the literature include feelings of affiliation and belonging, need for information, goal achievement, self-identity, values, and notions of accepted behavior (Ridings & Gefen, 2004). All of these factors relate to the perceived usefulness of social networking sites. The perceived ease of use is often conceptualized in SNS literature as Internet self-efficacy. Internet self-efficacy is defined as the personal confidence in one's ability to successfully understand, navigate, and evaluate content should alleviate doubts and suspicions when dealing with social networking sites (Daugherty, Eastin, & Gangadharbatla, 2005).

The technology acceptance model (TAM) draws extensively from attitude-intention-behavior models in social psychology. For instance, Fishbein and Ajzen's (1975) theory of reasoned action (TRA) suggests that attitudes are good predictors of behavioral intentions, which in turn successfully predict behavior across a wide variety of fields. This attitude-intention-behavior model is "designed to explain virtually any human behavior" (Ajzen & Fishbein, 1980, p.4) and could therefore be used to explain SNS adoption and usage as well. Individuals' attitudes toward social networking sites influence their intentions to join such sites, which in turn predict their actual adoption and usage. This basic TRA model when combined with technology acceptance model (TAM) explains the adoption process of almost all innovations and technological services (Gefen & Straub, 1997). However, a number of individual-level factors (e.g., gender) have not been included in this technology adoption model (Gefen & Straub, 1997; Agarwal & Prasad, 1999; Venkatesh & Morris, 2000). The following section examines individual differences frequently mentioned in technology adoption literature that can potentially influence SNS adoption and usage.

Individual-Level Differences in SNS Adoption

Researchers have frequently lamented that a "set of constructs not specifically included in TAM are variables related to individual differences" (Agarwal & Prasad, 1999, p. 362). These individual factors range from cognitive and personality traits to demographic and situational variables such as training and expertise (Zmud, 1979; Agarwal &

Prasad, 1999). Many researchers acknowledge the importance of individual differences in technology adoption (Agarwal & Prasad, 1999). Although a wide spectrum of individual-level variables are frequently mentioned in the technology adoption literature, only a few that are relevant to social networking site adoption and usage will be considered here.

Need to Belong

A commonly expressed motivation to join virtual communities is an individual's need to belong (Watson & Johnson, 1972; Ridings & Gefen, 2004). Need to belong is a personality variable that is considered a fundamental human motivation that all human beings posses (Baumeister & Leary, 1995). Over 90% of teens that visit social networking sites do so to stay in touch with friends, something that suggests the importance of need to belong. Other related reasons often mentioned in the literature include social support, friendship, and common interests (Ridings & Gefen, 2004). Furlong (1989) suggests that virtual communities are places where individuals go for emotional support, sense of belongingness, and encouragement in times of need. One of the main reasons for individuals joining virtual networks is finding social support on such sites (Herring, 1996) and making friends (Horrigan et al., 2001). Connections made online go beyond receiving support, as Ridings and Gefen (2004) suggest "the feeling of being together and being a member of a group of friends comes with the notions of being part of a group, spending time together, companionship, socializing, and networking" (p. 5). Online friendships go beyond just social support exchange. Internet makes it easy for individuals to connect to others in today's busy world. Social networking sites allow for individuals to reconnect with high school and college friends, ex-lovers, past and current colleagues, and sometimes even random strangers. This need to belong motivation is also related to individual usage of virtual communities. Leung (2001) found in a survey of 576 college students that students who were motivated by affection and sociability were the heaviest users of ICQ whereas light users were motivated by fashion.

Individuals have a strong motivation to "form and maintain at least a minimum quantity of lasting, positive, and significant interpersonal relationships" (Baumeister & Leary, 1995, p. 497). Due to this natural pursuit of maintaining belongingness, they propose that the strength and intensity would vary among individuals but that it would be "difficult or impossible for culture to eradicate the need to belong" (Baumeister & Leary, 1995, p. 499). Given that individuals vary in their levels of belongingness, it is only logical to except the effect of this "need to belong" on their SNS adoption and usage to also vary accordingly.

Internet Self-Efficacy

One of the chief determining factors of technology acceptance in TAM is individual's perceived ease of use of the technology. Perceived use of ease translates to Internet self-efficacy when dealing with social networking sites, which is represented in reasons such as "interface being ease to use" and "the search functionality being really cool" (Ridings & Gefen, 2004). Self-efficacy has been shown to have a significant impact on individuals' adoption of technology (Eastin & LaRose, 2000; Eastin, 2002). Self-efficacy is a person's ability to perform a task, a person's judgment about a future event, or even one's belief in their own ability (i.e., self-confidence) (Barbalet, 1998). This belief is a known predictor of involvement, intrinsic motivation, and task completion in a variety of domains (Ellen, Bearden, & Sharma, 1991). The effect of self-efficacy on consumer decision-making and behavior has been well documented in marketing literature (see Fleming & Courtney, 1984; Bettman, Johnson, & Payne, 1991; Bearden, Hardesty, & Rose, 2001) and information technology (Compeau & Higgins, 1995). However, none have directly examined the role of Internet self-efficacy on attitudes toward social networking sites and individuals' likelihood of adopting such Web sites.

Internet self-efficacy can be defined as the personal confidence in one's ability to successfully understand, navigate, and evaluate content, which should alleviate doubts and suspicions when dealing with social networking sites. Ajzen and Sexton (1999) suggest that as self-efficacy (i.e., beliefs) increases, attitudes toward the object of those beliefs will also increase. In other words, as individuals' levels of Internet self-efficacy increase their attitudes toward joining social networking sites should also increase.

Self-Esteem

A variable similar to self-efficacy is the individual's level of self-esteem. Rapacki (2007) argues that teens need places like MySpace as they help them express their ever-changing liquid self-concept in a non-permanent way as opposed to "permanent reminders like scares, bad credit, and tattoos" (p. 28). And self-esteem is an evaluative dimension of self-concept. The impact of self-esteem on technology adoption—in this case, adoption of social networking sites—has never been examined before. Given the expected positive relationship between self-efficacy and attitude toward SNS, one could also assume a positive influence of individual's self-esteem level on SNS adoption.

Need for Cognition

According to TAM, perceived usefulness of an innovation plays an important role in its ultimate adoption. Both need to belong and need for cognition in an individual can be linked to the perceived usefulness of social networking sites. Need to exchange information and goal achievement are often cited as reasons why individuals join virtual communities (Ridings & Gefen (2004). Need to exchange information relates to need for cognition or the desire to obtain information about a topic, educate oneself or learn new things. The successful adoption of virtual communities often depends on two key factors: individuals' need to access information and member-generated content (Furlong, 1989; Hagel & Armstrong, 1997; Ridings & Gefen, 2004). Many individuals join virtual groups mainly to obtain information and this is particularly true in the case of groups that are formed around special topics (Rheingold, 1993; Herring, 1996).

With social networking sites that allow for friends to keep tabs on each other, learn about each other's interests and groups, discuss and gather information on a wide variety of topics, the need for cognition should influence the usage and adoption. If an individual exhibits a high desire to gather this information, the likelihood of his or her adoption of SNS to serve such needs should also be high.

Gender

A number of demographic variables have been shown to influence technology adoption including age, income, education, occupation, and sex. The current study is limited to examining the effect of only one demographic variable—gender. Several studies examined the role of gender in technology adoption and usage (Gefen & Straub, 1997; Agarwal & Prasad, 1999; Venkatesh & Morris, 2000). Hawkins (1987) categorized various factors that are possible reasons for existing inequalities in computer usage between males and females. The first is the presence of a biological disadvantage in that girls find spatial and manipulative tasks required for interacting with a computer difficult and unappealing. The second reason suggests that usage of computers is incompatible with females' learning styles. Hawkins explains this further by saying that boys are more likely to attribute failure to external factors whereas girls tend to attribute failure to their own inability to succeed. The third reason is boarder and cultural in context in that most societies reinforce sexual stereotypes and prescribe gender-appropriate interests. Gender differences in computer skills and usage were found to transcend cultures as shown by Lowe and Krahn (1989) in their study of computer usage in Canada.

Gefen and Straub (1997) cite socio-linguistic literature to suggest that men tend to focus on hierarchy and independence, while females focus on intimacy and solidarity. This suggests gender differences in how individuals approach social networking sites. Self-efficacy and need for cognition might have a stronger say in SNS adoption for men whereas the need to belong might play a bigger role in SNS adoption for women. Lewis (2007) suggests the same in that social networking sites are primarily places to reconnect with friends from past for girls whereas for boys, the attraction to SNS is more geared toward making new friends (Lewis, 2007). In another study, it was found that female ICQ users spend more time on ICQ and chat longer for reasons of sociability and need to belong than males who tend to spend time chatting for recreation (Leung, 2001).

To summarize, the role of five individual-level factors in influencing an individuals' SNS adoption is examined. More precisely, the role of need to belong, need for cognition, Internet self-efficacy, self-esteem, and gender in influencing individuals' attitudes toward social networking sites and their willingness to join such sites is examined.

PRIMARY RESEARCH

Research Proposition

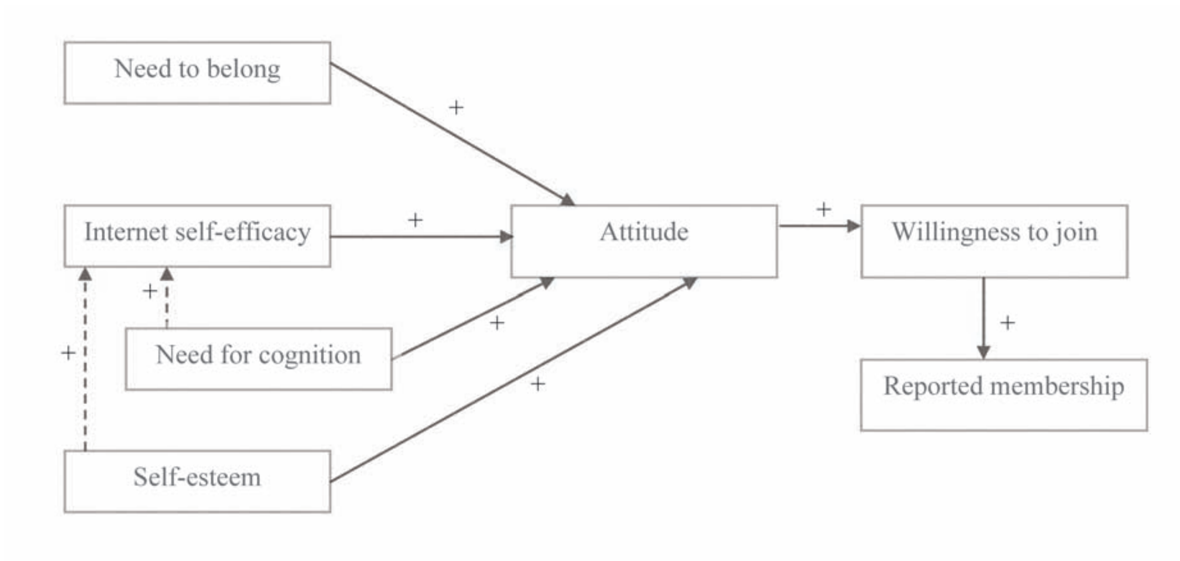
In order to better understand the role of Internet self-efficacy, need to belong, need for cognition, self-esteem, and gender in social networking site adoption, the following theoretical model is proposed based on the discussion in the earlier section. Although the model is the same for both genders, the magnitude of co-efficient estimates is expected to be different for males and females. Therefore, the grouping variable for the proposed model in Figure 1 is gender.

The principle research proposition is that individuals' need to belong, level of Internet self-efficacy, need for cognition, and self-esteem all positively affect their attitude toward social networking sites, which in turn positively affects their willingness to join such sites. Furthermore, this reported level of willingness to join SNS is positively related to their actual membership. This is reflected with solid line with + signs on top of them in the proposed model. Intuitively, Internet self-efficacy is expected to be dependent on individuals' need for cognition and their level of self-esteem. However, there were no direct studies found to support the directionality of this link, hence these relationships are represented by dotted lines with + signs on them.

Sample and Procedure

To test the proposed model, data was collected using a paper-pencil-based survey. An online version was not used to include both social networking site users and non-users. Furthermore, a paper-pencil-based survey would also ensure that non-users of the Internet are captured in the sample. A total of 237 undergraduate students (N=237) were recruited from a large southwestern university to participate in the study. Students were recruited to participate for extra credit during class time via an oral presentation given by the principal investigator. A student sample is justified given that social networking site users fit the demographics of college students between the ages 18 to 30 and that is the demographic of interest for the current study. Respondents took approximately 20 minutes to complete the entire survey. To maintain anonymity, no names were collected on the questionnaire.

Figure 1. Proposed model with gender as grouping variable



Questionnaire

A 65-item questionnaire was developed and pre-tested on a small sample of academic professionals and graduate students to insure clarity (additional data was collected but not analyzed for this study). Attitude was measured using an established six-item semantic differential scale (bad/good, foolish/clever, unpleasant/pleasant, useful/useless, boring/interesting, and negative/positive) (Bruner, James, & Hensel, 2001, p. 84). Willingness to join social networking sites was measured using four established semantic differential items (unlikely/likely, probably/probably not, impossible/possible, and definitely would/definitely would not) (MacKenzie & Spreng, 1992). Need to belong was measured using a seven-item Likert scale. Scale items included statements such as "I want other people to accept me," "I do not like being alone," and "I try hard to stay in touch with my friends" (Leary, 1957; Leary, Kelly, & Schreindorfer, 2001). Need for cognition was measured using Likert scale items such as "I prefer complex to simple problems" and "Thinking is not my idea of fun" (Cacioppo & Petty, 1982; Cacioppo, Petty, & Kao, 1984). Self-esteem was measured using six Likert scale items such as "On the whole, I am satisfied with myself," "I feel that I have a number of good qualities," and "I take a positive attitude toward myself" (Rosenberg, 1965). Finally, the Internet self-efficacy scale consisted of 10 items such as "I often surf the web for information," "I feel confident troubleshooting Internet problems," and "I am familiar with computers" (Eastin & LaRose, 2000). The questionnaire also asked about the number of hours subjects spent surfing the Web, the number of social networking sites they belonged to, the average number of times they signed on to their account on a social networking site, and the number of hours per week they spent on these sites. The survey concluded with demographic questions.

Results

The sample (N=237) consisted of 56% females (133) and 44%t males (104) with majority of subjects being Anglo (75%), followed by Hispanic American (8.4%). The mean age of the sample

Table 1. Mean, variance, and Cronbach's alpha coefficients for scales

Scale	Mean	Variance	α
Attitude toward social networking sites (6 items)	4.90	0.12	0.84
Willingness to join SNS (4 items)	5.19	0.07	0.89
Need for cognition (7 items)	4.00	0.21	0.75
Need to belong (7 items)	4.68	0.71	0.63
Self-esteem (6 items)	5.50	0.29	0.77
Internet self-efficacy (10 items)	4.74	0.42	0.91

was 22.6 with ages ranging from 18 to 46. Reliability analysis was conducted using Cronbach's Alpha. Table 1 lists the average scores, variances, and reliability indices for each scale used in the model. All scales had a Cronbach's Alpha of over 0.70 (Hair, Anderson, Tatham, & Black, 1998, p. 118) except for one (need to belong). However, need to belong was still used in the model given that it was over 0.60 and somewhat close to the prescribed limit.

The proposed model was estimated using AMOS software. Gender was used as a grouping variable in the model. In other words, the model was estimated twice, once for males in the sample and once for females. Table 2 depicts the correlation matrix of variables used in the model. The fit statistics for both models suggest that data fits the model very well. Both CFI (Comparative Fit Index= 0.984) and GFI (Goodness of Fit Index=0.967) are well above the prescribed limit of 0.90 (Tanaka & Huba, 1985; McDonald & Marsh, 1990), chi-square is not significant, and RMSEA (0.021) is below the limit of 0.80.

The various factors that influence individuals' attitude toward social networking sites are different for both genders as suggested by Figures 2 (a) and (b). For females in the sample, need to belong and self-esteem seem to play a part in influencing their attitudes toward social networking sites, whereas for males, only Internet self-efficacy seems to influence the attitudes. For both genders, attitude toward social networking site positively affects their willingness to join such sites, which in turn positively affects their actual membership. However, the magnitude of these effects is different for males and females.

Tables 3 (a) and (b) list the unstandardized and standardized co-efficients for females and Tables 4 (a) and (b) list the same for males.

For females, attitude toward social networking sites is dependent on their need to belong and self-esteem levels, whereas for males, attitude

Table 2. Correlation matrix

	Attitude	Willingness	Internet self-efficacy	Need for cognition	Need to belong	Self-esteem
Attitude	1.00					
Willingness	0.53*	1.00				
Internet self-efficacy	0.17*	0.11	1.00			
Need for cog	0.01	-0.07	0.30*	1.00		
Need to belong	0.23*	0.20*	0.08	-0.05	1.00	
Self-esteem	0.15*	0.10	0.16*	0.03	0.03	1.00

*p< 0.01, N=237

Figure 2.

Figure 2.a Structural model with fit statistics and standardized estimates for group 1-females

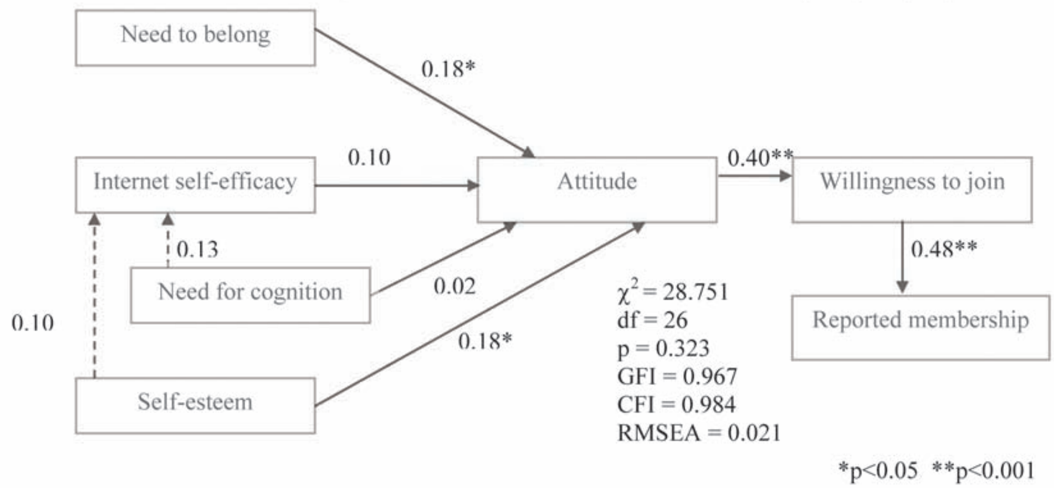
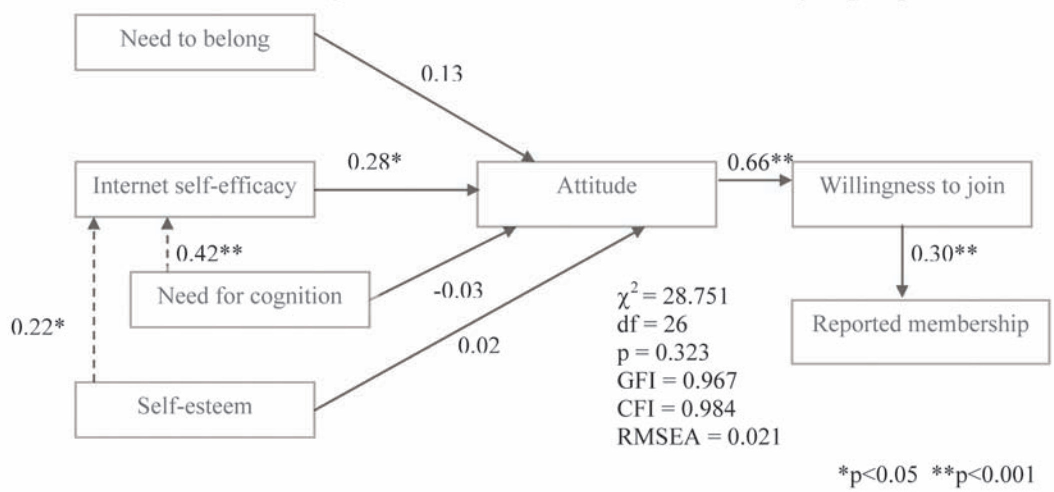


Figure 2.b Structural model with fit statistics and standardized estimates for group 2-males



toward SNS is only dependent on their Internet self-efficacy level. To interpret the standardized co-efficient estimates, each value represents the amount of change in "attitude toward SNS" given a standard deviation unit change in X (X being Internet self-efficacy or need to belong or self-esteem). More precisely, attitude toward SNS changes by 0.28 given a standard deviation unit change in Internet self-efficacy level for men. Similarly, attitude toward SNS changes by 0.18 and 0.18 for each standard deviation unit changes in need to belong and self-esteem, respectively for females. The parameters can also be interpreted using the unstandardized co-efficient estimates. In this case, each unstandardized value represents the amount of change in "attitude toward SNS" given a single raw score unit change in X (again, X being Internet self-efficacy or need to belong

Table 3(a). Unstandardized regression weights (maximum likelihood estimation)-females

			Estimate	S.E.
Internet self-efficacy	<---	Need for cognition	0.148	0.097
Internet self-efficacy	<---	Self-esteem	0.123	0.104
Attitude	<---	Need for cognition	0.021	0.102
Attitude	<---	Need to belong	0.251*	0.119
Attitude	<---	Internet self-efficacy	0.104	0.091
Attitude	<---	Self-esteem	0.226*	0.108
Willingness	<---	Attitude	.498**	0.099
Reported membership	<---	Willingness	.093**	0.015
*p<0.05 **p<0.001				

Table 3(b). Standardized regression weights (maximum likelihood estimation)-females

			Estimate
Internet self-efficacy	<---	Need for cognition	0.131
Internet self-efficacy	<---	Self-esteem	0.102
Attitude	<---	Need for cognition	0.018
Attitude	<---	Need to belong	0.176*
Attitude	<---	Internet self-efficacy	0.098
Attitude	<---	Self-esteem	0.176*
Willingness	<---	Attitude	.402**
Reported membership	<---	Willingness	.479**
*p<0.05 **p<0.001			

Table 4(a). Unstandardized regression weights (maximum likelihood estimation)-males

			Estimate	S.E.
Internet self-efficacy	<---	Need for cognition	0.595**	0.124
Internet self-efficacy	<---	Self-esteem	0.264*	0.106
Attitude	<---	Need for cognition	-0.044	0.134
Attitude	<---	Need to belong	0.214	0.152
Attitude	<---	Internet self-efficacy	0.253*	0.096
Attitude	<---	Self-esteem	0.026	0.106
Willingness	<---	Attitude	0.893**	0.100
Reported membership	<---	Willingness	0.050**	0.015
*p<0.05 **p<0.001				

Table 4(b). Standardized regression weights (maximum likelihood estimation)-males

			Estimate
Internet self-efficacy	<---	Need for cognition	0.417**
Internet self-efficacy	<---	Self-esteem	0.217*
Attitude	<---	Need for cognition	-0.034
Attitude	<---	Need to belong	0.132
Attitude	<---	Internet self-efficacy	0.280*
Attitude	<---	Self-esteem	0.024
Willingness	<---	Attitude	0.661**
Reported membership	<---	Willingness	0.303**
*p<0.05 **p<0.001			

or self-esteem). Attitude toward SNS (on a scale of 1 to 7) increases by 0.253 for a unit increase in the value of Internet self-efficacy for men and by 0.251 and 0.226 for a unit increase in the values of need to belong and self-esteem, respectively for women.

Next, it is interesting to note the differences in attitude-intention-behavior relationship by gender. From the standardized co-efficient estimates, the link between attitude-intention is stronger for males than females, and the link between intention-behavior is stronger for females than males. In other words, men are more likely to report a willingness to join SNS if they have a favorable predisposition toward SNS but women are more likely to actually join SNS if they report a willingness to join SNS.

DISCUSSION

Social networking sites (SNS) are growing in importance not just as places for individuals to communicate, network, and express themselves but also as advertising/marketing vehicles. Of all the existing revenue models for SNS, the most viable so far seems to rely on advertising and use of SNS as vehicles for branding. And with expected advertising spending on such sites to be around $2 billion by 2010 (eMarketer, 2006a) it is imperative that researchers focus on SNS and SNS adoption. The present chapter presents a framework for understanding SNS adoption based on five individual-level factors: need to belong, need for cognition, Internet self-efficacy, self-esteem, and gender.

Researchers in the past have registered gender differences in technology acceptance. For instance, Gefen and Straub (1997) found that females view e-mail as being higher in social presence than men. Consistent with gender differences in TAM literature, the current study also found differences in the way males and females adopt social networking sites. For females, the need to belong and self-esteem level were significant predictors of SNS adoption whereas for males, only Internet self-efficacy was significant in predicting SNS adoption. Surprisingly, the need for cognition did not predict SNS adoption for both genders. This may be due to the fact that social networking sites are geared more toward building networks and appealing to other social needs more so than virtual communities and discussion groups such as Yahoogroups where the focus is on information access and the member-generated content.

Consistent with TRA literature, the current study provides more evidence for attitudes-intention-behavior model. For both genders, attitudes significantly predicted their willingness and intention to join social networking sites, which in turn positively predicted their actual usage. In other words, if individuals report a favorable attitude toward social networking sites they are more likely to express a willingness to join such sites, which in turn is significantly related to their actual usage and adoption of SNS. However, the magnitude of attitude-intention-behavior relationship seems to differ by gender for SNS. This is surprising and suggestive of individual differences in the TRA model itself based on gender. Attitudes-intention-behavior relationships in TAM have been tested and supported extensively, but the influence of individual-level factors on attitudes is yet to be detailed (Agarwal & Prasad, 1999). Future research should address this.

LIMITATIONS

The current study presents numerous limitations. First, the sample drawn is a convenience sample of college students. Although majority users of social networking sites are between the age groups 18 to 30, a convenience sample does limit the validity of findings. Second, a number of individual factors (age, income, education, and occupation) that potentially influence SNS adoption were not included in the current study. This is again due to the convenience sample that was used where variation in terms of age, education, income, and occupation was not much. Third, the low score in Cronbach's Alpha for need to belong also limits the overall reliability of the study. That said, individual differences in social networking site (SNS) adoption has never been investigated before and the author feels that the present study is a right step in the direction of furthering our initial understanding of social networking site adoption even with its limitations.

MANAGERIAL IMPLICATIONS

The focus on only individual factors might lead one to question the practical significance of the current study. One could argue that individual-level factors are beyond the control of brand managers, and therefore the current findings hold no managerial implications. Nonetheless, the author strongly believes that our understanding of the role of individual-level factors does help in devising effective strategies to increase membership of SNS as well as target individuals on such sites with relevant and effective promotional messages. Furthermore, the establishment of a relationship between individual level factors, brand attitude and behavior for social networking sites is of importance to academic scholars interested in theoretical research. The study's findings present many implications for social networking site (SNS) owners and advertisers looking to use these sites as advertising vehicles. For both parties, the common objective is to increase usage and membership and enable brand managers to develop new markets and improve their competitive positions. The following are some such strategies.

The success of a social networking site is directly related to the number of individuals registered with a particular SNS as higher membership translates to an increased number of eyeballs that could be potentially reached with a promotional message. The current study suggests that SNS adoption is significantly influenced by gender. The underlying factors that drive female membership—and this becomes relevant when dealing with social networking sites devoted to women or e-dating sites that typically have fewer women registered than men—are their levels of self-esteem and need to belong. Designing advertising campaigns around these two factors can significantly increase female membership. For instance, designing a TV commercial for an e-dating site that taps into a single woman's need to belong while at the same time emphasizing and applauding her individuality and independence (self-esteem factor) should evoke positive feelings toward that particular e-dating site, which in turns translates to a willingness to join such a network resulting in an actual registration, ultimately.

When the objective is to increase male membership, which is dependent on Internet self-efficacy, social networking site owners can design sites that are easier to navigate, and thereby influence the perceived level of confidence. Social networking sites that enhance members' sense of control by providing highly interactive environments and allow users to upload multimedia files, link to their blogs on others sites, link to videos on YouTube®, and provide Web 2.0 tools extensively are more likely to appeal to men. An increased sense of control translates to an increase in perceived level of self-efficacy, which leads to a favorable predisposition toward a SNS leading ultimately to its adoption.

Gender differences also exist in the strength of relationship of the attitude-intention-behavior in the proposed structural model. Based on the coefficients in the model, females are more likely to do something if they say they would as opposed to men who might be more willing to do something if they had a favorable predisposition toward it. A plausible strategy that exploits this finding is to attempt to increase men's attitudes toward SNS and for women, stress more on their willingness to join SNS. For example, promotional messages devoted to increasing the membership of an e-dating site should concentrate on changing the attitudes of men (by advertising) and in providing incentives to join for women (by offering discounts).

For brand managers and marketers looking to use social networking sites as advertising vehicles, it pays to note that men and women choose to register and be a part of a SNS for different reasons. This difference in motivations can become the basis for designing campaigns on social networking sites that appeal to different genders. If indeed women increasingly choose to become members of SNS owing to high levels of need to belong then ads placed on SNS should carry emotional appeals that tap into this need. Along the same lines, ads targeting women on SNS should also consider appealing to the self-esteem of members. Moreover, social networking sites may be best suited for products that can easily appeal to individual's need to belong and self-esteem (such as beauty-related products). As an example, when targeting women on an e-dating site with an ad for a beauty product, the emphasis of the creative could be on how the product enhances the individuals' personality and looks (and indirectly her self-esteem), which in turn makes her more desirable to others (need to belong).

Despite the model investigated in the current study being overly simplistic, it does present some theoretical implications for researchers interested in understanding SNS adoption. A number of other factors could potentially impact SNS adoption (factors such as type and genre of SNS, relevance, socio-economic factors of members, context, mood, influence of peers and relationships with members on one's network, perceived risk and privacy issues, parental influence and success) and future research should include these factors and test a modified version of the model presented in this chapter.

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This work was previously published in Social Networking Communities and E-Dating Services: Concepts and Implications, edited by C. Romm-Livermore; K. Setzekorn, pp. 1-17, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 5.20
The Impact of Individual Differences on Social Communication Pattern in Online Learning

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ABSTRACT

This chapter describes the college students' online social communication patterns and behavior with a focus on the impact of individual differences on learners' online communication. The study consisted of 27 college students who engaged in an online discussion over a period of fourteen weeks as part of requirements in an undergraduate educational technology course. The findings indicated that cognitive styles such as field dependence and field independence played a critical role in forming learners' online social communication. Based on social compensation theory and Witkin et al.'s theory of individual differences, the authors claimed that effective individual communication in an online community can be fostered through creating learning support, taking into considerations factors like cognitive styles, complementary personality, interest and motivation in the process of design. Suggestions for future online learning are made with an emphasis on creating an effective online community for learning.

DOI: 10.4018/978-1-60566-392-0.ch015

INTRODUCTION

As an important aspect in online learning, online social communication has drawn attention of educators and researchers (Willing, 2007; Zheng & Ferris, 2007). With the increasing use of Web course tools (e.g., WebCT, Blackboard, Moodle, etc.), particularly the availability of social communication function in such tools as asynchronous and synchronous communication, educators and researchers have become interested in investigating variables and factors that influence learners' socially engaged activities in online learning (Cook & Smith, 2004; Weller, 2007). Following this line of research, researchers have identified social factors (see Dietz-Uhler & Bishop-Clark, 2005; McKenna, Green, & Gleason, 2002; Peter, Valkenburg, & Schouten, 2006; Sheeks & Birchmeier, 2007; Valkenburg & Peter, 2007) and individual factors (Anolli, Villani & Riva, 2005; Chak & Leung, 2004; Johnson & Johnson, 2006; Madell & Muncer, 2007) that have pronounced impact on learners' social communication and behavior in online learning. While there is a plethora of literature pertinent to the social and individual factors that influence online learning, little research has been done to explore learners' social communication patterns in online learning environment, particularly how individual factors such as cognitive styles affect the way learners communicate in web-based learning.

Research indicates that understanding learners' online social communication and behavior is crucial in successfully implementing effective online instructional strategies such as collaboration, group work, etc. (Johnson & Johnson, 2006; Weller, 2007). Online learning is substantiated through the activities of a virtual learning community. Since individual learners constitute the body of online learning communities, individual factors such as cognitive styles can play an important role in formulating the communication pattern and behavior of that community (Johnson & Johnson, 2006). This chapter offers a discussion on online learners' social communication patterns and behavior by (a) studying the differences between field dependent and field independent learners in online social communication; (b) identifying the correlation between cognitive styles and related factors in online learning including self-confidence, support, interest, motivation and so forth; and (c) analyzing learners' performance in online discussion. Discussion on research in online social communication and behavior will be made with guidelines for future studies.

COGNITIVE STYLES AND LEARNING

In the last half century learners' cognitive styles have been heavily studied; these studies encompass a wide range of topics: from brain hemisphere function (Samples, 1975; Springer & Deutch, 1985), to temperament (Gregorc, 1982), to impulsive/reflective cognitive tempo (Kagan, 1966), to field dependent and field independent theory (Witkin & Goodenough,1977), just to name a few. In an early study Kirby (1979) provided a comprehensive summary of 19 cognitive styles and concluded that all learners learn differently. According to Chinien and Boutin (1992), cognitive styles refer to "the information processing habits representing the learners' typical mode of perceiving, thinking, problem solving, and remembering" (p. 303). They claimed that cognitive styles constitute important dimensions of individual differences among learners and have important implications for teaching and learning.

Differing from learning styles which describe the conditions (i.e., auditory, visual, haptic, etc.) under which we best learn, cognitive styles are about how we perceive and think (Lever-Duffy, McDonald, & Mizell, 2003). The construct of cognitive style has been considered as a consistent, stable variable in learning. Keefe (1982) stated that cognitive styles are "the cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (p. 1). This view is shared by Smith and Ragan (2005) who propose a framework of learners' characteristics in which cognitive styles are subsumed under the category of stable-differences. Unlike psychosocial factors and prior knowledge which change during learning, cognitive styles are comparatively stable with little change over time. Whereas sensory capacities bear similarities among humans, cognitive styles are marked by a wide spectrum of differences with respect to how people perceive and respond to their learning environment. Because of their dual nature of stability and difference, cognitive styles are considered to have "the most potential utility to instructional design" (Smith & Ragan, 2005, p. 62). Smith and Ragan point out that understanding cognitive styles is important because it not only provides insight into how individual learners learn but also sheds light on why differing learning occurs.

Riding and Read (1996) investigated the relationship between learners' cognitive styles and learning performance and found that learners' cognitive profiles were consistent with their preferences in learning. For example, wholist-imagers like to use pictures whereas verbalizers were more prone to writing. In social learning context, wholist-imagers displayed a tendency for group work whereas analytics, such as verbalizers, preferred individual work. Russell (1997) conducted a similar study and reported that learners' cognitive styles, along with other variables like age and attitude could significantly influence their performance. Ates and Cataloglu (2007) studied first year undergraduates majoring in mechanics and tried to determine if cognitive styles have an influence on learners' achievements and problem-solving skills. Interestingly, they found no significant correlation between cognitive styles and pre/post achievement scores. However, they noted that learners' problem-solving skills were statistically related to their style. With the increasing presence of computers in teaching and learning, research on cognitive styles and learning has been extended to areas of computer assisted learning (CAL), hypermedia, and distance learning. Ford (2000) examined learners' information processing and strategies and their deep (transformational) and surface (reproductive) Riding and Read (1996) investigated the relationship between learners' cognitive styles and learning performance and found that learners' cognitive profiles were consistent with their preferences in learning. For example, wholist-imagers like to use pictures whereas verbalizers were more prone to writing. In social learning context, wholist-imagers displayed a tendency for group work whereas analytics, such as verbalizers, preferred individual work. Russell (1997) conducted a similar study and reported that learners' cognitive styles, along with other variables like age and attitude could significantly influence their performance. Ates and Cataloglu (2007) studied first year undergraduates majoring in mechanics and tried to determine if cognitive styles have an influence on learners' achievements and problem-solving skills. Interestingly, they found no significant correlation between cognitive styles and pre/post achievement scores. However, they noted that learners' problem-solving skills were statistically related to their cognitive style. With the increasing presence of computers in teaching and learning, research on cognitive styles and learning has been extended to areas of computer assisted learning (CAL), hypermedia, and distance learning. Ford (2000) examined learners' information processing styles and strategies and their deep (transformational) and surface (reproductive) learning in an online environment. He found that the unique features of online learning such as anonymity, synchronous and asynchronous communication enable learners of various cognitive styles to process information differently, which consequently impact their ability to learn both at deep and surface levels. Chen (2002) evaluated the effects of cognitive styles on student-centered learning in a hypermedia program. The author noticed that differences in cognitive style can affect different learners' learning in hypermedia. For example, the flexibility of hypermedia learning environment, e.g., non-linear learning, facilitates positive learning for field-independent learners and impedes the performance of field-dependent learners who often take a passive approach in learning. Taken together, the above research demonstrates that individuals learn differently and their various cognitive styles may affect the way they learn. In addition, educational technology such as hypermedia and the Internet may mediate learners' cognitive styles which could result in differences among learners in terms of their approaches to learning.

As was discussed elsewhere in the chapter, cognitive styles refer to an individual's preferred and habitual approach to organizing and representing information. Within the area of cognitive styles, field dependence (FD) and field independence (FI) have emerged as one of the most widely studied dimensions with the broadest application to problems in education (Meng & Patty, 1991; Witkin & Goodenough, 1977). The following section will focus on the characteristics and function of FD and FI, followed by a discussion on instructional conditions related to FD and FI learning. Field Dependence (FD) and Field Independence (FI)

Witkin and Goodenough (1977) defined field dependence and field independence as individuals' "tendencies to rely on self or field as primary referents" (p. 661). The word "field" can be a set of thoughts, ideas, or feelings. According to Witkin and Goodenough, people with field-dependent (FD) or field-independent (FI) cognitive styles are different in their interpersonal behavior, social skills, and information processing. FD people tend to make use of external social referents whereas FI people function with greater autonomy under such conditions. FD people are more attentive to social cues than are FI people. As a result, FD people show more interest in others, prefer to be physically close to people, and are emotionally more open, and gravitate toward social situations. In contrast, FI people are characterized by an impersonal orientation, less interested in others, show physical and psychological distancing from people, and prefer non-social situations (Ikegulu & Ikegulu, 1999; Liu & Reed, 1994; Witkin, Moore, Goodenough, & Cox, 1977). The practical implications of FD and FI research have indicated that different learning styles among individuals bear direct impact upon their achievement performance (Zheng, Yang, Garcia, & McCadden, 2008). Many studies have shown that FI people tend to outperform FD people in various settings. In a study by Griffin and Franklin (1996), one hundred and forty-three subjects were identified as FI or FD based on their performance on the Group Embedded Figures Test (GEFT). The results of their study indicated FI students performed significantly better on course tests. The study also suggested that FI students had higher academic potential than their FD counterparts. This finding was echoed by Richards, Fajen, Sullivan, and Gillespie (1997) who conducted two experiments, one in listening and one in reading, in connection to FD/FI cognitive styles. They examined the relationships among signaling (structural cues), notetaking, and FD/FI styles in college students. The results of both studies indicated that FI subjects seemed to use a tacit structure strategy, whereas FD subjects displayed structuring skills when notetaking. Along the same line, Danili and Reid (2004) studied 105 Greek pupils aged 15 to 16 and found that FI pupils were more organized and self-initiated than FD pupils in learning.

Instructional Conditions Related to FD and FI Learning

There is a concerted view among researchers and educators that instructional conditions should be identified to match the learning for FD and FI learners (Jonassen & Grabowski, 1993; Schmeck, 1988; Smith & Easterday, 1994). Witkin et al. (1977) point out that field dependence and field independence appear to affect many aspects of daily life including the ability to learn, particularly with regard to types of educational reinforcement needed to enhance learning, amount of structure required in an educational environment, cue salience, interaction between teachers and students, and so forth. One of the questions raised by Witkin et al. was whether teachers can adapt their teaching techniques to accommodate students with different cognitive styles. Related to this question is,

Table 1. Instructional conditions that capitalize on the preferences of and challenges to FD-I learners

Instructional Conditions Capitalized on the Preferences of FD Learners and Challenges to FI Learners	*Instructional Conditions Capitalized on the Preferences of FI Learners and Challenges to FD Learners*
•Providing structural support with salient cues •Including an advance organizer •Including an outline or graphic organizer of the content •Giving clear directions and guidance in instruction •Giving prototype examples •Facilitating a synergetic, social learning environment •Providing timely and detailed feedback •Embedding questions throughout learning •Providing multiple cues including visual, oral, and auditory, etc. •Providing detailed steps for deductive or inductive instruction	•Providing abundant content resources and reference material to sort through •Employing inquiry and discovery methods •Including minimal guidance and direction •Providing independent, contract-based self-instruction •Facilitating an independent learning environment •Encouraging learners to self-initiate questions •Employing inductive methods for instruction and learning •Employing outlines, pattern notes, concept maps as instructional strategies for teaching and learning •Using theoretical elaboration sequences

what are the instructional conditions needed to support FD and FI learners to learn effectively and efficiently? Jonassen and Grabowski (1993) summarized the research on the implications of the style characteristics and came to the conclusion that the instructional conditions differ between FD learners and FI learners. While some instructional conditions support FD learners, they can become, at the same time, challenges to FI learners.Table 1is a summary of the conditions that capitalize on the preferences of FD and FI learners and challenges to their respective counterparts.

To effectively utilize the instructional conditions so that FD and FI learners can maximally benefit from such learning, it is important to raise the awareness of cognitive style among learners. Perry (1994) pointed out that if there was an understanding of cognitive/learning styles, cooperative arrangements could be made between individuals of different styles to possibly compensate for the deficiencies of one style. He also suggested that an appreciation of the diversities (i.e., different cognitive styles) was important in any educational environment. According to Perry, when we allow learners to understand how they learn, there is greater possibility for efficient and effective learning and teaching. To elaborate on the compensatory role between different cognitive styles, our discussion in the next section will introduce social compensation theory to illuminate how learners with different cognitive styles may interact within a social learning environment and how external conditions may facilitate socially compensatory behavior.

SOCIAL COMPENSATION THEORY

Social compensation theory can be traced back to early works done by Otto Kohler (1926, 1927 cited from Williams & Karau, 1991) who demonstrated with dyads or triads working on a conjunctive work, that group performance depended on the relative individual performance of the group members. Kohler explored the group performance of members who showed moderate discrepancies in ability level and found that weaker members worked harder in groups than individually. Kohler explained that the most probable cause being that the weaker members tried to avoid the embarrassment of lowering the group product. Following Kohler's studies conducted some sixty years ago, Williams and Karau (1991) did several experiments to test the hypotheses that a group member will work harder in a group setting than individually if (a) the production of the public good is very important, (b) the task is addictive, (c) the individual perceives control over the production of the public good, and (d) the other group members are unable or unwilling to contribute to the production of the good. Their studies led to several important conclusions.

First, when subjects were led to believe that their coworkers were unable or unwilling to contribute to the group product, subjects produced substantially more ideas when working in a group rather than individually. Second, social compensation was only likely to occur under conditions where a capable group member was able and willing to compensate for the weaker member(s) of the team. Similar findings were obtained by Stroebe, Diehl, & Abakoumkin (1996) who identified a social compensatory relationship between high and low ability members in the group. They argued that discrepancy among individual abilities created optimal conditions for mutual influence and resonance. On the one hand, the stronger member somehow motivated the weaker member to work harder while at the same time increasing his own performance. On the other, the weaker member was galvanized by the member responsibility and the urge to avoid the embarrassment of lowering the group product.

The early work on social compensation (Kohler, 1926, 1927 cited from Stroebe et al., 1996; Williams & Karau, 1991) focuses primarily on the relationship between individual abilities and group performance. For example, Kohler's studies (1926, 1927) explored the group social compensation behavior based on the differences between physical strength of weight lifters. That is, the stronger weight lifter appeared to be more willing to contribute to the group performance as he took upon himself as a social obligation to help improve the scores of his group. The similar pattern was found for the group brainstorm activity where the more able learners became actively involved in brainstorming when they realized that it was they, rather than the less able learners, who could make difference in group brainstorming (Williams & Karau, 1991). However, the early work did not explore the social compensation phenomenon from the perspective of learners' cognitive styles, which are considered by many to be crucial in understanding the dynamics of social compensatory behavior (Peter, Valkenburg, & Schouten, 2005; Valkenburg & Peter, 2007). With the increasing presence of the Internet, this line of research seems to be more important as social compensation and cognitive styles are related and intertwined to form the ground for the study of social online communication and behavior.

Social Compensation, Cognitive Styles and Online Communication

A significant body of work has attempted to describe the relationships between individual differences and adolescent online communication (Anolli et al., 2005; Chak & Leung, 2004; Madell & Muncer, 2007; Sheeks & Birchmeier, 2007). Researchers are particularly interested in finding out how personality traits such as introversion/extroversion, neuroticism, and psychoticism would affect adolescents' behaviors in online communication (Anolli et al., 2005; Chak & Leung, 2004; Madell & Muncer, 2007). Research on introversion and extroversion is polarized in terms of the impact of each of the above personality traits on adolescent online communication. Some researchers argue that since extroverted people are "social, needing to have people to talk to, and disliking reading or studying by him or herself" (Bianchi & Phillips, 2005, p. 41), the Internet which has no time and geographic limitation thus becomes an ideal place for them to establish their social network. Researchers in this school (e.g., Amichai-Hamburger, 2002; Bianchi and Phillip, 2005; Valkenburg & Peter, 2007) support the rich-get-richer hypothesis that extroverted people may be compensated by online social environments that make them become more socially involved in online communication. They also note that extroverted people could become addicted to online communication due to the flexibility, ease of control, and multiple synchronous connections among participants (Madell & Muncer, 2007).

Contrary to the assumptions that the extroversion causes people to become addicted to the Internet communication, researchers (e.g., Chak

& Leung, 2004; Widyanto & McMurran, 2004) who studied the relationship between introversion and online behaviors found that the Internet communication appeals to introverted people and the introversion may be the reason to cause people to become addicted to online chat. They argue that introverted people are usually socially shy and often have difficulty in developing relationships with others in a face-to-face setting, particularly when such relationship development is affected by the "gating features" when the individual perceives a self-defeating social inhibitor such as stuttering. Chak and Leung (2004) contend that because of the perceived control of online communication, introverted people are more likely to go to the Internet to meet their social and intimacy needs. With all the affordances of the Internet, that is, anonymity, flexibility, multiple interaction, and so forth, socially anxious or lonely people can be socially compensated by communicating online with others without being overly conscious about who they are or what they say, and at the same time feel that their self-image is safeguarded. This group supports the stimulation hypothesis, arguing that reduced visual and auditory cues in the Internet can alleviate the social anxiety that introverted people experience and *stimulate* them to develop positive relationships with others (Subrahmanyan, Smahel, & Greenfield, 2006; Tajfel, 1978).

As with the research of introvert and extrovert in online communication, studies on personality traits including psychoticism, neuroticism, and etc. have also drawn the attention of researchers. Psychoticism, according to Eysenck and Eysenck (1964), refers to people who are impulsive, hostile, and creative whereas neuroticism includes those who are shy, anxious, and depressed. Anolli et al. (2005) studied the impacts of neuroticism on individuals' online behavior and found a significant correlation between neuroticism and age in terms of online chatting, with similar findings for psychoticism. Conversely, studies by Bianchi and Phillips (2005) and Madell and Muncer (2007) found that neuroticism was negatively related to web usage such as online chat since neurotic people are often overly sensitive and would resist to sensitive talk posted anonymously (also see McKenna & Bargh, 2000). Both studies excluded neuroticism as a factor for influencing individuals' behaviors in online communication. Obviously, research on online communication pertaining to cognitive styles is inconclusive. Evidence from recent research indicates that further study is needed to better understand the relationship between learners' online communication behavior and their cognitive styles (Peter et al., 2005).

Peter et al. (2005) studied online social communication and behavior. Drawing from a sample of 412 Dutch adolescents, the authors found that the motives of social compensation, along with entertainment and meeting with people, increased adolescents' online communication with strangers. Interestingly, they found no correlation between introversion and adolescents' tendency to talk, a finding that ran counter to the results obtained by Chak and Leung (2004) and Widyanto and McMurran (2004). So far, research on social compensation and cognitive styles in online communication has been limited to Eysenck and Eysenck's framework that focuses on psychoticism, neuroticism, introversion, and extroversion. Few studies have been conducted to explore the relationship between social compensation and FD/FI cognitive styles in online learning. Since FD/FI represent robust cognitive styles related to learning (Witkin et al., 1977), studies on how FD online learners are socially compensated by their counterparts and vice versa would provide important information about as well as new perspectives on learners' online social communication patterns and behavior, thus enabling instructional designers and educators to design and develop strategies and methods that are effective for online learning.

THE STUDY

To understand how FD/FI cognitive styles and other related variables influence learners' online social communication and behavior, and how FD/FI learners differ in their social communication, a study was conducted with the research questions formulated based on the above literature. The specific research questions pertaining to this study are:

1. Is there a difference in performance between FD and FI learners in online discussion?
2. Is there a correlation between cognitive style and related factors such as self-confidence, support, interest, and motivation?
3. Is there a difference between FD and FI learners in terms of postings?
4. Is there a difference between FD and FI learners in terms of computer skills and online chat experience?

Description of the Study

Twenty seven undergraduate students were recruited from a teaching education program in a research I university in the western part of the United States. Participants registered for non-online courses with an on-online component (WebCT) where the online discussion was part of regular course requirements. Participants were asked to (a) complete a demographic questionnaire that collects information about gender, age, etc. and (b) take the Group Embedded Figures Test (GEFT) which measures field dependent (FD) and field independent (FI) learners (Oltman, Raskin, & Witkin, 2003). They then joined in an online discussion forum and were assigned to seven discussion topics over a period of 14 weeks during which time period they (1) self-posted their own comments and (2) critiqued other participants' comments. At the end of the study participants were asked to take a survey of online discussion.

About 15 percent of the participants (n = 4) were males and 85 percent were females. A majority of them (n = 20) were under age 25 with two between the age of 26-35, two between 36-45, and one over 45. About 26 percent (n = 7) reported having excellent computer skills, 63 percent (n = 17) having good computer skills, and 11 percent (n = 3) having poor computer skills. With regard to online chat experience, 85 percent (n = 23) reported having been involved in online discussion, and 15 percent (n = 4) reported having no experience at all. Of 27 participants, 17 reported having home access, 2 having work access, and 8 having campus access.

Instrumentation

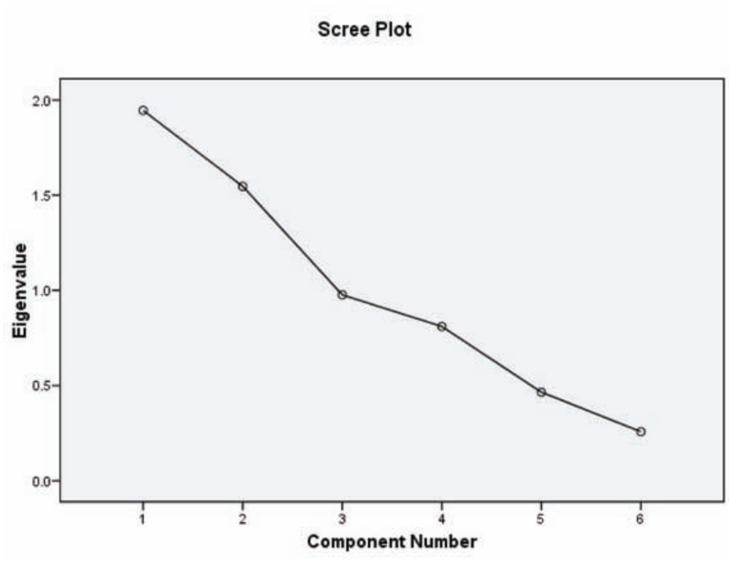
Group Embedded Figure Test (GEFT)

The GEFT was developed by Oltman et al. (2003). The test is designed to measure learners' perceptual ability. It consists of three sections with second and third sections being counted as valid GEFT test scores. The first section is not scored but can be used as reference for the final GEFT scores. Participants were provided with a sample form sheet that has eight sample figures. They were required to identify the embedded figure in the test item that matches one of the figures in the sample form. It took about 12 minutes to complete the entire test. The total possible score for the test is 18 points. A moderate-to-high reliability was reported for college students with a Cronbach alpha of .85 and .79 for males and females respectively.

Online Discussion Study Survey (ODSS)

The survey was developed by the first author based on social cognitive theories (Bandura, 1993); motivation (Keller, 1987); and social compensation (Peter et al., 2005; Valkenburg & Peter, 2007). The instrument contain ten items with items 1 and 10 probing into students' motivation, 3 and 9 for values, 5 and 6 for social compensation, 2

Figure 1. Scree plot for factors related to ODSS



for self-confidence, and 4 for social support. The instrument was reviewed by a panel of experts who have used online social communication tools in their instruction. Feedback from the panel members was carefully considered to further revise the survey. The survey uses a 5-point Likert scale with *Strongly disagree/Very low* = 1 and *Strongly agree/Very high* = 5 (Appendix I). The factor analysis was conducted to identify the factors related to ODSS. Figure 1 shows the scree plot of six factors. Three valid factors were extracted based on the criteria of (1) factor loading greater .40 (Hair, Anderson, Tatham, & Black, 1998) and (2) eigenvalue greater than 1. The factors and variances are presented in Figure 2. The instrument reports a medium inter-item reliability with Cronbach Alpha = .79.

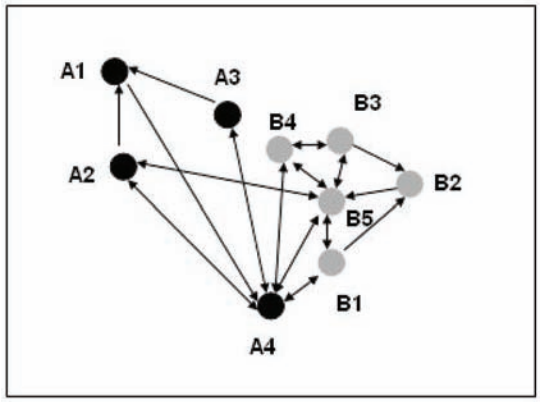
Methodology

Several methods were employed pertaining to the research questions previously proposed. They

Figure 2. Factors and variances related to ODSS

	Component					
	1	2	3	4	5	6
Self-confidence	.767	-.468	.205	-.049	-.342	.176
Support	.760	.364	-.443	-.004	-.177	-.249
Motivation	.125	.766	.112	.598	-.060	.154
Interest	.450	-.025	.856	.117	.144	-.173
Complementary Personality	.439	.594	.094	-.634	.160	.133
Value	.710	-.371	-.368	.270	.380	.076
Eigenvalue	1.874	1.464	.965	.784	.492	.421
% of Variance	31.238	24.395	16.090	13.073	8.195	7.009

Figure 3. Sample of sociogram representing nodes and arcs



include social network analysis (SNA), correlation and t-test analyses.

Social Network Analysis

According to Willging (2007), SNA is widely used to analyze participation, interaction, and learning in asynchronous online discussions. It provided important applications for organizational behavior, inter-organizational relations, social support, and so forth. Although traditional statistical approach has been predominately used to analyze the behavior of online performance and learning, such an approach often emphasizes linear causal relationship while overlooking the structural characteristics of the interactions. SNA has been applied to a variety of problems, and they have been successful in uncovering relationships not seen with any other traditional methods.

As was mentioned above, SNA tried to unveil the patterns of people's behavioral interaction. SNA measures many structural characteristics of the network such as the existence of subgroups, the relative importance of individuals which are called actors or nodes, and the strength of the links between actors or nodes (Wasserman & Faust, 1994; Willging, 2007). While providing a complete treatment of the SNA methodology is out of the reach of this chapter, some basic definitions are needed to conceptualize the SNA. The following discussion focuses on key concepts pertinent to SNA (See Appendix II for a SNA vocabulary list).

Components of SNA. The component of SNA consists of a set of nodes and arcs, a sociogram, and a sociomatrix. The nodes which are otherwise called actors can be persons, organizations, or groups. The arcs are the relationships between the nodes. Their strength is measured by the distance between the nodes. The shorter the distance is between the nodes, the stronger the relationship will be. The sociogram is actually a graphic that visually represents the relationships among the nodes. It provides a diagram where researchers can analyze the patterns of group behavior. Finally, the sociomatrix or adjacency matrix delineates the relationship between nodes through a mathematical representation in the form of a matrix (Hanneman & Riddle, 2005). Figure 3 provides an example of SNA in which the relationships between nodes and arcs are presented in a sociogram.

Figure 3 shows two subgroups with dark nodes representing group A and light nodes representing group B. The relationships among the nodes are defined by the arcs (i.e., links). Group B shows a close relationship among the individuals due to the immediate distance among the nodes. In contrast, individuals in group A are less closely connected due to the remote distance among the nodes. Individual A4 plays a mediating role that connects group A and group B.

Density, centrality, and cohesion. In analyzing group social interaction the concepts of density, centrality, and cohesion are critical in explaining how individuals respond and react to people around them. The density of interaction in a social network means the proportion of all possible ties that are actually present. It is calculated as the sum of ties divided by the number of possible ties. Hanneman and Riddle (2005) noted that density is closely related to the power in a network system. According to Hanneman and Riddle (2005), the power is defined as the number of incoming and outgoing ties of the nodes, which is also known as the communication power among nodes. In a system that has low density, usually not much power can be exerted. Conversely, in high density systems there is a potential for greater power.

The concept of centrality describes how a particular focal node is related to other nodes. This is defined in terms of in- and out-degree of a node. That is, a node that has many ties may have access to (out-degree), and be accessed by other nodes (in-degree) in the network. For example, both A4 and B5 in Figure 1 have high in- and out-degree and are thus considered influential nodes. So, a very simple, but often very effective measure of a node's centrality and power potential is its in- and out-degree (Willging, 2007). Of particular interest to researchers is the betweenness of a node. That is, the intermediatory role that a node plays between groups of points. For example, A4 has a high level of betweenness. If B1 wants to access A2 or A3, it has to go through A4.

The concept of cohesion refers to the homogeneity of the subgroups or network. It is measured by the density, reciprocity, and Geodesic distances among the nodes (Hanneman & Riddle, 2005). The reciprocity ranges from 0 to 1, with 0 indicating minimum reciprocity and 1 maximum reciprocity. In a social network high symmetric reciprocity among the nodes indicates high degree of cohesiveness among the participants. Finally, the Geodesic distance is indexed by a distance-based cohesion ("compactness") which ranges between 0 and 1 with larger values showing greater cohesiveness.

Data Scoring and Encoding

For the purpose of t-test analyses behavioral data were obtained which included learners' performance in both online postings: self-posting and critiquing. They were scored by two researchers using a rubric with numeric values ranging from 1 = *poor performance* to 5 = *excellent performance*. The data were used to analyze participants' performance in online discussion.

Next, the SNA data encoding was performed. The encoding process focused on the presence of critiquing postings. For example, if participant A critiques participants B and C's viewpoints, he/she gets one point for each. If participant B critiques participant C but not A, he/she gets only one point. Then each participant was matched with his/her cognitive profile based on the results of GEFT test. The data were entered in the UCINET software (Borgatti, Everett, & Freeman, 2002) to create a matrix for social network analysis.

Results and Analysis

Records of online asynchronous discussions which were kept and archived in an online learning system (WebCT) were retrieved by the researchers for data analysis. A total of 541 online discussion messages were retrieved which were generated over a period of 14 weeks. The data were coded with a combination of letters and numbers to protect the anonymity of participants.

Specifically, the researchers were interested in finding out how FD and FI participants differed in online communication. To answer the above question, the SNA was employed to analyze the participants' behavior in online communication.

Figure 4. Sociomatrix for FD and FI online participants

```
NETWORK BLOCK DENSITIES
--------------------------------------------------------------------
Method:                         Average
Input dataset:                  N:\Cog-emotion-web\revision\online

                              1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2
            1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
            F F F F F F F F F F F F F F F F F F F F F F F F F
           ---------------------------------------------------
  1   FI1 | 1 1 1 1   1 1   1   1   1 1 1 1   1   1   1     1 |
  2   FI2 | 1 1   1   1 1   1   1   1   1 1           1 1   1 |
  3   FD1 |     1         1     1 1   1     1     1       1 1 |
  4   FI3 |       1 1 1 1                 1   1               |
  5   FD2 | 1 1   1 1 1 1     1 1         1   1               |
  6   FD3 | 1 1   1 1 1 1     1 1         1   1               |
  7   FI4 |       1 1 1 1                 1   1               |
  8   FD4 | 1 1 1                 1   1     1     1       1   |
  9   FI5 |       1     1       1   1 1 1 1           1 1   1 |
 10   FI6 |       1     1                 1   1               |
 11   FI7 |     1         1     1 1         1     1       1 1 |
 12   FD5 |     1         1     1 1   1     1     1       1 1 |
 13   FI8 | 1 1     1 1             1   1       1   1 1 1   1 |
 14   FI9 |     1     1   1     1           1     1       1 1 |
 15  FI10 |                         1   1       1   1 1 1     |
 16   FD6 | 1 1   1 1 1 1     1 1         1   1               |
 17   FD7 | 1 1 1         1     1 1   1     1     1       1 1 |
 18   FD8 |             1                 1   1               |
 19  FI11 | 1 1       1 1           1   1   1   1   1 1 1     |
 20  FI12 |     1         1     1 1   1     1               1 1 |
 21   FD9 | 1 1                     1           1   1 1 1 1   |
 22  FI13 |                         1   1       1   1 1 1     |
 23  FD10 | 1 1                 1   1   1       1   1 1 1 1   |
 24  FD11 |     1         1     1 1         1     1       1 1 |
 25  FI14 |     1 1 1     1     1 1   1     1     1       1   |
           ---------------------------------------------------

Reduced BlockMatrix

         1
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  1    0.333

Use DICHOTOMIZE procedure to get binary image matrix.
Reduced blockmodels saved as dataset Blocked
Actor-by-actor pre-image matrix saved as dataset PreImage
```
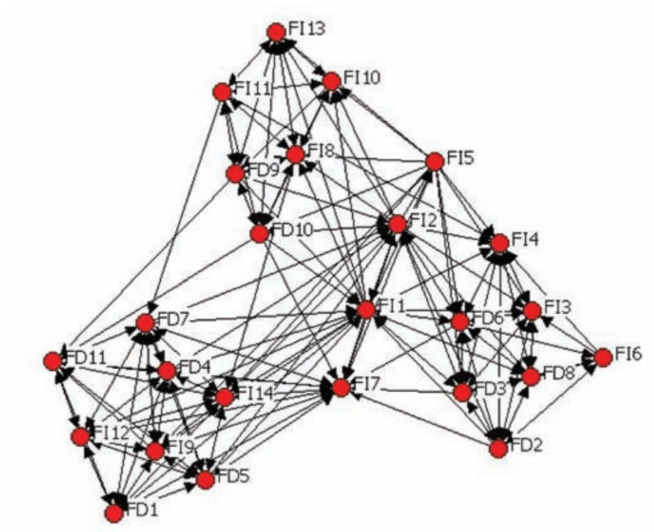

Results of SNA

The SNA analysis was performed with the UCINET software (Borgatti, Everett, & Freeman, 2002). A sociomatrix is presented in Figure 4 which delineates the social communication relationships between FD and FI learners in an asynchronous online forum. Based on the above results, a sociogram was created to display the relationship among members in online social community. Three social groups were formed as the result of the SNA analysis. Figure 3 indicates that FD and FI learners were distinctly separated into three groups generated by the UCINET software based on the input data. The sociogram identified focal actors (e.g., FI14, FI9, FI8, FI1, FI2, FI3, FI4, FD4, and FD6) who played a prominent role in organizing the group and implementing the online discussion, which was evidenced by the number of incoming and outgoing ties in the social groups.

Next, analyses on density, centrality, and cohesion of participants' online social communication were performed. Results showed a high degree of density (=.72), which means 72% of all possible ties are present. The analysis of geodesic distance revealed a moderate distance-based cohesion (= .609) which showed moderate-high cohesiveness among the members in the social

Figure 5. Sociogram for FD and FI online participants



network. The results showed that FI participants in general played a leading role in online social communication when online discussion involved critiquing and challenging others. In contrast, FD participants seemed to rely on the initiation of FI participants while engaging in online discussion (see Figure 5).

The tests of centrality, reciprocity, closeness (in- and out-closeness) and betweenness were conducted to explore the strength of social communication among the members. The Freeman's degree centrality analysis reported a mean degree of 10.4 (SD = 3.262). Results showed that focal actors (e.g., FI14, FI9, FI8, FI1, FI2, FI3, FI4, FD4, and FD6) played a central role in organizing and keeping the members together in online discussion (see Figure 6). They were prominent actors to whom many other actors sought to direct ties. The finding is further supported by the high reciprocity between the focal actors and their constituent members. As indicated, high reciprocity means high degree of cohesiveness among the participants.

To find out how participants responded to each other in online communication, the test of closeness was run which identified the incoming and outgoing ties of the participants. There was a consistency across the centrality, reciprocity, closeness (in-closeness and out-closeness) for the FI participants. That is, FI participants (e.g., FI14, FI9, FI8, FI1, FI2, and FI3) who scored high on centrality and reciprocity also scored high on closeness. They received more incoming and outgoing ties in social communication than did FD participants (see Table 4). However, FD participants (e.g., FD4 and FD6) who scored high on in-closeness did not score as high on out-closeness. This suggests that FD participants who did well on receiving incoming ties failed to reach out successfully to others. In this study both FD and FI participants received the same support in online discussion. However, due to their heavy reliance on external conditions/support, FD students needed more support than did their counterparts. Thus, it is possible that inadequate support led FD participants to fail to reach out to other participants in online communication. Finally, the results of betweenness indicated that FI participants played a critical role in mediating the group discussions. This is shown in Figure 3 in which FI1, FI2, FI5, and FI7 mediated between the participants from three discussion groups.

Figure 6. Centrality, reciprocity, closeness, and betweenness of social communication among online participants

	Degree	Symmetric reciprocity	incloseness	outcloseness	betweenness
FI14	21.000	0.890	71.538	57.268	55.252
FI9	18.000	0.778	70.533	50.233	42.743
FI8	15.000	0.801	70.000	51.475	45.998
FI1	14.000	0.752	61.538	59.833	58.817
FI2	14.000	0.821	56.762	66.894	67.046
FI3	13.000	0.700	67.143	50.248	53.550
FI4	13.000	0.831	62.158	40.419	46.368
FI10	12.000	0.652	68.588	42.523	31.010
FI12	11.000	0.750	71.538	41.963	33.978
FD4	11.000	0.735	55.338	34.384	45.143
FD6	10.000	0.883	63.158	51.201	49.548
FI11	10.000	0.581	57.143	61.064	35.856
FI7	10.000	0.864	60.588	60.198	52.547
FI6	10.000	0.542	67.588	40.552	25.230
FI13	10.000	0.521	68.538	42.257	21.176
FD7	9.000	0.768	58.537	37.546	44.598
FD3	9.000	0.654	70.588	35.870	29.548
FD8	9.000	0.734	61.538	41.402	20.303
FI5	8.000	0.544	61.538	58.421	35.912
FD5	8.000	0.765	68.571	37.565	27.250
FD9	8.000	0.687	64.865	35.148	15.300
FD11	8.000	0.641	61.538	40.229	9.336
FD10	7.000	0.648	45.283	38.030	27.001
FD1	7.000	0.458	45.283	41.987	1.987
FD2	6.000	0.434	50.000	46.290	17.241

Correlation Analysis

To answer research question two, a correlation analysis was performed with SPSS version 14.0. The following variables were entered for the correlation analysis. They are self-confidence, personal support, motivation, interest, complementary personality, and FDFI type. The results showed that motivation was significantly correlated with personal support ($r = .584$, $p < .01$), interest was significantly correlated with personal support ($r = .440$, $p < .05$) and motivation ($r = .530$, $p < .01$), complementary personality was significantly correlated with interest ($r = .445$, $p < .05$) and motivation ($r = .592$, $p < .01$), and value was significantly correlated with personal support ($r = .564$, $p < .01$), motivation ($r = .793$, $p < .01$), interest ($r = .487$, $p < .05$) and complementary personality ($r = .432$, $p < .05$). The correlations of FDFI with other variables were not significant. However, a marginal significant correlation was observed between FDFI and complementary personality (r = .361, p = .058) (Figure 7). This suggests that FD and FI learners perceived complementary personality as a contributing factor to the formation of online social community, which is consistent with the social compensation theory that posits people with different personalities and interests tend to draw toward each other as a gesture of social compensation. The finding is supported by the social communication pattern generated by the above SNA analyses where people with opposite cognitive styles worked closely together in online learning environment (see Figure 3).

Figure 7. Correlation analysis

	1	2	3	4	5	6	7
Self-confidence	-						
Personal Support	-	-					
Motivation	-	**	-				
Interest	-	*	**	-			
Complementary Personality	-	-	*	**	-		
Value	-	**	**	*	*	-	
FD-I	-	-	-	-	-	-	-

** Correlation is significant at 0.01 level (2-tailed)
* Correction is significant at 0.05 level (2-tailed)

t-Test Analyses

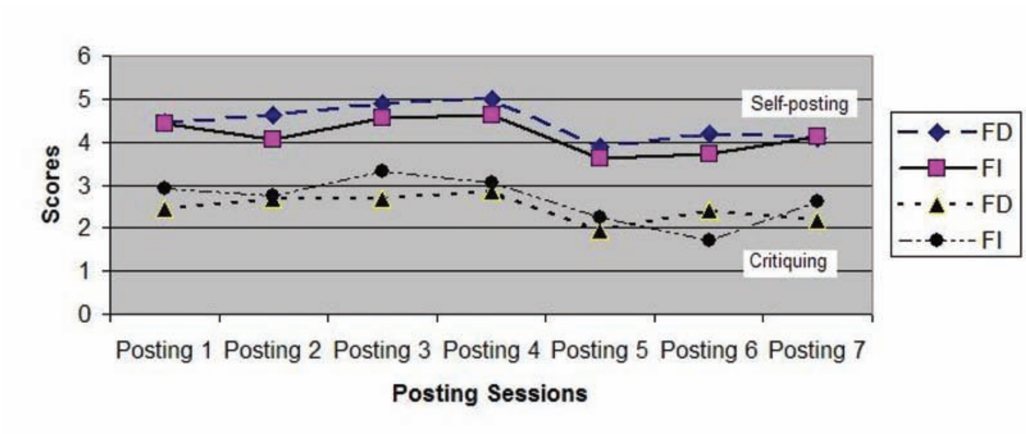
Research question three asked whether there was a difference in performance between FD and FI learners with regard to online postings. The independent variable which consists of two levels, that is, FD and FI learners was created based on the results of the GEFT test. The dependent variables which included self-posting and critiquing were obtained based on participants' performance scores. A *t* test was conducted. The means and standard deviations for online postings are reported as follows (see Figure 8).

Given the small sample size, the results of *t* test showed no significant difference between FD and FI learners in self-posting (t (25) = .875, p = .441) and critiquing (t (25) = -.438, p = .666). However, there was an interesting trend that differentiated FD learners from FI learners in terms of self-posting and critiquing others' messages. Figure 9 demonstrates that FD learners in general outperformed FI learners in self-posting, but didn't perform as well in critiquing. This finding is aligned with the literature that FD learners usually do well in a learning that provides structural support with salient cues. In self-posting, learning is structured around the topics. Therefore, FD learners were able to pick up the cues more easily in their learning. However, in critiquing, learning is dependent on learners' abilities to discern differences in viewpoints, organize relevant resources and develop abstract critical thinking

Figure 8. Descriptive Statistics for FD and FI Learners in self-posting and critiquing messages

		Postings						
	Field Type	1	2	3	4	5	6	7
Self Posting	FD	4.45 (1.50)	4.63 (0.67)	4.91 (0.30)	5.00 (0.94)	3.90 (1.04)	4.18 (1.40)	4.09 (1.57)
	FI	4.44 (0.36)	4.06 (0.34)	4.56 (0.26)	4.62 (0.25)	3.62 (0.70)	3.73 (1.83)	4.13 (1.72)
Critiquing	FD	2.45 (1.25)	2.68 (1.47)	2.68 (0.78)	2.86 (1.45)	1.95 (1.21)	2.40 (1.60)	2.18 (1.48)
	FI	2.93 (0.26)	2.75 (0.50)	3.31 (0.11)	3.06 (0.27)	2.25 (0.65)	1.70 (1.42)	2.63 (1.67)

Figure 9. FD and FI learners' performance chart



skills. Simply providing a structure with topics will not suffice as FD learners need

Research question 4 probes into the differences between FD and FI participants in terms of their computer skills and online chat experience. The t-test results revealed a significant difference between FD and FI participants for computer skills (t (25) = 2.714, p = .012) and a marginal significance for online chat experience (t (25) = -2.010, p = .055).

DISCUSSIONS AND CONCLUSION

Different from traditional learning environment, online learning can become quite challenging to both instructors and learners, partly because the learning cues that are observable in traditional classroom become non-existent in online learning, and partly because people often take with them the same traditional teaching and learning paradigms or even the same mentality as they move onto online environment (Zheng, 2006; Zheng & Ferris, 2007). The results of this study indicate that online learning should be designed differently from traditional learning. The following discussion will therefore focus on the important aspects of online instructional design with regard to cognitive styles, learning support, and critical factors related to the success of online learning.

Role of Cognitive Styles in Online Learning

The findings of the study show that cognitive styles can significantly impact learners' social communication and behavior in learning. The SNA revealed a consistent pattern across three online discussion groups where FD and FI learners collaborated in online learning (see Figure 3). According to social compensation theory, discrepancy among individual abilities created optimal conditions for mutual influence and resonance (Stroebe et al., 1996). Research in online communication supports the above conclusion, showing a strong correlation between individual differences and patterns of communication in an online environment (Chak & Leung, 2004; Widyanto & McMurran, 2004).

There is a difference between FD and FI learners with respect to their roles in online community. It appears that FI learners were more active in initiating discussions and had more in- and out-connections among group members. This is especially true when learning involved critiquing others' viewpoints, in which critical thinking skills were demanded. Based on the findings of the study, it is suggested that the design of online instruction should put cognitive styles in perspective, particularly when the design involves developing and promoting high level thinking skills.

Learning Support for FD and FI Learners

When designing instruction to develop learners' critical thinking skills, it is essential that such instruction include adequate support for FD and FI learners. Results from the study showed that FD learners need clear instructional directions and salient cues in learning. This is consistent with the literature pertinent to the instructional conditions for FD learners. The study found that the FD learners performed less well when they engaged in learning activities that required them to critique others' messages than when they self-posted the messages (see Table 6 and Figure 4). The difference in FD learners' performances for two learning tasks was most likely due to (1) a change in the task demand, i.e., moving from posting messages to critiquing others' messages, and (2) a lack of support to match the task demand. For FD learners, providing support such as giving detailed steps, multiple cues, embedding questions, including an advance organizer, etc. would help them succeed in learning. Likewise, providing abundant content resources, employing inquiry and discovery methods, encouraging self-initiated questions, etc. would give FI learners the kind of support they need to be successful in online learning.

Factors for Successful Online Learning

As discussed above, cognitive styles and learning support are important in online learning. However, based on the findings of the study, other factors like complementary personality, interest, motivation, support and value have shown to be significantly correlated in online learning (see Table 6). Factors like complementary personality, support and value are significantly correlated with interest and motivation – the two most important factors in learning. Additionally, computer skills and online chat experience were seen to influence learners with different cognitive styles. Effective utilization of these factors to leverage online social learning is important for teachers and online trainers.

One of the messages that online instructional designers can probably carry home from this finding is that designers should examine the roles and function of complementary personality, support and value as they design and develop instruction to get learners interested and motivated in online learning. It is thus suggested that online research should encompass a larger context in which cognitive styles, motivation, interest, learning support, value, and so forth are examined to better understand the factors contributing to the success of online learning.

Limitations of the Study

There are several limitations to the study. Firstly, the small sample size affected the statistical power in t-test analysis which explained the reason why no significance was found for self-posted and critiquing postings. Secondly, the population was limited to one university with primarily educational major students. This could affect the generalizablity of the findings. However, this was a pilot study that would hopefully lead toward a series of more in-depth studies in this area. In fact, the initial findings have already pointed to the need of developing effective instructional intervention to mitigate the difference between FD and FI learners' abilities in critiquing and challenging other people's viewpoints.

In conclusion, this study has provided initial evidence that social compensation is shown to be one of the factors that accounts for the social communication pattern among learners with different cognitive styles. It also shows that other factors such as interest, motivation, support, value as well as learners' computer skills and online chat experience may play important roles in influencing FD and FI learners in online social communication. Results indicate that adequate support is essential for FD learners to obtain positive experience in online learning. It is suggested that future studies should investigate the role of support and its design mechanism so that both FD and FI learners can benefit from this unique form of learning.

ACKNOWLEDGMENT

This project was supported in part by a grant from the Utah State Commission on Criminal and Juvenile Justice and the Center for the Advancement of Technology in Education, College of Education, University of Utah.

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APPENDIX A

Online Discussion Study Survey

Please circle one of the following that mostly reflects your experience of web-based learning. (Table 2)

Table 2.

Items	1	2	3	4	5
1. The online discussion mode can motivate learners to engage in meaningful learning.	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
2. When I was discussing online with other people, my level of self-confidence was	Very low	Low	Don't know	High	Very high
3. The online discussion is an effective tool for social communication	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
4. The online discussion builds up positive support among students	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
5. The rule of complementary personality applies to online discussion as people like to hang around with those of opposite personality	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
6. The rule of congeniality works in online discussion because people like to hang around with those of similar personality	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
7. The rule of complementary personality applies to online discussion as people hang around with those of different interest	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
8. The rule of congeniality works in online discussion as people like to hang around with those of similar interest	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
9. Individuals would be likely to retain in online discussion if they value what they have learned in online	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree
10. Individuals would be likely to retain in online discussion if they are motivated by what have learned in online	Strongly Disagree	Disagree	Don't Know	Agree	Strongly Agree

Appendix B

Vocabulary list for SNA Analysis

Arcs: Arcs are the relationships between the nodes. Their strength is measured by the distance between the nodes. The shorter the distance is between the nodes, the stronger the relationship will be.

Betweenness: Betweenness of a node refers to the intermediatory role that a node plays between groups of points.

Centrality: Centrality describes how a particular focal node is related to other nodes. This is defined in terms of in- and out-degree of a node. That is, a node that has many ties may have access to (out-degree), and be accessed by other nodes (in-degree) in the network. A very simple, but often very effective measure of a node's centrality and power potential is its in- and out-degree.

Cohesion: Cohesion refers to the homogeneity of the subgroups or network. It is measured by the density, reciprocity, and Geodesic distances among the nodes. Reciprocity ranges from 0 to 1, with 0 indicating minimum reciprocity and 1 maximum reciprocity. In a social network high symmetric reciprocity among the nodes indicates high degree of cohesiveness among the participants. Finally, the Geodesic distance is indexed by a distance-based cohesion ("compactness") which ranges between 0 and 1 with larger values showing greater cohesiveness.

Density: Density of interaction in a social network means the proportion of all possible ties that are actually present. It is calculated as the sum of ties divided by the number of possible ties. Density is closely related to the power in a network system which is defined as the number of incoming and outgoing ties of the nodes, which is also known as the communication power among nodes. In a system that has low density, usually not much power can be exerted. Conversely, in high density systems there is a potential for greater power.

Nodes: Nodes which are otherwise called actors can be persons, organizations, or groups.

Sociogram: Sociogram is actually a graphic that visually represents the relationships among the nodes. It provides a diagram where researchers can analyze the patterns of group behavior.

Sociomatrix: Sociomatrix or adjacency matrix delineates the relationship between nodes through a mathematical representation in the form of a matrix.

Section VI
Managerial Impact

This section presents contemporary coverage of the managerial implications of social computing. Particular contributions address the importance of guarding corporate data from social engineering attacks and explore a professional social network system. The managerial research provided in this section allows executives, practitioners, and researchers to gain a better sense of how social computing can impact and inform practices and behavior.

Chapter 6.1

Exploring a Professional Social Network System to Support Learning in the Workplace

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ABSTRACT

This chapter sets out to explore how professionals can network, collaborate and capture informal learning in an online work-based environment. It addresses the pedagogical approaches that underpin emerging Web 2.0 technological trends and provide recommendations for future use of such online environments. Existing Virtual Learning Environments (VLEs) are primarily content driven with little provision for social engagement and stakeholder-generated material. Similarly, many organisations have little or no structure for facilitating online interaction in a work based learning context. Since 2006 Emerald Group Publishing and the Middlesex Centre for Excellence in Work Based Learning have been partnering to develop, test and implement an online platform that will support collaborative, interactive learning. This link between Industry and Higher Education is critically reviewed. The InTouch (2008) platform was incorporated into the syllabus for MCEWBL's work-based Professional Practice BA Honours programme in 2007 to support newly trained professionals as they worked through a professional development work based learning programme. The pedagogical underpinning of the course was reflective, self-directed learning and the blog, Wiki and profiling tools provided had the potential to either contribute to this aim or become a major part of how students construct their understanding of themselves in their professional practice. Emerald and MCEWBL have been monitoring the adoption, use and challenges associated with using Web 2.0 technology to support work based learning in order make recommendations about future pedagogical frameworks and approaches. This platform and related online pedagogic principles fills the gap between informal, free tools that provide little security or structure and heavyweight VLEs that offer tutor-made content, but do not naturally support social interaction for learning. The chapter provides some ideas and strategic options about implementing

DOI: 10.4018/978-1-60566-272-5.ch001

similar tools in other organisational settings and provides frameworks to evaluate these options in line with existing resources and capabilities. It concludes with an in-progress web-based learning design or ePedagogy that unifies the threads of the online learning experience.

INTRODUCTION

Middlesex University work based learning (WBL) has been operating for over ten years at the time of this writing. Its original distance learning design was a paper-based correspondence model which relied heavily on the content in the handbooks and one-to-one (1-2-1) tutorial support from WBL Learning Development Tutors predominantly through email and phone feedback. Over the past few years there has been a steady transition into the use of a commercial virtual learning environment (VLE) in the form of Blackboard/WebCT.

At first this system matched the WBL teaching and learning design since there was a strong reliance on the course handbook for information and guidance. However, as student numbers increased the student-teacher ratio meant this model was not sustainable for the future. The 1-2-1 pedagogic model would need to expand into a triad that would promote and support peer involvement. Students were growing in their ICT confidence and capability with the increased use of Web 2.0 social network systems such as Facebook and YouTube. This was evidenced by student representatives at the WBL Board of Studies sighting the need to continue to improve the VLE for the future (BOS, 2007).

Cohorts of WBL candidates identified the need for a shift from a content-driven eLearning system to one which could support the type of peer review that WBL was growing into. The WBL programme structure has three main stages. First, students construct a portfolio of their prior professional knowledge. This Recognition of Accredited learning (RAL or a.k.a. Accreditation of Prior Experiential Learning (APEL)) stage benefited by candidates sharing professional experiences in constructing their areas of learning claims (Armsby, 2006). Next, WBL students would formulate an individual learning agreement that would guide the construction of the degree programme based on how much Higher Education (HE) credit was attained in the RAL stage. In conjunction with this activity they would learn about methods of conducting research in the workplace which would prepare them for the final stage of the degree. Lastly, research systems would be carried out in the workplace to amass enough credit to complete the programme. The nature of this learner-managed-learning approach to WBL meant that as the candidate progressed through the programme peer-support became increasingly beneficial (Stephenson, 2007).

In a work based learning context, then, there can be both a *formal* and *informal learning* scenarios. The traditional formal learning setting might be one of the blended learning tutorial sessions for WBL candidate getting an induction on how to compose a prior learning accreditation portfolio. Here the training pedagogy would be teacher-led and supported by on/offline discussions. But it could be argued that the ‘real learning’ transpired informally after the ‘taught session’. Informally the students may meet to debrief with each other at the café over coffee. There they would compare their interpretation of the learning event which would lead to the formation of learning partnerships. This learning support network would communicate to provide peer-review of draft work for the portfolio. An online system was needed to facilitate this evolving professional social network for practitioner researchers.

It was at a conference at University College London (2006) that a dialogue opened between the MU-WBL group and the Emerald Publishing InTouch contingent. The open source Elgg Social Network platform being developed by Emerald would be the new approach to address these needs.

A university / industry partnership association was also a positive deliverable of this network collaboration. Emerald Publishing had a good test bed and source of evaluation data in the WBL pilot case study group. This is discussed in detail later in the chapter. The Institute for Work Based Learning benefited by having a professional social network to support its learners. Additionally, both groups collaborated in scholarly activity. Co-authored research system proposals were written for JISC (2008) in the UK and the FP7 European Commission (2008).

Another joint effort was seen in international conference publications and poster-demo presentations. The 7th European Conference on e-Learning (2008) held in Cyprus gave both organisations the opportunity to get feedback from the eLearning community and share the services they provide to potential clients. Future collaborations are currently being investigated.

A PROFESSIONAL SOCIAL NETWORK (PSN) APPROACH

A variation of social networking focuses on a professional context which demonstrates how an innovative combination of existing technologies and interoperability standards can be harnessed to support the learning paradigm shift taking place from learning by knowledge transfer to learning by knowledge construction. This next section of the chapter discusses a European Commission (FP7, 2008) project proposal.

The PSN group brings together a range of extant and emerging standards and technologies to provide a next generation platform for Technology Enhanced Learning that will have a significant impact on learning outcomes.

The PSN enables:

- Faster and more effective learning, acquisition of knowledge, competences and skills.
- Unlocking people's and organisations' ability to master knowledge and apply it.
- Increased knowledge worker productivity.
- More efficient organisational learning processes.

System Outcomes

The motivating factor for the technology objectives is not the technology itself but the comprehension and application of specific technology in the service of learning and development.

Our semantically rich PSN platform promotes networked learning by connecting stakeholders in real-time through an agent or 'mentor-help' system. This can be achieved through a combination of technologies and standards, including the Elgg server, RDF (Resource Description Framework), SKOS (Simple Knowledge Organisation System) and FOAF (Friend of a Friend). Interoperability with existing services and standards ensures the long term sustainability of the system. Therefore the PSN, where possible, offers users the ability to search across currently popular network sites using a web services approach – e.g. OpenSocial, OpenID, FaceBook, and Explode.us.

Social and Organisational Learning Objectives

Our initial proposition is that effective learning in a networked society includes the natural discovery of learning resources, contextualised support services (i.e. Mentor-Help) and the mining of personal profiles, opinions and social networks, wherever they are located. Specifically, the system aims to develop a deep understanding of the pedagogies and technologies required to exploit the strategic learning opportunities that a richly connected society offers European businesses, government agencies and academic organisations.

The system also aims to advance the collective understanding of the issues involved in deploying and integrating PSNs in organisational learning infrastructures. This work uncovers reasons for success or failure and asks if these outcomes are related to culture, technology or something else entirely. The findings help inform non-technological strategies for organisations attempting to exploit these new tools to achieve and sustain EU competitive advantages regardless of industry or sector. As such, the system models are scalable and flexible for re-use.

System design should allow for scalability in the provision of adding languages to the system database:

- This would allow real-time text communication in a trans-national fashion.
- Support system can be accessed via mobile interfaces via text and/or voice.
- Feedback from the support system will factor in psychological considerations to match appropriate levels of help to the user making the query.

An intelligent and adaptive support system provides end-users with the resources to engage confidently with the network members and maintain motivation within the online community.

Technology Objectives

The PSN group are developing a next-generation multi-modal, multi-lingual professional social networking platform with the following characteristics:

- **Organisational Design:** Structurally neutral to allow a generic PSN to be deployed to academic, corporate or government organisations.
- **Simple System Design:** Scaleable and portable and easy to deploy technology that requires little or no overhead to existing IT investments.
- **Plug-in Technology Architecture:** Can be flexed in a number of directions to support content and services supporting many subjects/disciplines and industry sectors through the addition or removal of plug-in software modules.
- **Open Standards Compliant:** SKOS, SIOC, FOAF, OpenID, OpenSocial.

Progress Beyond the State-of-the-Art

We can form a common ground of understanding that the '**state of the art'** is *the current stage of development of a practical or technological subject; freq. (esp. in attrib. use) implying the use of the latest techniques in a product or activity* (OED Definition 2008).

In this section we broadly define the 'State of the art' for the key technical and infrastructural and pedagogical components of the system. We refer to both the theory and practice surrounding:

- Social networks
- Semantic web
- Organisational learning models of European SMEs
- Mobile and Multimodal interfaces for social and professional activities via web platforms

Once the state of the art has been defined we proceed to describe how the PSN system moves beyond what is currently the state of the art in order to achieve the goals of the system.

In an attempt to understand the current state of the art, as it relates to the strands of development of the PSN we have carried out an extensive literature and patent review.

Social Networking and the Semantic Web

Social networking web sites fostering the development of explicit ties between individuals as "friends" began to appear in 2002. Sites such as Friendster, Tribe, Flickr the Facebook and

LinkedIn were early examples. Less explicitly based on fostering relationships than, say, online dating sites, these sites nonetheless sought to develop networks or "social circles" of individuals of mutual interest. LinkedIn, for example, seeks to connect potential business partners or prospective employers with potential employers. Flickr connects people according to their mutual interest in photography. And numerous sites offer dating or matchmaking services. Emerald InTouch connects researchers, academics and practitioners concerned with, amongst other things, management theory and practice, publishing, learning and research.

The semantic web, as originally conceived by Tim Berners-Lee, "provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries" (W3C, 2001). Developed using the resource description framework (RDF), it consists of an interlocking set of statements (known as "triples"). "Information is given well-defined meaning, better enabling computers and people to work in cooperation" (Berners-Lee et al., 2001). The semantic web is therefore, a network of statements about resources.

Outside professional and academic circles, arguably the most widespread adoption of the semantic web has been in the use of RSS. RSS, known variously as rich site summary, RDF site summary or really simple syndication, was devised by Netscape in order to allow content publishers to syndicate their content, in the form of headlines and short introductory descriptions, on its My Netscape web site (Downes, 2000). The use of RSS has increased exponentially, and now RSS descriptions (or its closely related cousin, Atom) are used to summarise the contents of hundreds of newspapers and journals, weblogs (including the roughly eight million weblogs hosted collectively by Emerald InTouch, Blogger, Typepad, LiveJournal and Userland), Wikis and more.

Initiatives to represent information about people in RDF or XML have been fewer and demonstrably much less widely used. The HR-XML (Human Resources XML) Consortium has developed a library of schemas "define the data elements for particular HR transactions, as well as options and constraints governing the use of those elements" (HR-XML Consortium, 2005). Customer Information Quality TC, an OASIS specification, remains in formative stages (OASIS, 2005). And the IMS learner information package specification restricts itself to educational use (IMS, 2005). It is probably safe to say that there is no commonly accepted and widely used specification for the description of people and personal information. As suggested above, developments in the semantic web have addressed themselves almost entirely to the description of resources, and in particular, documents.

Outside the professional and academic circles, there have been efforts to represent the relations between persons found in social networks explicitly in XML and RDF. Probably the best known of these is the Friend of a Friend (FOAF) specification (Dumbill, 2002). Explicitly RDF, a FOAF description will include data elements for personal information, such as one's name, e-mail address, web site, and even one's nearest airport. FOAF also allows a person to list in the same document a set of "friends" to whom the individual feels connected. A similar initiative is the XHTML Friends Network (XFN) (GPMG, 2003). XFM involves the use of "rel" attributes within links contained in a blogroll (a "blogroll" is a list of web sites the owner of a Blog will post to indicate readership).

Currently there is little in the way of personal description in the semantic web. The vast majority of XML and RDF specifications identify persons (authors, editors, and the like) with a string rather than with a reference to a resource. And such strings are ambiguous; such strings do not uniquely identify a person (after all, how many people named John Smith are there?) and they do not identify a location where more information may be found (with the result that many specifications require that additional information be contained in the resource description, resulting in, for example, the embedding of VCard information in LOM files).

The Learning Organisation and Networks

A recent benchmark study from Nemertes Research (2007) showed that 83 percent of organisations now consider themselves to be "virtual" with workgroups spread across multiple locations and geographies. The workforce is increasingly mobile. According to Nemertes, fully 91% of company employees do at least some work outside of traditional headquarter locations, and 96 percent use some form of real-time collaboration tools (e.g. IM, Web or audio/video conferencing).

But Nemertes also found that only 43% of global organisations had a mobility strategy (with another 26% currently developing one). Among US and EU based companies, only 35% had a strategy, with another 16% having one in development; thus, almost half of US and EU enterprises have no organisation-wide strategy for supporting the needs of the mobile workforce. Even more noteworthy, only 15% of all organisations interviewed had a specific mobility budget.

Although collaboration is an increasingly vital feature of business life, companies often promote collaboration indiscriminately. Directive mandates to "just collaborate" create confusion and bottlenecks, diminishing organisational effectiveness (Cross et al., 2004). Creating a business case for exploring and creating cooperative workplaces seems to be more fitting. The word cooperative is defined as the engagement in joint economic activity. It also suggests an enterprise may be operated jointly by those who use its facilities or services.

It is also clear however from the following research, and from Nemertes, that the competitive advantages that can be created through the networked relationships formed in the pursuit of learning and training is uneven.

However, co-operation between organisations within markets has long been identified as a factor in economic success and networking between organisations can contribute to stability and reduce uncertainty (Porter, 1990). These networks can evolve over time as 'natural' clustering's of enterprises, or can be 'induced' artificially as a result of interventions like the development of business or science parks.

Table 1. Mobile social networks

Dodgeball	Veeker
ZingKu	Zemble
Groovr	Socialight
Friendstribe	Hobnobster
JuiceCaster	Flagr
Rabble	Twitter
Moblabber	Jambo
Wadja	Nakama
Treemo	

Mobile and MultiModal/ MultiLingual Social Networks for Organisational Learning

A key design requirement of a Professional Social Network is that is should be able to support multiple languages and modalities.

A brief survey of Social Professional networking sites that exhibit mobile characteristics produced list shown in Table 1.

Many of these sites and services offer a simplified location-based service for connecting with friends and groups to coordinate activities and stay in touch and have little impact or relevance to issues of work based or organisational learning.

However new developments centred on the convergence of location based services, social networking and semantic web are underway. Artilium (2008), a US based provider of enhanced mobile communications is leading the way on next

Table 2. Patent summary

Patent registers of the EU, Europe and the US				
'Learning Social Network'	'Learning Social Network'	'Organisational Learning'	Interactive social network'	'Semantic Social Network'
No results	No results	SYSTEM FOR SUPPORTING A VIRTUAL COMMUNITY Inventor: SCHLACK JULIE W (US) Applicant: COMMUNISPACE CORP (US) EC: IPC: G06F3/14; G06F3/14 Publication info: US2007226628 - 2007-09-27	SYSTEM AND METHOD FOR DYNAMICALLY GENERATING AND MANAGING AN ONLINE CONTEXT-DRIVEN INTERACTIVE SOCIAL NETWORK Inventor: REICH ROBERT (US); NEWCOMB PETER (US) Applicant: EC: IPC: G06F15/173; G06F15/16 Publication info: US2007192461 - 2007-08-16	Knowledge discovery agent system and method Inventor: ESTES TIMOTHY W (US) Applicant: EC: G06N5/02K IPC: G06E1/00; G06E1/00 Publication info: US2006112029 - 2006-05-25
			SOCIAL NETWORK-ENABLED INTERACTIVE MEDIA PLAYER Inventor: CRULL ROBERT WAYNE (US); MILLER BILL CODY (US); (+2) Applicant: CATALOG COM INC (US); CRULL ROBERT WAYNE (US); (+3) EC: H04L29/06S8B IPC: G06F15/16; G06F15/16 Publication info: WO2007076072 - 2007-07-05	

generation context-aware services, presence and personalisation in the mobile networking arena and their expertise in this area is acknowledge. The PSN team however believe that many of the characteristics of the Artilium offer can be provided through the applied combination and improved interoperability of the component parts the PSN team bring to the system.

Additional searches through the patent registers of the EU, Europe and the US highlighted some basic work in this area from the private sector.

Standards and Interoperability

The Social Networking phenomenon, as described in the previous section began to appear in 2002. Sites such as Friendster, Tribe, Flickr the Facebook and LinkedIn were early examples. Recently there has emerged a move towards the standardisation of Social Network Profiles in an attempt to manage Access and Identity Management (AIM) and provide more opportunities to connect across networks from LinkedIn, Google, FaceBook and so on. Such a development is often referred to as OpenAPI.

Open API (often referred to as OpenAPI) is a word used to describe sets of technologies that enable websites to interact with each other by using SOAP, JavaScript any other web technology. While its possibilities aren't limited to web-based applications, it's becoming an increasing trend in so-called Web 2.0 applications including social and professional networks. The term API stands for Application programming interface. With the advent of the Facebook Platform, launched June 1st 2007, Facebook incorporated an OpenAPI into its business model.

OpenSocial is currently being developed by Google in conjunction with MySpace and other social networks including Bebo.com Engage.

com, Friendster, hi5, Hyves, imeem, LinkedIn, MySpace, Ning, Oracle, orkut, Plaxo, Salesforce.com, Six Apart, Tianji, Viadeo, and XING. The ultimate goal is for any social website to be able to implement the APIs and host 3rd party social applications. Explode.US is the OpenAPI of the Emerald InTouch platform.

Beyond State of the Art?

The previous section reviewed developments and current capabilities in:

- Social & professional networks
- Semantic web
- Organisational learning
- Mobile and Multimodal Interfaces to social networks
- Standards and interoperability

We identified the key technologies, trends and theories that one should be aware of in any discussion of professional networks, interoperability and organisational learning as seen in Table 3.

Development of a Semantic Web Capability within a Mainstreamed and Practical Platform for Organisational Learning

The links found in the web pages of social networks are instances of what are known as "weak ties". Weak ties are acquaintances that are not part of your closest social circle, and as such have the power to act as a bridge between your social cluster and someone else's (Cervini, 2005).

As matters currently stand, if I conducted a search for "social networking" then probability dictates that I would most likely land on the pages of Tony Karrer, since he is cited in most places I am likely to find through a random search. But Karrer's organisational affiliation and location may be very different from mine; it may also be preferable to find a resource authored by someone who shares my own perspective more closely or is, geographically more convenient. Therefore, it is reasonable to suppose that if I were to search for a resource based on both the properties of the resource and the properties of the author, I would be more likely to find a resource than were I to search for a random author.

Such a search, however, is impossible unless the properties of the author are available in some form (something like a FOAF RDF file), and also importantly, that the properties of the author are connected in an unambiguous way to the resources being sought.

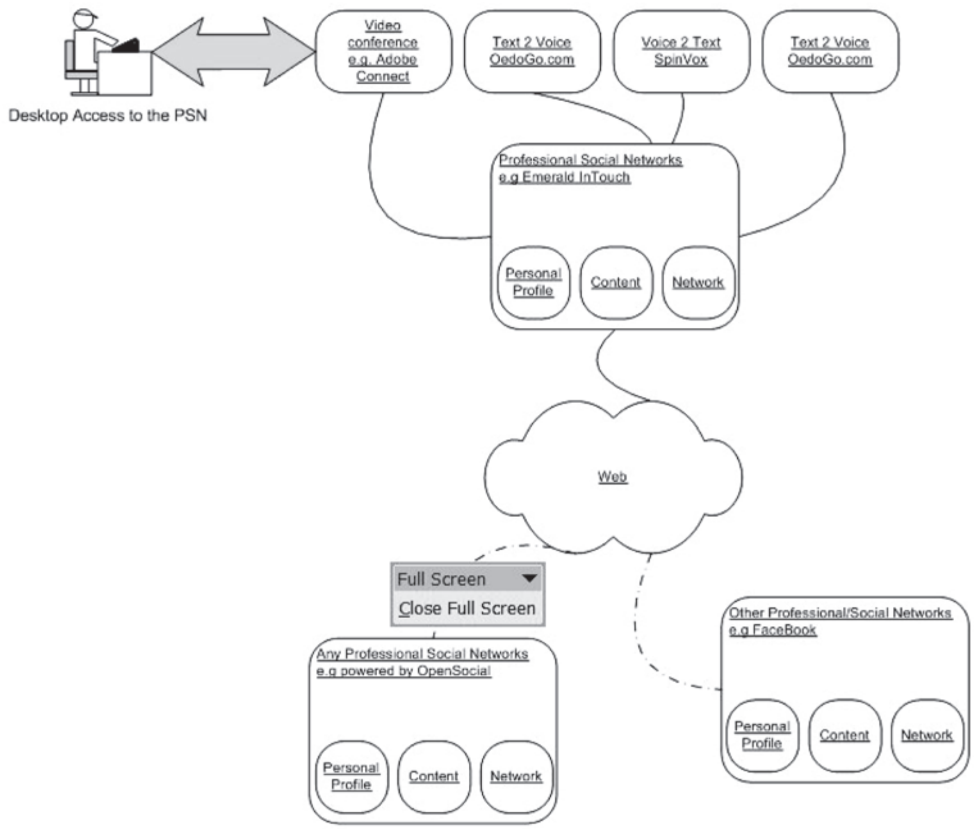
The explicit conjunction of personal information and resource information within the context of a single distributed search system will facilitate much more fine-grained searches and levels of rich interactivity than either system considered separately.

A convergence of these disparate technolo-

Table 3. Professional networks summary

Current State of the Art	Beyond State of the Art
• Social & professional networks • Semantic Web	[1] Development of a Semantic Web capability within a mainstreamed and practical platform for Organisational Learning
• Mobile and Multimodal Interfaces to Social Networks	[2] Multimodal access to a PSN
• Standards and Interoperability	[3] Standards and Interoperability

Figure 1. Current mechanisms for social network interactions and interactive media for organisational learning. ©2008 Basiel & Coyne. Used with permission.



gies brought together in a unified and applied format represents a true step beyond the current state of the art in Professional Social Networks for learning.

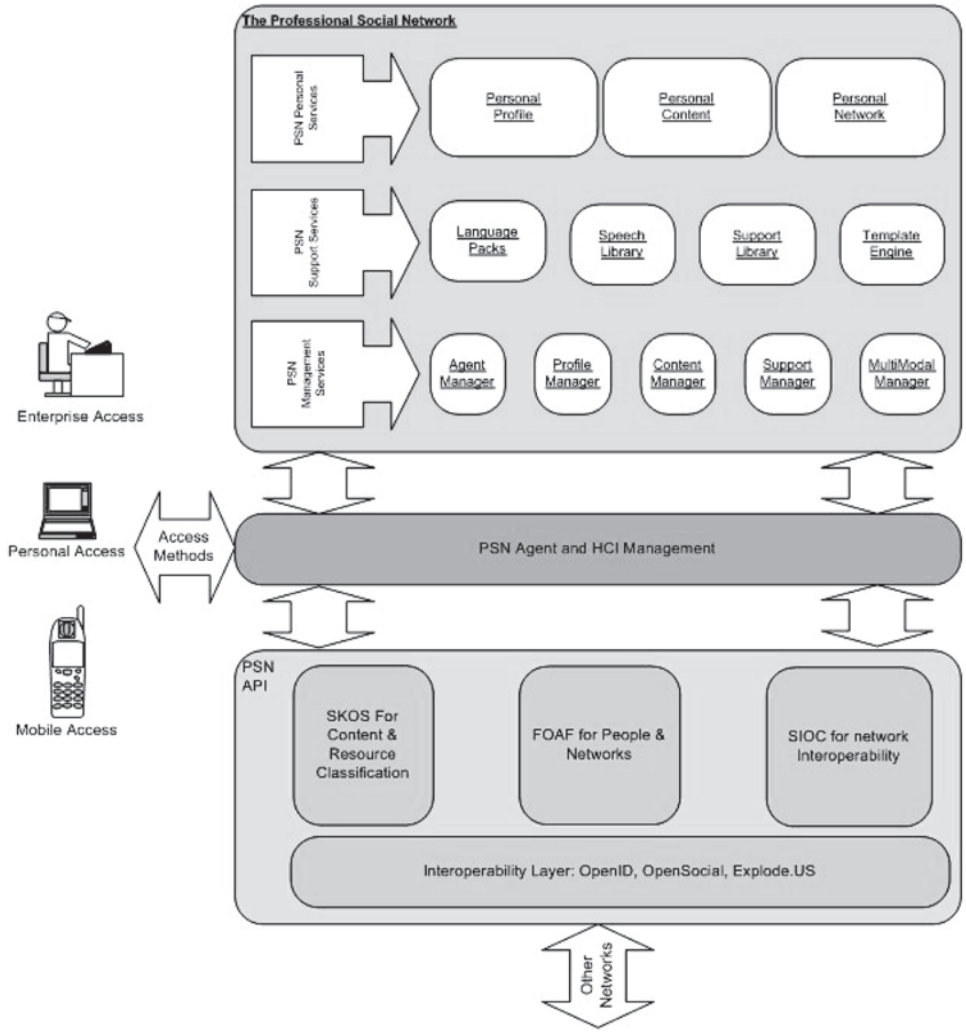
Figure 2 presents a simplified schematic of the PSN. With reference to Figure 1, it is now possible to perceive the step forward in interoperability and the concomitant benefits for personal and organisational learning that the PSN offers.

Mobile and MultiModal Interfaces to Social Networks: The PSN Agent

The PSN agent provides a natural language style interface to the people and resources of the site. By employing 'Call-Centre-like technology' any user will be able to call the PSN and submit a request to the agent facilitating a natural, although remote, interaction with the PSN to discover network human resources and content.

The agent and the PSN platform interact with each other as a direct benefit from the newly developed semantic profiling work provided through the FOAF module and the inclusion of a SKOS conformant ontology. Such interactions allow for complex queries to be made in a natural and language neutral fashion. We believe this represents a step forward in multilingual and Multimodal access to professional social networks.

Figure 2. The PSN Architecture. ©2008 Basiel & Coyne. Used with permission.

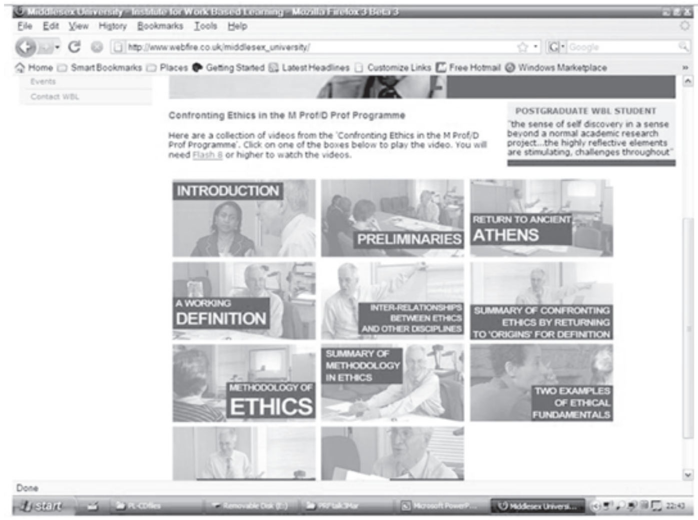


Adoption and Support

The biggest threat to the system is that we have a well designed online Professional Social Network that no one uses. Our answer to this challenge is addressed by our New Media Induction design. First, state of the art of induction and training applies a marketing approach. The pedagogic design of the induction is closer to a movie trailer or television advertisement than the traditional instructional design. Information is provided in smaller chunks with an emphasis on building personal connections as much as learning how to use the system. Next, our blended approach to dissemination is taken to this induction process. A face-to-face session is sandwiched between online sessions to strengthen motivation. Figure 3 shows a collection of short 10 minute digital videos that are used to reinforce the issues addressed in the induction process.

The innovative PSN induction pedagogic design builds on the members' prior knowledge of ICT systems and human networks to apply to our new eLearning environment. Just-in-time/

Figure 3. New Media captioned web video



case pedagogic design appeals to the full-time workplace based learner in our busy knowledge economy.

Standards and Interoperability: The PSN API

The current methods of accessing disparate social and professional networks are limited. However, as mentioned in the previous section, there is much work underway to develop an OpenAPI approach to network connectedness. Mobile and Multimodal access is developing at a variable rate but is limited to leisure and social networks.

The work of the PSN team seeks to build upon the work of the SIOC, SKOS and FOAF working groups and in addition seek to incorporate the work of the OpenSocial and OpenID movements to ensure the long term sustainability and interoperability of the PSN.

The PSN API and in particular the documentation supporting the architectural development work will we believe provide other groups with a solid basis for extending and creating professional and social sites which will be quite different from the PSN but backwards and forwards compatible dues to the adoption and integration of multiple and non-proprietary standards.

CASE STUDY

The following case study explores the use of Emerald InTouch (2008) social network environment where the programme tutor, Alan Durrant, shared his experience:

… I thought about how to use Web 2.0 technology as part of my teaching (and) considered the requirements of learners coming onto the Professional Practice BA Hons. programme. The course is for professional performing arts students (i.e. dancers, musicians or actors) where training has been very hands-on and directed. I wanted to give these students a higher education experience counter to this approach, where they would have to take much more autonomous control over their programme of study. The pedagogical underpinning of this method is reflective, self-directed learning. I wanted to help students develop their career management, critical and reflective skills in order to pursue their career more effectively.

The biggest challenge for the pilot study was that of adoption. Although it was one of the course requirements to use Emerald InTouch, there were mixed levels of usage. Some students regularly posted blogs and updated their profiles, whereas others did not log-on since the induction sessions. Durrant said he "*adopted an approach of strong encouragement"*. As he points out:

there are always going to be questions about how a system like InTouch fits into an academic programme. My feeling is that students are often busy people who may not take time to reflect and will simply do what they need to do to complete the course. So if we want to develop them as reflective practitioners then we have to create situations where they are forced to reflect.

One of the ways to do this would be by replacing assignments with assessment of the effectiveness of a students' contribution to the collective discussions on the blog or the wiki:

This approach may be something we consider at Middlesex, but at present we are starting by creating situations where students must record reflections via InTouch without the assessment imperative. At the start of the course this was very tutor-driven but we are now seeing more peer-to-peer interaction as compared with a lot of e-learning systems. InTouch is very intuitive. However, like any system, you need to use it often enough to feel confident on it. We have found that the students that did not attend the induction session took a long time to understand the system. Next year it will be essential for students to attend the (face-to-face or online) induction where we will carry out a more in-depth introduction to this platform.

Alan's conclusions highlight the importance of a well designed new media induction resource. If you want to use this type of social network system, it is important to identify the value of the new media system induction that can be designed to engage the stakeholders of the Professional Social Network (PSN) System.

As well as student usage, it has also been important to ensure that there are protocols in place for the tutors. Durrant acknowledges that he also had to do some work to ensure complete familiarity with the platform and also to regularly check InTouch for comments and new blog posts as, he asserted, "*There was nothing more demoralising than posting a comment and your tutor does not respond to because they have long since stopped checking the site*." In response the Emerald technical team have added an 'alert tool' to email when changes are made to the system.

Basiel (1999) refers to this accessibility issue as a 'push-pull learning preference'. Some online learners like to go to a website or learning system to engage with the learning resources or communication / collaboration tools. They 'pull' their learning from the system. Others prefer to have prompts sent to them. This may take the form of an email alert or a text SMS message to their phone. This preference may differ for the various functionalities of the VLE. For example, the learner may want to have a text message sent when a new meeting is posted in the online diary, but not get an alert every time someone enters a message on the text discussion board.

This 'media literacy spectrum', as coined by Basiel et. al. (2008) can be observed when developing the learners' profile. Some attributes are summarised in Table 4.

A functionality of the platform was the profiling tool which connected students through shared interests, research areas, courses or via a simple keyword search. According to Durrant, "(this) tool was extremely helpful because students would be coming onto the programme largely, if not completely working at a distance. Keyword linking made instant connections between people with the same interests, a great icebreaker." Campus based induction focused on the profiling tool to allow students to become familiar with the

Table 4. Media literacy spectrum summary

eLearning events	*'Offline students'*	'Millennials' networked learners
Synchronicity	*Asynchronous*	'Live interaction'
Learner age profile	*Mature learner*	Millennium kids
Learning style	*Reflective*	Spontaneous
Learning design	Just-in-case	*Just-in-time*
Learning platform	*Local hard drive*	Server-side & client-side web browser
Mobile applications	*'off network games'*	Bluetooth & Broad band wireless social online games & simulations
Historic perspective	*'90's multimedia stand alone resources'*	'00's new media streaming '
Content source	*Expert generated Content focus*	'Stakeholder generated' Process focus
Revise content	*Slower turn-around on revised materials*	Online revisions more quickly achieved
Push-pull preference	*Tend to go to sources of knowledge*	Tend to have up-to-the-minute information sent

system. Many of the students were already using social software such as Facebook and were more comfortable about uploading information about themselves rather than starting off with some sort of course-related or professional blog.

An instantiation of the success behind the pedagogic design of the system to develop an online community was demonstrated by one of the distant (off-campus) German students inviting a UK colleague to visit over the Christmas holiday. This comradery was fostered through the InTouch online social system design.

SUMMARY DISCUSSION

This chapter has addressed some interesting issues about the evolution of learning from an individual face-to-face context to one of an online professional social network model. We have stressed the importance of examining the underpinning pedagogic designs of the learning systems to guide the appropriate choice of online support tools.

In summary now we provide a critical discourse in the current 'gap in state of the art'. The main issues concerning social networks that are flourishing on the web now focus on the Web 2.0 semantic web design. Present tagging conventions are not adequate to progress the value of the systems forward. Accessibility to multimodal interfaces is improving with mobile systems, but there is a need to adapt and apply pedagogic design principles from this chapter to improve mobile performance. Standards and interoperability is in its early stages with web 1.0 content. More work is needed to synthesise these guidelines to professional social network system.

The case study offered in this chapter provided us with a grounded experience of using a professional social network. Both barriers and lessons learnt are now highlighted.

Barriers to professional social networks:

- **Adoption:** How can we get full-time working professionals to use a PSN? No evidence has emerged in this chapter to suggest that a 'silent member' of the PSN is not learning. Further studies are needed to challenge this possible misconception.
- **Induction design:** To address the concern about active participation through to the completion of the eLearning event the value of new media design was emphasised.

Traditional instructional design training strategies should be challenged in this new PSN context.

Lessons learnt from the case study:

- **Protocols:** Communication and collaboration guidelines are needed to be made explicit in a PSN system. A mix of top-down (managers) and bottom-up (learners) approaches should be taken to get feedback from PSN stakeholders. These protocols are negotiable over time and will continue to adapt with the flexibility of the system.
- **Evaluation:** The PSN must have in place an evaluation strategy and associated technical system. Through the constant collection and analysis of data from PSN stakeholders the natural evolution of the system can continue.

The closing thoughts for our chapter on professional social networks offer some recommendations to those readers that may want to venture into this area of organisational eLearning:

- **Establish learner's profiles:** Profiles of the PSN members should be done at several levels. First, a feasibility study will show the needs identified by the stakeholders. Next, personal Web 2.0 profiles identify learning styles and preferences.
- **Define the type of VLE (online pedagogy):** Will the eLearning model be content driven with a strong set of digital resources? Or, will the focus be on the communication and support needed to network and collaborate?
- **Define the tools to use (eg: blogs, Wikis, etc.) and the deployment strategy (eg: how many and at what stage):** Appropriate eLearning toolsets should be mapped over from the PSN member profiles.
- **Design induction pedagogy and new media presentation:** Get good initial motivation to promote a culture of change to adopt regular use of the PSN. By getting its use to be part of the daily routine you can address drop out prevention.
- **Explore organisational learning for your context:** Can you progress individual learning to a networked context? What system changes will be needed to adjust for this scalability?
- **Plan a shift to a professional network context:** How can you adapt existing eLearning protocols and systems to a PSN context? Or, will it be easier to start over fresh with a new system?
- **Decide on the appropriate online support model for your PSN:** The range of support may range from a static FAQ to mobile web bot agent model. From your feasibility study data pick an appropriate set of tools to provide academic, technical and administrative help in the media and mobile platform that the learner's need.
- **Formative feedback:** In the annual review strategy be sure to have systems in place to act on the changes needed to keep the PSN current to the learner's needs.

If you are a member of a professional organisation then this chapter has critically discussed some issues to take you forward into the 21st century learning society. The Web 2.0 pedagogic models, tool sets and protocols have been offered to provide a framework by which you will be able to open and establish the communication needed to help your organisation progress.

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This work was previously published in Social Web Evolution: Integrating Semantic Applications and Web 2.0 Technologies, edited by M. D. Lytras; P. Ordonez de Pablos, pp. 1-16, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 6.2
Managing Relationships in Virtual Team Socialization

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INTRODUCTION

The traditional organizational workplace is dramatically changing. An increasing number of organizations are employing workers who are physically and geographically dispersed and electronically dependent on each other to accomplish work (Gibson & Cohen, 2003; Griffith, Sawyer, & Neale, 2003). Recent technological advances, combined with more flexible job design, have helped increase the number of people working in distributed environments. Hence, more employees are working individually and on teams that seldom, if ever, meet face to face. These virtual employees have the same work responsibilities as traditional employees in addition to the challenge of operating within the dynamics of these newly designed mediated workplaces.

Rapid developments in communication technology and the increasing influence of globalization and efficiency on organizations have significantly accelerated the growth and importance of virtual teams in contemporary workplaces. Virtual teams are becoming more commonplace because of the possibilities of a more efficient, less expensive, and more productive workplace. Additionally, distributed teams are less difficult to organize temporal organizational members than traditional co-located teams (Larsen & McInerney, 2002; Lurey & Raisinghani, 2001; Piccoli & Ives, 2003).

Although there are apparent advantages of organizing work virtually, the challenge for new member integration lies in the fact that team members must communicate primarily through communication technology such as electronic mail, telephone, and videoconferencing or computer conferencing. This increased dependence on technology as a medium of communication significantly alters the way new members are socialized to work teams. Additionally, team members' ability to use complex communication technologies varies across individuals. This variation potentially may lead to inter- and intra-group conflict, as well as creating organizational work ambiguity, which refers to the existence of conflicting and multiple interpretations of a work issue (Miller, 2006). This article addresses the challenges of virtual team socialization with regard to newcomer assimilation and how newcomer encounter is an embedded process of virtual team assimilation.

BACKGROUND

Effective communication is central to organizational and team socialization. The way individuals are socialized in a team may determine his or her success within the team and the successful achievement of organizational and team goals. Team socialization and the communication practices associated with newcomer integration have been researched extensively (e.g., Brockmann, & Anthony, 2002; Lagerstrom & Anderson, 2003) since Jablin (1982) first explored this multilayered process. Socialization occurs when a newcomer of a team acquires the knowledge, behavior, and attitudes needed to participate fully as a member of that team. Jablin (1987) framed the stages of socialization as anticipatory socialization, organizational assimilation (encounter and metamorphosis), and organizational exit. Although there is an abundance of literature on traditional organizational socialization, research on virtual team socialization is beginning to emerge (Ahuja & Galvin, 2003; Picherit-Duthler, Long, & Kohut, 2004; Long, Kohut, & Picherit-Duthler, 2004).

NEWCOMER ASSIMILATION IN VIRTUAL TEAMS

Organizational assimilation is perhaps the most important, yet complicated, stage of virtual team socialization. Assimilation concerns the ongoing behavioral and cognitive processes of integrating individuals into the culture of an organization (Jablin, 1982). Assimilation is a dual-action process that consists of planned and unintentional efforts by the organization to "socialize" employees, while at the same time the organizational members attempt to modify their work roles and environment to coincide with their own individual values, attitudes, and needs. Jablin (1987) suggests that organizational roles are negotiated and socially constructed by actively and reactively communicating role expectations by both the organization and its members. Newcomers typically enact this negotiation through information-seeking tactics.

Organizational culture also informs how newcomers are assimilated in virtual teams. Socialization is one of the most important processes by which organizations communicate their culture (Cheney, Christensen, Zorn, & Ganesh, 2004). While each member entering the organization learns the values, beliefs, and practices of the organization, they simultaneously shape the organization through their "reading" of those values. Because the spirit of virtual teams focuses on innovation, change, dynamic structure, and participant diversity, we should expect newcomers to be able to do more to shape the culture of their virtual team with their own values, beliefs, and practices than in the traditional team structure.

Organizational encounter as a phase of socialization is a time for newcomers to learn behaviors, values, and beliefs associated with their jobs and organizations (Schein, 1988). By entering a new situation, newcomers want to clarify their situational identity through their work roles (Berlew & Hall, 1966; Feldman, 1976), or through securing approval of others (Graen & Ginsburgh, 1977; Katz, 1978; Wanous, 1980). To reduce uncertainty, newcomers often search for information that allows them to adjust by defining the expectations of others and orienting their behavior to the behavior of others.

The speed that virtual teams form demands that workers deal with change rapidly. Although research on teamwork suggests that teams function optimally after they have worked together for a period of time, virtual teams may not have the luxury of establishing working relationships over an extended period of time (e.g., Furst, Blackburn, & Rosen, 1999; Mark, 2001). Hence, it is vital for newcomers to quickly establish and develop relationships with others in the work setting, especially with peers and supervisors (Jablin, 2001).

Among other things, organizational relationships provide newcomers with support that facilitates the learning process and reduces stress and uncertainty associated with adjusting to a new work environment (Jablin, 2001). Much of the research on relationship development in the organizational encounter stage focuses on information seeking and information giving (e.g., Boyd & Taylor, 1998), learning behaviors and attitudes through exchange activities (e.g., Comer, 1991), technical or social information (Comer, 1991; Morrison, 1995), and regulative and normative information (e.g., Galvin & Ahuja, 2001). Evidence suggests that formal and informal socialization practices may affect the level of organizational commitment (Berlew & Hall, 1966; Buchanan, 1974), longevity in the organization (Katz, 1978; Wanous, 1980), and satisfaction and feelings of personal worth (Feldman, 1976). In fact, Gibson and Gibbs (2005) propose that a supportive communication climate, defined as an atmosphere that encourages open, constructive, and honest and effective interaction (p .4), often enables innovation.

The next section examines the three central areas of relationship building in virtual teams: peer relationships, supervisory relationships, and mentoring relationships.

Peer Relationships

Working with others on a team may be problematic. Several questions arise when working with others in this context. Do individuals meet the expectations the team has of them? Are they easy to get along with? Are they competent? Peers help newcomers integrate disjointed pieces of information (Van Maanen, 1984) and communicate subtle values and norms that may not be explicitly expressed by their supervisors. Newcomers have more contact with coworkers, and as a consequence, more opportunities to share information with them and develop relationships (Jablin, 2001; Comer, 1991; Teboul, 1994). Sias and Cahill (1998) proposed a variety of contextual factors, including shared tasks and group cohesion (e.g., Fine, 1986), physical proximity (e.g., Griffin & Sparks, 1990), lack of supervisor consideration (Odden & Sias, 1997), and life events outside the workplace, as well as individual factors, such as perceived similarity in attitudes and beliefs as well as demographic similarity (Adkins, Ravlin, & Meglino, 1996; Duck, 1994; Glaman, Jones, & Rozelle, 1996; Kirchmeyer, 1995), that may affect the development of relationships with peers.

Trust is a key factor in developing close relationships. However, due to the lack of physical proximity and the reliance on communication technologies, our understanding of trust in virtual teams is different from the trust in traditional teams. Piccoli and Ives (2003) define team trust as the belief that an individual or group makes good-faith efforts to behave in accordance with any commitments both explicit and implicit. Cummings and Bromley (1996) further define trust as honesty in whatever negotiations preceded the commitment as well as not taking excessive advantage of another even when the opportunity is available (Cummings and Bromley, 1996). Meyerson, Weick, and Kramer (1996) coined the term “swift trust” to describe how virtual teams develop a different type of trust than in traditional teams. Due to the highly interdependent nature of task orientation of the team, newcomers develop trust more quickly. Team members are able to develop trust in the relationships on the basis of shared tasks rather than on the basis of similar demographics and/or physical proximity found in traditional teams (Jarvenpaa & Leidner, 1999).

However, swift trust is not enough to develop close peer relationships. Team members face a number of challenges including: technological mistrust by both newcomers and established members, intuitive fear of the misuse of archived communication (e.g., e-mail trails), and the difficulty of sharing personal or non-work-related issues. Thus, virtual newcomers may be unable or unwilling to take advantage of the informal organizational development that appears central to organizational socialization in traditional teams. This clearly inhibits the development of close peer relationships in virtual teams, which in turn may inhibit constructive team cohesion. Similarly, opportunities to understand organizational politics are greatly reduced by the inherent dispersed nature of virtual teams. Unless the communication among team members is open, power alliances may form that foster certain behaviors such as social loafing, domination, and the formation of cliques to occur. Groups or individuals are alienated by these behaviors and may differ in their responses based on location or functional role. The outcome is the same — limited effectiveness of the team, low commitment, low loyalty, and mistrust. Other sources of information such as supervisors and mentors may prove more helpful in recognizing and adapting to political nuances.

Supervisor Relationships

Supervisors are important for assimilating newcomers to organizations by helping build a shared interpretive system that is reflective of assimilation (Berlew & Hall, 1966; Feldman, 1976; Graen, 1976; Kozlowski & Doherty, 1989; Ostroff & Kozlowski, 1992; Schein, 1988). Supervisors who frequently communicate with newcomers serve as a role model. These supervisors filter and interpret formal downward-directed management messages, have positional power to administer rewards and punishments, are a central source of information related to job and organizational expectations as well as feedback on task performance, and are pivotal in the newcomer's ability to negotiate his or her role (Ben-Yoav & Hartman, 1988; Jablin, 2001). According to Staples, Hulland, and Higgins (1998), workers who learn their communication practices by modeling their managers' behaviors have greater self-efficacy, better performance, and more positive job attitudes.

The supervisor-subordinate relationship is more important in virtual teams than in traditional teams due to the dislocated nature of the virtual structure (Long et al., 2005). The supervisor-subordinate relationship is complicated by the absence of a physical communication context that characterizes most traditional teams. The supervisor's coordination of virtual team activities is more difficult because of the distinct nature of technological feedback (synchronous vs. asynchronous), the lack of robust spontaneous information exchange between supervisor-subordinate, and the obvious reduction of face-to-face verbal and nonverbal communication cues. On the other hand, some findings suggest that assessment of team member contributions may be more accurate in virtual rather than face-to-face environments. For example, Weisband and Atwater (1999) found that ratings of liking contributed less bias to evaluations of contribution for virtual groups than face-to-face groups. Similarly, Hedlund, Ilgen, and Hollenbeck (1998) found that leaders of computer-mediated teams were better able to differentiate quality of decisions compared to leaders in face-to-face teams.

Regardless of whether the supervisor is part of the team or not, the effective supervisor-subordinate relationship depends in large part on whether the organization uses a traditional approach to managing the virtual team. In traditional teams, often supervisor-subordinate relationships are characterized by hierarchical embedded roles in responsibilities, more formalized rules, procedures, and structures (McPhee & Poole, 2001). However, in virtual teams there is a loosening of the rules and responsibilities in the supervisor-subordinate relationship. The virtual setting reduces tangible cues that distinguish the status and/or hierarchy of the team members. Thus, the supervisor-subordinate relationships in a virtual team rely more on co-orientation, which facilitates the socialization process more effectively. Mentoring relationships is also important to newcomers' adjustment to socialization efforts.

Mentoring Relationships

When discussing relationship building as part of the assimilation process, mentoring relationships is an important aspect. Mentors facilitate newcomer organizational adjustment by offering advice, support, and if appropriate, coaching behaviors to accomplish goals. Wigand and Boster (1991) suggest that "mentoring speeds up socialization into the work role, encourages social interaction, provides an opportunity for high-quality interpersonal interactions, and enhances identification with and commitment to the organization" (p. 16).

Mentoring relationships are formal and informal. Formal mentoring is a "deliberative pairing of a more skilled or experienced person with a lesser skilled or experienced one, with the agreed upon goal of having the lesser skilled or experienced person grow and develop specific competencies" (Murray & Owen, 1991, p. xiv). Several scholars (e.g., Allen, McManus, & Russell, 1999; Heimann & Pittenger, 1996; Seibert, 1999) acknowledge that newcomers who participate in formal mentoring relationships in traditional organizations realize greater benefits than those who do not have formal mentoring. Specifically, participation in formal mentoring increases the newcomers' understanding of various organizational issues and increases their level of organizational and job satisfaction.

Informal mentoring relationships develop naturally at the discretion of the mentor and protégé, and exist as long as the parties involved experience sufficient positive outcomes (Jablin, 2001). Newcomers who are informally mentored are privileged to information not directly associated with the job role or organizational tasks. This indirect communication includes organizational power and politics, involved career-related support, "inside" information about various organizational issues, and increased social interaction outside of the workplace. As trust, commitment, and identification in the virtual team develops for both the newcomer and more experienced workers, informal mentoring will naturally occur. Virtual teams are more effective when communication barriers such as role uncertainty, task ambiguity, and tacit norms of the team are dismantled.

Organizations benefit when they recognize the value of both formal and informal mentoring relationships. Acknowledging the positive impact mentoring has on newcomer assimilation in a traditional team arrangement leads us to assume that mentoring will have similar impact on virtual team assimilation. However, due to the structural challenges of virtual teams, organizations should consider both formal and informal mentoring programs as tools to socialize newcomers to virtual teams.

In summary, virtual teams face an uncertain, but promising future. The socialization process of team members can become an enigma when building virtual teams. The next section outlines future trends in newcomer assimilation in virtual team socialization.

FUTURE TRENDS

Three interrelated relational aspects of virtual team assimilation are important to note when attempting to predict future trends in this emerging field of study. First, growing interest in virtual team socialization will lead to an accelerated interest in how trust is developed and maintained in virtual team relationships. Trust is a major factor influencing the cohesiveness among virtual team members (Sarker, Valacich, & Sarker, 2003). Instrument development and validation is of central concern as virtual teams become a ubiquitous aspect of organizational life. Scholars and practitioners both have a vested interest in fully developing this aspect of virtual team scholarship, as more individuals will work in this new organizational configuration and become more dependent upon the work of others in their virtual team. Working remotely clearly has its benefits, but opportunities will only be maximized when trust is fully realized among all organizational citizens, especially virtual team members.

Second, focused attention should be given to the amount of social contact individuals experience via mediated communication with their peers and supervisors. As workers become increasingly more isolated because of the flexibility technology affords them (e.g., telecommuting, flex hours), managers should be proactive in ensuring that many of the social components characteristic of working in traditional "brick-and-mortar" workplaces—the characteristics that keep individuals socially satisfied and committed to the organization—are transferred to the new dislocated work environment. Several scholars have suggested that the informal organization is equally, if not more powerful than the formal organization (e.g., Rogers & Kincaid, 1981; Monge & Contractor, 2001; Monge & Eisenberg, 1987). In order to maintain a consistently committed and talented workforce, deliberate attention should be earmarked to foster the intangible social relational aspect of virtual team functioning.

Finally, managers and scholars should work in tandem to fully realize the opportunities and potential for virtual mentoring. Networking and building informal coalitions and communities with others within and outside of their employing organization is a key strategy for upward mobility for individuals, especially minority organizational members (Bell & Nkomo, 2001; Parker, 2003). As more individuals are hired and socialized to work in more virtual team-based structures, it is critical that organizational leaders leverage the power of mentoring as a means to create a more committed workforce and reduce job transfers and turnover. Establishing a protégé and mentor relationship is critical, as technological uncertainty and task ambiguity increase due to the erosion of traditionally rich media forms such as face-to-face communication. Implementing formal and informal mentoring programs is certainly a future trend in virtual team socialization.

CONCLUSION

Organizations are turning to virtual teams as a way to remain competitive in an environment characterized by globalization, mergers, acquisitions, and dependence on information technologies. A great deal of attention is paid to how to provide adequate virtual team infrastructure such as hardware and software components. However, little attention has been devoted to the "human-structure" of virtual team organizing. Future research and organizational attention should focus on the methods of assimilating newcomers in virtual teams. This communication process is as important as the technology selected to accomplish work.

Some aspects of virtual team assimilation are similar to traditional team assimilation, but many are not congruent. Staples and Webster (2007) posit that the distinction between traditional and virtual teams is no longer needed, as all types of teams are characterized by varying degrees of virtuality. The primary difference is that virtual team members are typically more reliant on information technology as the medium for communicating, and virtual team members are more likely to be isolated from the rest of their team — hence, the importance of examining how virtual team members build relationships in this new organizational structure. Communication in peer, supervisor, and mentoring relationships is vital in optimizing organizational functioning, yet little attention is focused on these important relationships in the virtual team environment. In addition to the traditionally studied outcome variables such as costs, productivity, and effectiveness, organizations should also be mindful of the importance of issues related to the internal team and interpersonal communication processes that embody and constitute organizations.

Effective virtual team assimilation, just like traditional team assimilation, fosters loyalty, commitment, trust, and potentially greater cohesiveness with the team. Virtual team socialization is a shared relational responsibility for the newcomer, the supervisor, and the organization. If little concern is given to building the relationships, then the long-term stability of the virtual team may be threatened.

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KEY TERMS

Co-Located Team: A traditional team that shares a common goal and works toward that goal in a face-to-face, same-office environment.

Formal Mentoring: A deliberate pairing of a more skilled or experienced person with a lesser skilled or experienced one, with the agreed-upon goal of having the lesser skilled or experienced person grow and develop specific competencies.

Informal Mentoring: The non-assigned pairing of an experienced person who respects, guides, protects, sponsors, promotes, and teaches a younger, less experienced personnel member who develops naturally at the discretion of the mentor and protégé, and persists as long as the parties involved experience sufficient positive outcomes.

Organizational Assimilation: The processes by with individuals become integrated into the culture of an organization.

Newcomer Encounter: A time for newcomers to learn behaviors, values, and beliefs associated with their jobs and organizations.

Socialization: The process in which that member of a team acquires the knowledge, behavior, and attitude needed to participate fully as a member of the team.

Swift Trust: A type of trust that develops quickly on the basis of shared tasks rather than on the basis of similar demographics or physical proximity.

Virtual Team: A group of geographically and organizationally dispersed workers brought together across time and space through information and communication technologies.

This work was previously published in Encyclopedia of Information Science and Technology, Second Edition, edited by J. Wang, pp. 2510-2516, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 6.3
Guarding Corporate Data from Social Engineering Attacks

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ABSTRACT

The threat of social engineering attacks is prevalent in today's society. Even with the pervasiveness of mass media's coverage of hackers and security intrusions, the general population is not aware of the possible damage that could occur should they be subjected to a social engineering attack. In order to show the damage caused by these attacks, we will discuss the results of a social engineering attack based on a survey conducted in the downtown area of a large financial center in the United States. The authors make suggestions companies can incorporate into their policies in order to protect their employees, as well as systems from intrusions based on social engineering attacks.

INTRODUCTION

As more and more organizations invest in technology to ease the delivery and dissemination of information, more opportunities are created for security incidents. Before the Internet was a part of everyday life, intruders usually gained access to sensitive data by physically setting foot on a company's premises and breaking into a safe or file cabinet. As a result, companies installed security cameras, door locks, and alarm systems.

Today, corporations still have these devices but must also protect their digital data. Investments in devices, such as intrusion detection/prevention systems to alert them of a security incident; firewalls to protect their internal network; and virtual private networks to ensure individuals connecting from the outside are authorized and have a secure connection are necessary expenses.

Another tool corporations use are organizational controls. These are processes and procedures put in place to control and protect assets, which include physical goods, buildings, money, and even a firm's reputation and image. Of the many types of controls, one of the most fundamental is access control. Access controls restrict access to your business systems to authorized personnel. These controls are key to information security and are one of the ten required

DOI: 10.4018/978-1-59904-855-0.ch037

domains of study for the certified information systems security professional (CISSP) certification exam (Krutz & Vines, 2001).

One of the most critical types of access control in today's internet-connected world is the use of passwords. We use passwords to access many of our online and company accounts (Zivran & Haga, 1999). Usernames and passwords are the most common form of authentication, but are also the weakest due to human error (Ciampa, 2005). One weakness of passwords is they are difficult to remember, leading people to choose weak passwords they can remember (Cazier & Medlin, 2006) and the tendency of people to reuse their passwords for multiple accounts, making the danger of a weak password greater as it can compromise multiple systems (Ives, Walsh, & Schneider, 2004).

Today, most network and system security devices rely on the username and password to grant access. As such, obtaining this information is the equivalent of hitting the jackpot for a hacker. When a hacker is attempting to break into a system, they want to find the quickest and easiest point of entry. The longer it takes to break into a system, the more information the hacker leaves to get caught in the end. Better security technologies are continually being invented to make it more difficult for an attacker to gain access. As a result, many hackers will rely on social engineering methods, that is, using social skills to obtain information, such as a user's password (Krutz & Vines, 2001), to gain access to a target since in many cases it is a lot easier to exploit a human than a system (Mitnick, 2002). The social engineer utilizes an arsenal of methods, allowing him or her to leverage the emotions of a victim, aiding in an attack. The social engineer can flirt with the victim in an attempt to gain information; make the victim feel guilty so they divulge information they would not have otherwise; or even convince the victim that their job could depend on giving the attacker the requested information (Mitnick, 2002).

With this research, empirical data is presented on the current susceptibility of social engineering attacks on companies. From this information, several suggestions are made for companies to ensure social engineers do not succeed. Recommendations are aimed at preventing potential attacks. Lastly, possible future research aimed at studying social engineering further in different areas is discussed.

BACKGROUND

Each day, numerous employees have access to sensitive data in order to do their job. Generally, they will use a password to access this data. Their password is one of the only things keeping a potential intruder out of their employer's network. In the event their password is compromised, the entire company's infrastructure is at risk. Social engineers use human weaknesses, such as trust and fear, to their advantage to exploit these people and get as much information as possible. With experienced social engineers, the employee will not even know what has happened and will continue their day without so much as a second thought. This creates even more risk, as not only does the social engineer have the employee's password, but he or she also avoids detection and possibly can have free roam of the company's network and systems.

Social engineering is the act of gaining either unauthorized access to a system or sensitive information, such as passwords, through the use of trust and relationship building with those who have access to such information (Damie, 2002). A social engineer uses human psychology to exploit people for his or her own use.

According to Kevin Mitnick, a prominent social engineer, "Savvy technologists have painstakingly developed information-security solutions to minimize the risks connected with the use of computers, yet left unaddressed the most significant vulnerability, the human factor"

(Mitnick, 2002, p. 8). In 2005, the FBI conducted a computer crime survey with a sample of 2066 organizations in the U.S. They found that the average cost for the companies that had an incident was $24,000, with a total cost of $31,732,500 for all respondents (FBI, 2006). Based on this information, they estimated a total cost of $67.2 billion per year for security incidents.

Social engineering attacks can take on many methods. Each method uses the same basic four-step cycle in order for the social engineer to be successful. The first step is to gather information about the target and potential weak points (Allen, 2006). The attacker can gather names of people through a company's site, co-workers, or even a phone directory. Since most employees have their name, job title, and whether they will be in the office on their voicemail, an attacker can simply find a day when a specific person is not in the office and imitate them to an unsuspecting employee (Mitnick, 2002). Additionally, most employees who have security badges wear them in public places. This could be during a lunch break, going out after work, or even going out with friends at night and simply forgetting to remove their badge. The attacker could find an area where many employees from the target company congregate and use the information on the badge or from the employee to their advantage. Other methods for the social engineer to gain information are:

- **Call specific personnel.** This generally involves convincing people over the phone into giving them information through persuasion with tools such as fear, imitation, and compassion (Granger, 2001).
- **Dumpster diving.** The social engineer physically goes through a company's garbage to find useful information (Mitnick, 2002). This could lead to a sticky-note with a password on it, or even other sensitive internal documents that a careless employee forgot to shred (Castelluccio, 2002). An example of another useful find is organization charts with names that can enable the social engineer to proceed with another method, such as using the phone, in order to impersonate personnel based on their standing in the company.
- **The Internet.** Not only does it provides anonymity but also allows them to maximize their impact. This method is being used primarily by phishers in an attempt to defraud unsuspecting individuals by getting them to divulge personal financial data. In 2006, the total cost of identity fraud in the US was $56.6 billion. Of this amount, 3 percent was obtained through phishing attacks on home users (Javelin Strategy & Research, 2006).
- **Site visitation.** This method involves the attacker physically going to the target site to carry out their attack. However, the attacker may decide the easiest way to get access to the network is to simply go to the target's site and log in (Mitnick, 2002).

The second step is to develop a relationship with the target individual(s) (Allen, 2006). This is needed in order to build trust with the individual in order to exploit them and continue to use them in the future (Mitnick, 2002). General human nature is to trust others and to receive a sense of satisfaction out of helping others (Dolan, 2004). The social engineer builds this trust in order to exploit it. This can involve simply talking on the phone with the target for a few minutes (Dolan, 2004), or striking up a conversation and exchanging business cards at a bar the target frequently attends (Mitnick, 2002).

The third step is to exploit the trust that has been built with the target by manipulating the target into doing something they would not normally have done (Allen, 2006). The key to this step is to ensure the target does not at any point catch on to what is happening and leaves with a sense of satisfaction. This allows the attacker to continue the trust that has been built up with the target in order to exploit them again in the future (Mitnick, 2002).

The fourth and final step is the execution. Once reached, the target has completed the task requested by the social engineer (Allen, 2006). The goal with this final step is to not only have the desired task completed, but to ensure a continual relationship with the target (Mitnick, 2002).

METHODOLOGY

A survey was created and administered with multiple purposes and multiple sections. Data was gathered to not only establish how many people would disclose their passwords, but also to simulate the type of information a social engineer would attempt to gather, other than a password. The survey was divided into three sections: (Table 1)

The first section of the survey was designed to gather personal non-identifying information, such as a favorite movie, television show, place of birth, or pet. These categories were chosen based on research performed by Medlin, Cazier, and Dave (2006). In their research, they found 19.3 percent of passwords gathered were based on family, 2.1 percent were based on being a fan, 5.7 percent were based on faith, and 1.3 percent were based on places. The survey incorporated as many of these as possible into this section without being overwhelming in order to simulate guessing a password in the event a password was not disclosed.

The second section of the survey was designed to gather information on their employer's information security climate. Through this the researchers are able to show how training and individual awareness relate to success in receiving the individual's password. Since training is considered to be the greatest way of preventing attacks, the researchers felt it was important to include this information to assess if training, and how much, helps prevent these attacks.

The final section was designed primarily to convince the individual that the researchers were doing password research and needed their help. Questions were created based on best password principles, and were designed to show if there was a significant correlation between those who divulged their password and other factors such as password length and composition. Additionally, the section was designed so that in the event a password was not given, the information from the first section and last could be combined to guess the individual's password.

Some personal demographics were also gathered for informative purposes in order to support the research. This was gathered under the context of a drawing for a gift certificate to a local restaurant, and respondents were given a separate sheet of paper with personally identifying information, such as name, address, and phone number, as well as place of employment and email address. The last two pieces of information were especially important in the event of a true social engineering attack. This would give an attacker the company's name, possible login information

Table 1.

Item	Survey Question	Percent
A	Gave Their Password	52%
B	Password Security Training Offered	56%
C	General Security Training Offered	63%
D	Choose Own Password	89%
E	Password is Alpha-Numeric	91%
F	Password Contains Special Passwords	51%

from the email address, and the password in the event it was filled out.

The survey and demographics were kept separate for two reasons. The first was to protect the respondents as well as the researchers from possible privacy breaches. The second reason was to put them at ease with filling out the survey and to facilitate a greater percentage of respondents disclosing their password by giving the impression the survey was truly anonymous. For ethical reasons, the researchers chose to keep everyone anonymous exactly as promised, however it would have been a simple matter for a social engineer to combine the data.

Sample

In order to assess the current awareness of information security in today's climate, a survey was aimed at corporate employees. However, in order to better represent what a social engineer might be able to do, a survey booth was set up outside the corporate headquarters of several major businesses, rather than have the companies ask their employees to participate. The corporate employees were targeted due to the sensitive information about individuals they are entitled to. Members of this group often have access to social security numbers, account information, healthcare records, or credit information on a daily basis. Additionally, they may have access to the intellectual property of their employer.

The term "corporate employees" is being used as a general category for the random sample of people from the downtown area of a large financial center in the United States. In order to take this sample, the researchers took every step possible to ensure there were no ethics violations and were completely honest with those surveyed. The researchers identified that they were from a university and wore name tags to identify themselves and did exactly what they told people they were doing. A real social engineer would not have this handicap.

A table was set up in the downtown area in front of one of the top five banks in the U.S., with another of the top five only a block away, and an energy company two blocks away. This location was selected due to its centralized nature, as well as the employers it was around. This area has a high concentration of financial institutions, making it a target for not only domestic hackers but terrorists as well. We chose this location to test our attack in an area likely to be more secure than areas with less to protect. This study likely *underestimates* the amount of information the average person is likely to share.

People walking by our table were randomly asked to fill out a survey in exchange for candy and the opportunity to win a free gift card to a restaurant from a drawing. All personal information for the drawing was filled out on a separate piece of paper in order to protect all persons involved, including the researchers.

RESULTS

In all, 53 surveys were completely filled out, with three not being fully filled out (only one side was completed) for a total of 56 surveys. Seventy-four percent of respondents were male. There was no significant difference between males and females in terms of willingness to share their password.

This sample included employees of energy companies, banks, and technology companies. While no identifying information was gathered at any point of filling out the survey, the researchers had the opportunity to mark each survey as well as the demographics slips. Many of the respondents had ID badges, identifying their name, company, and position. It would have been a simple matter to write this info down, or capture it with hidden cameras.

In our sample, 52 percent of respondents shared their password. This was accomplished with very little to no pressure in order to ascertain the true level of ease with which people would give up their passwords. Fifty-six percent work for a company that offers password security training, 63 percent offer general security training. Most people were allowed to choose their own password (89 percent) with 91 percent having both letters and numbers. However, only 51 percent of respondents reported using special characters in their password.

In addition, the average person in our sample accessed a system using a password in the very often range, occasionally changed their password and occasionally too often used the same password on multiple systems. We also measured the last time the users participated in a security training program, with the average person indicating they had participated within the last year. In fact, 63 percent had participated within the last year, with many of those participating more recently.

A test was run to compare whether a password was given to us based on factors found in the survey. We found people who use the same password on more than one system were more likely to share it with us, however security training was found to *not* be a significant factor in whether the password was shared.

Lastly, we ran a test for differences between groups that had training in password security and those that had not. Fortunately those that used passwords the most were also more likely to have received training. Those that had training were more likely to change their passwords frequently and have special characters. However they were not significantly more likely to *not* reuse their passwords, have longer passwords, or to incorporate numbers into their passwords. Most importantly, password security training had *no* measurable impact on their willingness to share, or not to share their password with us!

DISCUSSION

This study found that those users who used the same password across multiple systems were more likely to disclose their password. Using a scale of one to five, with one being very often and five being never, the study found that those users who disclosed their password stated they used the same password across multiple systems "often," or an average of a 2.00. On the converse, those who did not disclose their password had an average of 2.60, falling in between "often" and "occasionally." Altogether, 38.5 percent stated they used the same password across multiple systems "very often," and a mere 6.9 percent stated they "never" reused passwords. That those that used the same password on multiple accounts were also the same ones that were more willing to share their password is especially ironic as these people have the most to lose from sharing their password because they can be attacked from multiple angles.

It is also interesting to note that security training was not found to be significant in the sharing of people's passwords. While many would expect this to be the biggest prevention of a social engineering attack, there was no correlation between those who had training and those who did not. Even though a significant correlation was not found, it is important to note that without training, there is no possible way for employees to understand social engineering attacks or even begin to know how to prevent them.

However, even though training did not prevent people from sharing their passwords, those with training did have more secure ones. While this is important, giving your password to a stranger defeats the purpose of having a stronger password. This suggests that security training, while important, perhaps needs to be refocused or expanded to include more on social engineering attacks.

RECOMMENDATIONS

This study finds that employees are way too vulnerable to a social engineering attack. Even though training did not affect the willingness to share the password, it did have some impact on the strength of the password. This shows that if the training program were designed better, it might have a better chance of effecting change. Unfortunately, our other options for improving security are limited. Password strength may be improved through technical means and system requirements. However, people are often the weakest link in the security process. This is a weakness that needs to be addressed.

According to Pramod Damie (2002), "a three-phased approach is helpful in combating social engineering." This three phased approach covers training, policy creation, and testing to ensure the training was understood and policies are being adhered to. Through these processes, an organization can work towards preventing social engineering attacks, and ensuring their infrastructure, employees, and customers are protected.

The first phase of this approach is an elaborate and comprehensive training program. These training programs must cover a wide array of potential vulnerabilities within an organization. In particular, the program must cover the risk of social engineering attacks to the organization, how to spot these attacks, and how to protect against them.

Users must be trained on social engineering attacks and given the knowledge needed to protect the organization as a whole (Dolan, 2004). In a study of user's knowledge of security issues within an organization, it was found that users were "not sufficiently informed about security issues" (Adams & Sasse, 1999, p. 43). The point of the training program must be to eliminate this issue, and ensure all users are informed and well trained.

The second phase is creating policies and procedures in order to protect the organization. These policies must be created with the user, as well as the organization, in mind. The policy outlines the expectations and responsibilities of the employees, as well as the procedures to follow in the event of a breach or attempted attack (Dolan, 2004).

The following outlines areas training programs and policies should include protecting against a social engineering attack:

Password security. At no time should a password ever be shared with anyone. Social engineers will sometimes pose as technical support personnel in order to get the user to disclose information such as username and password (Allen, 2006). The company's help desk and IS/IT department should never need to ask a user for their password. This allows the employee to be told point blank that no one will ever ask them for their password, and in the event they are asked, they should not give it out. In this study, the perception of anonymity was used as well as the request of college students doing research to exploit individual's human emotions.

Ensure users adhere to a password criteria policy. This policy needs to include factors such as special characters, numbers, letter case, and reuse within the company. The user must know not to reuse passwords, and a system needs to be in place to verify that the user is at least not reusing his or her password on their system. Lastly, dictionary words should not be allowed and again, a system needs to be put in place to ensure the user is not using dictionary words.

Users must understand not to write down their password in any location. In the event a social engineer decides to physically access the company's site, any passwords written down can become a valuable resource. The social engineer needs to only walk past an employee's workspace to gather the information they need to attack the company's infrastructure (Dolan, 2004).

Additionally, two-factor authentication in the form of a token can be used to prevent unauthorized access to the company's system. An asynchronous dynamic password token with a number changing at fixed intervals would significantly decrease the likelihood of an intruder getting into a system, since even if a social engineer gets access to a user's PIN, the password would change each time the specified interval lapses (Krutz & Vines, 2001).

Employee verification. The company must establish policies and procedures for allowing employees to verify people who call them are who they say they are.

For companies with internal caller-ID phones, the system must display their name as well as extension number. The employee must know to verify who they are speaking with and compare it to the display of their phone system. In the event of a discrepancy between the two, the employee should instead rely on an internal directory and inform the caller they need to verify their identity before speaking with them. For companies without an internal caller-id phone system, the end user must know to verify who they are speaking with before disclosing any information. The simplest method is to use an internal directory and the end users tell the caller they will be called back at their extension (Mitnick, 2002). This gives a two-fold protection, since not only does the user call the extension back, establishing the caller was really at that extension, but also by using the directory, the user is guaranteeing they are calling the correct person back (Gragg, 2002).

Physical access. Ensure all employees have an ID badge with a large print of their photo on it. The large photo prevents a social engineer from obtaining a legitimate badge from an employee and relying on having a badge with a smaller picture that cannot be seen.

A determined social engineer may photograph an employee's badge and create their own based off the photograph (Gragg, 2002). With the power of photo editing software, this is a simple task. To combat this, the badge needs to incorporate a form of protection against being counterfeited or have a policy that employees cannot wear their badge off company property. A simple form of counterfeit protection would be a hologram specifically designed for the organization, or printing with ink that can only be seen under a blacklight.

Task all employees with protecting the organization, and inform them they have the right to question anyone, at any time, anywhere. Social engineers sometimes rely on having the appearance of being a person of authority in order to intimidate employees so they will not be questioned (Gragg, 2002). If an employee does not see a badge on an individual in the building, they must stop and ask them to see the badge; otherwise they have to escort them to the front desk.

Sensitive locations, such as the mail room and networking closets, must be secured. The mail room provides a means for an attacker to deliver a forged memo that seems to be internal (Granger, 2002).

Visitor badges must be given to every person who is not an employee, and must be clearly marked as a visitor. Employees should be trained on areas where visitors have to be escorted, as well as areas where a visitor may be without an escort. The employees must have the authority to challenge visitors, and be allowed to report any suspicious behavior to a specific individual (Arthurs, 2001).

Document and media disposal. Employees must be educated on the importance of shredding any and all documents, and ensuring all media that is no longer needed is destroyed. What the employee may view as safe may actually be the only thing the social engineer needs to attack the organization. Items such as company directories, calendars, planners, and organizational charts can be prized finds for a social engineer (Granger, 2001). This is why all documents must be shredded, regardless of the user's perception of the safety of the contained information.

For documents and media, such as floppy disks and CDs, a licensed disposal company should be used which gives the organization a certificate of destruction and performs the destruction on-site rather than transporting to a separate facility. The company should provide locked trash bins, where all employees would be required to dispose of their documents. They need to be trained to never place documents in a trash can.

General training. Employees must be educated on spotting social engineering attacks, whether through the phone, physically, or spotting someone dumpster diving. They must have specific steps to follow and people to contact to report an incident (Granger, 2002), rather than keeping them private. Many times when an employee falls victim to an attack, they do not tell anyone about it out of fear of ridicule or punishment (Mitnick, 2002). In order to ensure incidents are reported, the employee must feel safe and free from punishment, otherwise they will be more inclined to not report the incident.

The program needs to inform the employee about the organization's policies, as well as the sensitivity of information they give out. This involves personalizing the training to each person and how it applies to them as well as their company (Arthurs, 2001).

Employees must be able to spot and understand emotional social engineering attempts. Frequently, this involves exploiting the employee's natural inclination to help a fellow employee in a time of need (Farber, 2001). Many times this will involve the attacker pretending to have a deadline or other immediate need, and attempts to appeal to the victim's emotions (Mitnick, 2002). The user must understand they have the right to say "no" at any time, and have absolutely no fear of reprimand should the request be legitimate.

The final phase is testing to see whether the training has been understood, and policies are being followed. The testing should be implemented *only* after all employees have been trained. Due to the sensitive nature of social engineering, employees can feel deceived and morale can be hurt from a test (Kabay, 2000).

Once the test has been performed, all employees should meet together to discuss the results of the test without any particular person or department being named (Kabay, 2000). The results of the test can be used to further mold the training program, as well as educating those who participated in the training and creating areas of focus (Coffin, 2003).

All policies and training should have the support of upper management. Employees must understand if they see the CEO of their organization walking down the hallway without his or her badge that they must be challenged without fear of reprimand. Without this, employees may not feel comfortable questioning someone who appears to have authority, and thus may let an intruder roam their premises without any problem. Rather, a reward system should be implemented in the event an employee challenges any member of management. This reinforces that they have the authority and obligation to challenge anyone they see without a badge, further protecting the organization as a whole.

FUTURE RESEARCH

With permission of companies, it would be interesting to put other social engineering methodologies to the test to assess the organizations themselves. Using methods described above, a thorough analysis of multiple organizations could be created and the results compared with other organizations.

An additional area of interest would be how different regions respond to the same type of attack. In 2004, an experiment similar to this one was conducted in the United Kingdom by Claire Sellick, event director for Infosecurity Europe. She found 37 percent of people immediately gave her their password (Kotadia, 2004). This is a much smaller number than the 73 percent, leading to the assumption that different regions can yield different results.

CONCLUSION

The fact that even a single password was gathered shows a distinct need for more training and awareness among users. Having gathered the passwords of 52 percent of those surveyed shows that there is a real threat of social engineering to the corporate environment. A social engineer may need only one username and password in order to gain access to the company's network. After this point, they essentially have free reign, potentially costing the company thousands of dollars per incident (FBI, 2006).

In addition, a stronger emphasis should also be placed on security while students are still in school. Since these are the future employees, they need to have a basic understanding before entering the workforce; otherwise they will become the target of social engineers. They should also feel free to challenge authority if they do not feel comfortable giving out sensitive information. This gives them the ability to enter into a corporate information security training program with a basis of challenging individuals who should not have physical access.

In spite of training, users still voluntarily gave their passwords. These users can end up being the weakest link in a corporate security program, showing a need for a different training strategy since 63 percent of users had participated in a training program within the past year, but 52 percent of those surveyed provided their passwords. The training programs need to have more emphasis on protecting the user's login information, and education on how simple it can be to obtain a password through various social engineering techniques.

Users must be educated in social engineering attacks and have the knowledge to spot and protect against these attacks. They must be given the authority to challenge people they do not believe should have physical access to the company's site. Without the support of management, training programs will fail, and policies will not be followed.

As more and more information becomes digitalized, there needs to be a greater increase in security awareness. This awareness can be the difference between an organization falling victim to a corporate espionage attack, or ensuring their future success.

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KEY TERMS

Authentication: The process of verifying that a person or resource accessing your system is actually how they claim to be.

Access Controls: Controls that restrict access to your business systems to authorized personnel.

Corporate Espionage: The act of covertly obtaining sensitive information on a competing organization. Similar to governments spying on each other, corporations also spy on others.

Dumpster Diving: The act of sifting through discarded items looking for something of value. This can include trash, documents, computer hard drives, or information unintentionally left online.

Hacker: A person trying to break into an information system, either to cause damage, find information or to satisfy their curiosity.

Password: A secret word used to verify a person is authorized to access a system.

Phishing: The art of trying to gain sensitive information through impersonating a legitimate organization and individual interacts with.

Social Engineering: The act of gaining either unauthorized access to a system or sensitive information, such as passwords, through the use of trust and relationship building with those who have access to such information.

Username: The name of a person or object on a system used of identification. Often used with a password for authentication.

This work was previously published in Handbook of Research on Information Security and Assurance, edited by J. Gupta; S. Sharma, pp. 423-432, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 6.4

Social Interaction Technologies:
A Case Study of Guanxi and Women Managers' Careers in Information Technology in China

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ABSTRACT

This chapter explores a relationship between social interaction technologies (SIT) and guanxi, a major Chinese informal style of networking, in the context of the careers of women managers in the information technology (IT) field in China. Addressing women's under-representation in non-traditional occupations (such as IT), prior research has established that networking, especially informal, is an important career management tool for women. Recent advances in social capital theory and social network analysis provide a framework for understanding the role of social processes in achieving career success. Today, the growing Web-based social and professional networking in China weighs against the traditional forms of relationships, such as personal networks based on guanxi. The study indicates that SIT and guanxi should be viewed as complementary rather than mutually exclusive influences.

DOI: 10.4018/978-1-60566-368-5.ch023

INTRODUCTION

Careers are a window to a network of values of the institutions where they are actually made. Recent advances in social capital theory have helped analyze the ways in which the social networks of individuals affect their careers in organizations (Burt, 1997; Coleman, 1990; Ibarra, 1995; Kanter, 1977; Lin, 1999; Podolny & Baron, 1997). This theoretical background provides scholars with knowledge for understanding the role of social processes in career success. Information technology (IT) and information and communication technology (ICT) refer to an industry that broadly covers the technologies of information and communication. In China, as in other countries around the world, more and more women are today working in this field as managers—although only a few at the top level (Aaltio & Huang, 2007). Ahuja (2002) stated that the barriers to female positioning in the IT industry are due to an "old boys network"—a large pool of more qualified and experienced male professionals, the lack of female role models and mentors, and established discriminatory practices. Kaplan and Niederman (2006) argued that inadequate social networks, skill obsolescence and limited vertical/internal job mobility present challenges to the career success of women in IT. In contrast, women who have more demographically diverse networks generally experience greater levels of career success (Cox, 1994; Ely, 1994; Ibarra, 1995). A lack of social networks and role models has been related to women's under-representation in the field of IT.

Social relations and ties between actors characterize today's business culture. As expected, prosperity and social capital cumulate in the interplay between human partners and organizations (Bourdieu, 2005). There is a trend to understand business life more as a product of collective and shared interactions than separate individual efforts. This collectivity is not universal by nature but has country-specific and local features. Recently, *guanxi,* a major Chinese networking style, has been receiving a heightened research interest in the Western management field, with a major expansion in the literature on the growing importance of networks, networking, and network organizations (Puhakka, 2002; Steier & Greenwood, 2000; Tallberg, 2004; Wellman, Chen, & Dong, 2002). This is partly driven by the continuing and changing impact of ICT and the technological and social aspects of networking through them (Wellman, 2001). The very nature of ICT, incorporating both information and communication technologies, reflects how computers, communication, and social networks have become intertwined in people's everyday life. This is also in line with the argument according to which networks have a positive impact on entrepreneurial success (Puhakka, 2002; Steier & Greenwood, 2000). Leung (2000) points out that gender issues and Chinese cultural traditions, such as *guanxi*, are major factors influencing career development and managerial growth in China.

The development of Internet-based social networking sites have advanced social interaction, collaboration, and sharing of information (Boase & Wellman, 2006; Kavanaugh, Reese, Carroll, & Rosson, 2005), which weigh against the traditional forms of relationships—the social network and *guanxi*. According to Barry Wellman and collegues (2002), *guanxi* can be studied with a social network approach. According to social network analysis (SNA), Internet-based social networking enlarges people's weak ties, which are different from the strong ties in *guanxi* and are essential to the effective spread of information between people in separate clusters (Burt, 1992; Granovetter, 1973; Wellman, Chen & Dong, 2002). From this perspective, SIT should enhance women's networks and, therefore, benefit women IT managers' career development.

Based on a social network perspective and *guanxi*, this chapter explores the impact of SIT and *guanxi* on women managers' careers in the context of the IT field in China. The chapter starts with a literature review on *guanxi*, SIT, and women's careers in IT. The authors then analyze the results of a case study conducted in China and continue by covering future trends, a discussion, and a conclusion.

BACKGROUND

Guanxi and *Guanxi* ties

In the Chinese language, *guanxi* has different meanings. It could refer to one of three things: (1) the existence of a relationship between people who share a group status or are related to a common person, (2) the actual connections with people and frequent contact between them, or (3) a contact person with little direct interaction (Bian, 1994). Commonly, *guanxi* is defined as the special relationships that two individuals have with each other, referring to a relationship between a person who needs something and a person who has the ability to give something.

According to Fei (1992), the Chinese society is organized by concentric *guanxi* circles, extending outward from the family (the core) to relatives, friends, and business colleagues. The core of Chinese values is the differentiated attitudes toward parents, children, siblings, kinsmen, and friends, which Fei (1992) calls the "differentiated mode of association": "No tie, no obligation, and no rights" (Lee & Dawes, 2005, pp. 29). *Guanxi* is based implicitly on mutual interests and benefits (Yang, 1994): such as, respect towards seniors coupled with respect from juniors, or the soliciting and giving of favors explicitly or implicitly (Wong & Slater, 2002). Yang (1994) categorizes interpersonal relationships (*guanxi*) in China into three groups: (1) between family members; (2) between familiar people (such as neighbors, friends, classmates and colleagues); and (3) between strangers or mere acquaintances. This classification is consistent with that of Hwang (1987) who argues that the relationships with family members primarily consist of expressive ties, with strangers of instrumental ties, and with familiar people of mixed ties. Instrumental ties are unstable and temporary, impersonal and utilitarian, and based on the norm of equity (resource allocation based on contribution). Mixed ties are in between and somewhat permanent and stable, such as those between friends, within the hometown, the same area, and the same school.

The Impact of SIT on Social Networking and *Guanxi*

The development of web-based social networking sites weighs against the traditional forms of relationships—personal networks and *guanxi*—and has significant implications for the way people acquire information, interact with each other, learn, and entertain themselves.

Social networking proliferated before the coming of the Internet and the web. Since the 1990s, there has been a shift from place-to-place networking towards person-to-person networking, which Wellman (2001) calls *networked individualism*, meaning that people have flexible autonomy using social networks. This is enhanced by the application of the Internet and its progeny, following a myriad of SIT: instant messages, webcams connecting individuals; chat rooms connecting groups; and blogs, photoblogs and podcasts to broadcast thoughts, pictures and sounds. Meanwhile, there has been a global expansion of mobile phone use, carrying both voice and text. People's social interactions are mediated by modernity and technologies. The authors use social networking software to find, connect and capitalize on thousands of current, former, and potential network members. To note, one person achieved nearly 8,000 connections through LinkedIn (Mayaud, 2005).

Early literature on the Internet's role in society often made assertions that were either extremely optimistic or pessimistic (Boase & Wellman, 2006). Recently, research has begun to address this issue by providing evidence about the relationship between Internet use and contacts with friends and family, the extent to which the Internet is used to form new relationships, and the web's role in neighbor relations. Based on an investigation with 350 randomly selected English-speaking non-frail adult online Toronto residents, the results of Connected Lives Project (Wellman et al., 2006) supported the theory of networked individualism—the Internet does not turn people away from their supportive ties. Internet-based social interaction software help people get a variety of social support—major and minor goods and services as well as emotional support. The findings from these studies indicate that the web adds to the overall volume of communication, helping maintain various kinds of relationships. Networking through Internet-based SIT can reduce the perceived hierarchies because gender, social class, ethnicity, age, life-style, etc. are less visible.

Social capital is captured from embedded resources in social networks. The premise behind this notion is investment in social relations with expected returns (Lin, 1999). This is parallel with the nature of *guanxi*—reciprocity (Luo, 1997). For example, when one person offers a favor to another, the recipient must do an even bigger favor for him/her later: "The concept of social capital in a Chinese social context has been closely linked with the concept of *guanxi*" (Putnam, 2004). G*uanxi* also carries the meaning of power, social status, social capital, and resource transmission. It has been found that g*uanxi* is a source of sustainable competitive advantage (Tsang, 1998), and Chinese managers' career success depends on ties within and outside their firm (Dittmer & Lu, 1996). However, during the past two decades, China has experienced great economic and technological progress, which in turn affects people's social interaction. As people are more mobile, the types of ties that lead to strong *guanxi* are presumably harder to maintain. The increase of information flows through SIT also weighs against the traditional forms of relationships, as people have more direct sources of information and influence. From this perspective, the application of SIT can surpass the hierarchical organization structure and gendered *guanxi* (examined in more detail in the third section) to facilitate personal networks, especially women's networking.

SIT and Women's Careers in IT

The extensive application of IT has restructured the world economic system and exerted a great influence on women's role in the world economies. However, the IT industry is also one of the most competitive industries around the world. Most IT companies are in their infancy. Growth in business and changes in the business environment have happened continuously. This situation causes pressure on management. In IT companies, there exists a need to accordingly develop management and leadership methods. Rapid movements in business have decreased systematic development. The span of planning has become short-term and plans may be controlled yearly, quarterly or even monthly. Profitability is now more important than growth. The most important target of human resource management (HRM) is personnel motivation and satisfaction. The CEOs of small IT companies take care of personnel matters with other responsibilities in the firm. The most important HRM practices in small-medium enterprises of IT seem to be recruitment, familiarizing, development, and motivation. In contrast, HRM processes in bigger companies are more precisely defined and planned.

A study conducted by the Guanghua School of Management at Peking University shows that in a typical IT enterprise in China, females are concentrated in the departments of human resources and administration (73%) and marketing and financing (60%). From women employees, 12% are research employees and 16% of those in manufacturing (Shen & Ge, 2005). Women IT managers face both opportunities and challenges in their career. On one hand, they have passion and confidence. As among the female university graduates who can choose their career, the IT industry still takes precedence and becomes the most preferred occupation. Moreover, women's average salary in the IT industry is 5 to 15% higher than that in other sectors (Shen & Ge, 2005). On the other hand, there are still many constraining factors preventing women's career development in the IT industry.

The report of the Blue Ribbon Panel (ITAA, 2003) lists five reasons for possible barriers women face in their entry into IT careers. These include the lack of role models and networking opportunities, the information gap about the academic requirements expected of high school students to enter the field, the unattractiveness of IT as a work environment, the lack of strong corporate commitment, and gender-related stereotypes that may impede women's hiring and advancement opportunities. The lack of social networks and role models has been related to women's under-representation in the IT field (Ahuja, 2002; Kaplan & Niederman, 2006). Companies like hiring and promoting individuals with personal connections because those personal connections provide greater assurances that the individual will fit into the culture. Women in IT are still searching for appropriate expressions of behavior and values in organizations. Research has shown that women (in male dominated organizations) and minorities who have more demographically diverse networks generally experience greater levels of career success (Cox, 1994; Ely, 1994; Ibarra, 1995).

The application of SIT makes it possible to facilitate women's social networking. For example, WorldWIT (World Women. Insights. Technology) is the largest online networking group for women in business with free chapters in 24 countries. WorldWIT (2004) is the women's version of social networking: a true community offering career advice, job opportunities, and business planning tips. As in "I know a guy who knows a guy," it is the virtual solution to the old boys' network. Mimi Francis, WorldWIT's Chief Revenue Officer says: "Men tend to network on the golf course, which has historically left many professional women out in the cold. Today, women are networking on WorldWIT." As the founder of WorldWIT, Liz Ryan says: "In today's business climate, networking has become increasingly vital, especially for women. WorldWIT … is about making very real connections with other women who are hiring, mentoring, and building businesses."

Another study (Rutkowski et al., 2002) also indicates that Groupware, and particularly Group Support System (GSS) tools, support organizational co-ordination and interaction between various organizational structures. This implies that distance education, when employing group communication software, can produce educational results as good as face-to-face learning.

Case Study

To explore *guanxi* from gender and career perspectives, the authors conducted an empirical study focusing on the characteristics of *guanxi* bases of women managers in IT in Mainland China[1] (Huang & Aaltio, 2008). The study is based on a social network theory perspective, which focuses on the structure of social interactions and how these structures enhance or constrain access to valued resources (Burt, 1992, 1997; Granovetter, 1973). Concerned with the fact that only few women in China play a part in the management, the authors specifically explore the composition and structure of these women IT managers' *guanxi* bases and how they affect their careers and lives, partly using SNA.

With the snowball sampling method (Singleton & Straits, 1999), the data about 21 women IT managers in southern China (Aaltio & Huang, 2007) was collected based on a face-to-face in-depth interviews and a questionnaire. The participants were asked to provide information on their associates in five network contents. The name-generator approach (Marsden, 1987) can be employed to ascertain the composition of social networks. This approach focuses on a core discussion network. A simplified name-eliciting method that allowed the associates to remain anonymous was adopted. This works well to help dismiss the suspicion of the participants. Since previous results indicate that 95% of people report fewer than five individuals in their (core discussion) networks (Marsden, 1987), the participants were asked to identify up to five persons with whom they had discussions: (1) to seek advice on a decision you have to make, (2) to seek information on what is going on in the organization, (3) to seek help when you want to influence the outcome of an important decision at work, (4) to seek help in times of (personal)

Table 1. Demographic characteristics of the participants and their associates

		Participants (%) (n = 21)	Associates (%) (n = 190)	
Age		100	46.4	
	≤30	23.8	21.6	
	31-35	28.6	23.2	
	36-40	33.3	22.1	
	41-45	14.3	10.0	
	45+		23.2	
Married		52.4[^]	72.1	
College degree (Master's degree and above)		90.5 (33.4)	69.5 (24.2)	

[^] 29% of the participants were married and had one child.

crisis, and (5) to socialize with outside work. The five questions summarize the network contents of these IT women concerning their work and lives. For each associate identified, the participant was asked about her relationship with the associate and the associate's demographic characteristics, including age, gender, education and marital status. Table 1 shows the characteristics of the participants and their associates.

By exploring the composition and structure of the associates, the authors found that the *guanxi* bases of these IT women are limited. The findings show that the average network size of these women IT managers is about 9 individuals. Compared with 14 individuals in the study of Chow and Ng (2004) in which the majority of the participants were male, our participants' average network size is significantly smaller. The study also found the effect of female-to-male dyads, which are mainly within power-related and work-related *guanxi.* Women, who have a successful managerial career in IT, get wide *guanxi* networks and their career success network ties, especially power ties, are with men. For example, the majority of these women's supervisors are over 45 years old (50%) and male (78.6%). The main role of supervisors is that of influence. This indicates the masculine and hierarchical managerial model even in a new industry such as IT. Female-to-female dyads are mostly related to socialized *guanxi*.

The results demonstrate that the first three largest *guanxi* bases are coworkers, classmates, and family members. This indicates that women IT managers' networks are mainly work-related (or professional) networks, although personal life and family ties are also important for them. Coworkers, especially supervisors, are the most important *guanxi* base for these women managers concerning career and work. Classmates are also a very important *guanxi* base to the participants. As one participant reported: "Classmates are important for me because by interacting with my classmates, it's quite possible for me to get access to their networks." Obviously, the role of classmates is in personal life and career networks. The age of classmates shows that most of them are younger than the participants; this indicates the tendency of on the job training and lifelong learning in the IT industry; and, it supports the research finding that women are more likely than men to try to learn more and to want more education as career tactics (Granrose, 2007).

The results indicate that the majority of *guanxi* ties which have an impact on career (influence ties) are with older men, and these networks of ties are smaller than those of men's as shown by Chow and Ng (2004). This implies a relatively narrow scope for women's informal networking and weak ties. Researchers have argued that informal networks and weak ties are more important for women's career success (e.g., Burt, 1992; Travers & Pemberton, 2000). However, women in organizational settings are often reported to experience a limited or indeed no access to informal networks (Kanter, 1977; O'Leary & Ickovics, 1992). This means that women's access to the instrumental resources is limited, which are critical to one's job effectiveness and career advancement, and are allocated by these networks. Besides, informal networks also provide friendships and social support. The disadvantages of experiencing difficulty in getting access to the networks include restricted knowledge of what is going on within the organization (or information) and difficulty in forming alliances—these in turn may be linked to career advancement issues, such as limited mobility and the glass ceiling effect.

Obviously, networking with supervisors (most of them are older men, as shown by the results) concerning work and career issues is one of the strategies these women IT managers adopt. This to some degree limits women's weak ties. Besides, all formulations and applications of the concept of *guanxi* are based on the idea of reciprocity as a key mechanism by which relationships may be transformed into a variety of assets. Researchers differ with respect to assessing the effects of reciprocal obligations on action. Some see reciprocity as the primary basis of social identity, leading to strong social relations, conveying a sense of belonging, and creating a clear normative order within which individuals can optimize their performance (Podolny & Baron, 1997). Others view reciprocity as a potential source of "structural arthritis" (Burt, 1997) because cohesive social ties may lock individuals into a continued mutual exchange. For example, one participant said: "I have good *guanxi* with my supervisor. Because of this, I can always get positive support and valuable information from him for my work. You know this is very important for my career…Of course I work hard in return." There are two sides to a coin; thus reciprocity obligations, cemented by strong social ties, may make it difficult for individuals to extricate themselves from those obligations and to cultivate new relationships. Sometimes *guanxi* receivers feel a burden to "pay back." As one participant emphasized, "After I got support or help from my coworkers, especially from my supervisors, I always think of "paying back" somehow one day. Sometimes this is really a burden for me. Because of this, I gave up an opportunity to work for another company with higher salary last year… I don't know if I will regret, but this is what I should follow…" This implies that women are experiencing some emotional costs for maintaining the *guanxi* ties.

From the in-depth interviews, it was found that in the gendered IT industry, women managers are finding a way of coping with the limited network. They either try to cope at work by somehow negating their gender, by being an "it" in IT (Adam et al., 2006), by networking in accordance with the principles of *guanxi*, or by using SIT to widen their networks and keep contact with their networks. Some participants talked about how they have joined the web-based communities and share information among members. SIT provide people with alternative ways of acquiring information and interacting with each other regardless of time, space, and physical presence. This makes it possible for these women to surmount gendered *guanxi* and the perceived hierarchies in an organization because the gender, social class, age, etc. are less visible in SIT-based networking. Based partly on the social network analysis, SIT-based networking can enlarge women's weak ties and release the "paying back" burden for these women. For instance, one participant reported she got her recent position (vice president) through an Internet-based headhunter company. Another participant, who is the CEO of a cross regional IT company, talked about how she managed her company through an Internet-based platform. When talking about SIT and *guanxi*, one participant noted: "Networking through SIT looks easy and simple; however, there exists uncertainty because of less, even no commitment and obligation between networking individuals. From this perspective, networking by *guanxi* is more efficient because it is based on obligation and long-term trust." This indicates that the use of SIT as an efficient way of networking for women IT managers has just begun. This also implies the significant effect of the traditional culture on people's lives and communications. Overall, the study indicates that SIT and *guanxi* should be viewed as complementary rather than mutually exclusive or separate influences.

SIT and Women in China

Traditionally people in China, as in other emerging markets and developing nations, rely on their social networks as information sources, and public institutions tend to be fairly weak as citizen resources. With the development of the information technology, social software has shown itself to have significant potential for people's interactions.

According to *The 22nd Statistics Report of China's Networks Development* issued by the China National Net Information Center (CNNIC, 2008), the domestic IT industry and market in China have undergone rapid development, with the number of Internet users reaching 253 million and the number of mobile phone users nearing 592 million. Chinese female netizens totaled 46.4% of all Internet users, which has formed a subset of IT users with strong potential. Compared with men's use of the Internet, Chinese women mainly use the web for entertainment, sensibility needs, information, and networking with friends. It is interesting to note that more women (17%) than men (7%) in China use the Internet for developing friendships (Shen & Ge, 2005). This indicates that Chinese women emphasize the social networking function of the Internet more than men. Networking online affords people the ability to maintain larger networks of weak ties with a minimum effort, however, such networks can be viewed as physically distant, sparsely knit, transitory, socially diverse, and weak (Boase & Wellman, 2006; Wellman, 2001).

Since the face-to-face network is still a key component of people's daily life in China, it is not surprising that mobile phone usage is outpacing the rate of Internet adoption. The use of text messaging through mobile phone is an inexpensive way to maintain contacts with friends and family; it is also a mode of information exchange within a professional network. Social software applications used for networking (e.g., QQ, MSN Messenger, Yahoo Messenger, Skype, and Google Talk) have been widely adopted among certain demographics for a variety of purposes including career management. In China, a growing number of companies are applying SNS for employment recruitment (e.g., Zhaopin Ltd.[2]).

Weblogs (or blogs) are becoming a "new form of mainstream personal communication" (Rosenbloom, 2004, p. 31) for millions of people to publish and exchange knowledge and information as well as to establish networks or build relationships. In 2007, there were about 46.98 million bloggers in China, which is about 26.1% of the netizens (CNNIC, 2007). Recent releases of blogging tools provide enhanced features for between-blog interactivity, thus promoting the creation of social networks among bloggers. As innovative social interaction technologies, these advances enable web-based word-of-mouth (through blogging activities) and demonstrate that it is not accidental that just a few years ago blogs were identified as being among the top "10 tech trends to watch" by the Fortune magazine (Vogelstein et al., 2005, p. 43). Additionally, web-based SIT are being increasingly used by Chinese women as efficient tools for compensating their inadequate networking in the male-dominated industries.

FUTURE TRENDS

Since g*uanxi* networks include connotations that are gendered and culturally bound, the authors argue that the research of professional networking in China needs to address the nature of social ties that create networks. These networks can be based on local and country-specific traditions even when displaying similarity with Western prototypes at the surface level. The present case study indicates that the application of SIT to personal networking can weaken the negative impact of gendered *guanxi* and expand the women's network. The implementation of SIT can be a positive strategy for women's managerial careers. These findings have important implications for organizations' human resource management practices. Future research should focus more specifically on the impact of SIT on social networking in China, especially from the gender perspective: for example, showing how women can be trained to use SIT, comparing how women and men can equally benefit from using SIT, and drafting a legal framework to support the application of SIT. Furthermore, the application of SIT within cross-cultural contexts should be examined to understand how Chinese women's social networking differs from their Western counterparts, considering *guanxi* as a central concept in Chinese society.

CONCLUSION

The under-representation of women in the IT sector worldwide, especially in managerial positions, has been widely documented in the research literature. Most of the studies reported that inadequate networking and the lack of female role models and mentors are the main barriers for women entering the IT industry. The case study conducted in China and presented in this chapter also found evidence of the gendered *guanxi* and women's limited networking abilities (Huang & Aaltio, 2008).

In practice, women respond to male-dominated organizational cultures in a variety of ways, including the development of female associations or networks (Mills & Murgatroyd, 1991). Within the IT field, women have taken advantage of the emerging SIT to develop support networks to reach beyond organizational boundaries and create associations in cyberspace (see Lahey, 2002; WorldWIT, 2004). These female-centered formal and informal networks are aimed at encouraging and promoting IT as a professional field for women and developing effective networking and mentoring relationships for women across industries and IT interests (Ahuja, 2002). However, some scholars warn that organizations should be careful about the obvious matching of women with women in mentoring programs. Kaplan and Niederman (2006) argue that selecting women as mentors is perfectly suitable as long as the potential mentor has a diverse and powerful social network; otherwise, all else equal, a potential female protégé could arguably benefit more by being paired up with a male mentor, as this would address the important cross-gender networking concerns.

Based on the results of the above case study and social network perspective, the authors can explicate about the ways SIT may impact women managers' networking:

- **Advice and Information:** Both consultation (advice) and information (*guanxi*) have been successfully linked to the strength-of-weak-ties hypothesis (Granovetter, 1973). Therefore, SIT may allow for better networking, enlarge the possibility to seek advice and new information by using their effective communication abilities, and lessen the gender inequality based on "old boys" networks.
- **Influence:** By using SIT, women can overcome old normative barriers which are based on traditions and gender stereotypes.
- **Seeking Help:** SIT may help women contact their affective *guanxi* networks (family, relatives, friends, etc.) when they are distant.
- **Socializing:** SIT can help women build careers and use networking strategies based on technology applications.

Overall, although the impact of SIT is not revolutionary, new technologies enlarge possibilities for networking and create situations in which the impact of traditions, norms, and gendered values is lessened. Therefore, the influence of SIT is empowering for women who build careers in the IT industry.

For most of the women IT managers, a career epitomizes the advancement of individual abilities.

Successful functioning in professional networks requires efficient communicational skills. Because much of their work is based on collaboration, women need to adapt to this reality if they seek to be successful in their careers. At the same time, the increased use of the multidimensional networks of organizations as vehicles for economic and political decision-making requires a distinct set of organizational, communication, and managerial skills, in which women have traditionally been considered proficient (Fountain, 2000; Morrison, Randall, & Van Velsor, 1992).

Currently, the IT industry is in transition between the old sense of identity, which is based on masculine culture (the technical side), and the new one, based on inherently female values (the communication side) (Colwill & Townsend, 1999). Gender-biased cultural expectations still create a barrier to female managers' careers in IT. However, the changing nature of IT work and the implementation of SIT opens it to diverse expertise and values. Considering that China is in transition at both social and organizational levels, the authors suggest that IT organizations may develop mentoring programs, especially informal ones, to address inadequate representation of women in the field and to support women managers' careers in IT. Besides, women need to be more strategic when deciding how to develop relationships within and outside their organizations, which will benefit their career development in the field of IT.

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KEY TERMS AND DEFINITIONS

Career: Consists of the sequential choices made by an individual, and is a development process of creating and managing a professional identity and personality.

Culture: A process of constructing shared meaning and is based on a unique human capacity for self-consciousness and awareness of others.

Gender: Refers to the cultural construction of femininity and masculinity.

Guanxi: a central concept in Chinese society, is defined as a personal network, a network of ties, or as a special relationship between two or more individuals, which has wide cultural implications

Guanxi Base: Defined as a shared common identification held by two or more persons.

Social Network: Refers to a social structure made of nodes (which are generally individuals or organizations) that are tied by one or more specific types of interdependency (such as values, visions, exchange, friends, kinship, dislike, trade, or sexual relations).

Social Network Analysis (SNA): Views the attributes of individuals as less important than their relationships and ties with other actors within the social network. SNA has turned out to be useful for explaining many real-world phenomena, but it leaves less room for individual agency. It provides both a visual and a mathematical analysis of human relationships.

ENDNOTES

1 This study was supported by the Social Sciences Fund of Guangdong Province, China (No. XLY0313).

2 Founded in 1997 and with branch offices in over 30 cities, Zhaopin Ltd. (www.zhaopin.com) is one of the leading recruitment and management agencies in China. Its services include: Internet-based and traditional media recruitment, campus recruiting, human resources outsourcing, corporate training, and staff assessment. Currently, there are hundreds of online-based recruitment companies in China.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 257-269, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 6.5
The Potential of Enterprise Social Software in Integrating Exploitative and Explorative Knowledge Strategies

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ABSTRACT

The aim of this chapter is to investigate the potential role of social software inside business settings in integrating knowledge exploitation and knowledge exploration strategies. These strategies are approached through the lens of dynamic capabilities, organisational learning and knowledge lifecycle models. The authors argue that while current enterprise Information Technology (IT) systems focus more on knowledge lifecycle processes concerning the distribution and application of knowledge, enterprise social software can support knowledge exploration strategies and leverage knowledge creation and validation procedures. We present secondary data from the utilisation of enterprise social computing tools inside two companies for that matter. The first case illustrates how social computing tools were deployed in an international bank, and the other presents the employment of these technologies in an international broadcasting company. The authors suggest that free-form and pre-defined structures can co-exist in bounded organisational environments, in which knowledge

DOI: 10.4018/978-1-60566-208-4.ch020

exploitation and knowledge exploration strategies can harmonically interact. This chapter concludes with some managerial implications and future research avenues.

INTRODUCTION

During the last decade, industry and scholarly communities have equally highlighted the importance of managing organisational knowledge and posited that intangible assets form a critical enterprise resource asset (Metaxiotis et al., 2005; Davenport and Prusak, 1998). Knowledge management has been previously associated with the exploitation and growth of the organisational knowledge assets (Davenport and Prusak, 1998) aiming at increased operational efficiency and continuous time-to-market improvement. Yet, recent developments associate knowledge strategies with the ability of the organisation to explore and identify critical changes of the external operating environment, ultimately renewing its internal knowledge base and core competencies (Bhatt et al., 2005). Hence, the mere existence of strong organisational resources and capabilities appear to be inadequate for obtaining long-term sustainable competitive advantage.

The term "Enterprise 2.0" promptly followed the widespread of the so-called "Web 2.0" and dominated the discourse surrounding the utilisation of business concepts in relation not only to enterprise information applications, but also to associated managerial approaches related to our post-industrial age (Bughin, 2008; Hamel, 2007). The use of the decimal point in the term implies a proposed discontinuity from previous forms of organisational contextures, emphasising on a suggested transformative role of social computing inside companies (e.g. wikis, blogs, podcasts, RSS (Really Simple Syndication), Instant Messaging, social bookmarking, etc) (McAfee, 2006). Now, there is a heated debate between sceptics who argue that the term "Enterprise 2.0" has nothing to offer other than basic managerial selections regarding the utilisation of generic networked business applications (Stenmark, 2008), while supporters claim that the term conveys something new: a flexible and adaptable perspective to organisational knowledge strategies (Bibikas et al., 2008; Ip & Wagner, 2008; Kosonen & Kianto, 2008; Marfleet, 2008; Patrick & Dotsika, 2007; Coakes, 2006; McAfee, 2006) and a key driver towards the development of dynamic capabilities (Shuen, 2008). Has Enterprise 2.0 some actual meaning or the term should just be approached metaphorically? In this paper, we explore whether Enterprise 2.0 can provide strategic business value affecting key knowledge processes and adaptive capabilities of organizations.

The remaining of this chapter is structured in five parts: The first presents the research approach and study methodology. The next section explores knowledge exploitation and knowledge exploration strategies through the lens of dynamic capabilities theory. The third part presents some of the main characteristics of Enterprise 2.0 and investigates the potential of social software in the future of organisational information and knowledge management systems. We argue that these technologies can help towards the integration of exploitation and exploration knowledge strategies. The fourth session presents secondary data from the utilisation of enterprise social computing tools inside two multinational companies. Finally, suggestions and managerial implications are presented along with future research directions.

Research Approach

This article is an early exploratory study and employs a deductive qualitative research approach. It uses a combination of critical literature review on dynamic capabilities theory, knowledge lifecycle and organisational learning in order to conceptualise a model illustrating the potential role of enterprise social software in bridging knowledge exploitation and exploration strategies. Subsequently, this model is tested through secondary data from use cases of social computing inside two large organisations. Since empirical studies providing insights and concrete results on the use of social computing tools for knowledge management purposes are rare, a few anecdotal case studies present some early indications. This research was performed using a desk study method, exclusively using secondary sources. Desk research approaches are usually regarded as mere literature reviews in order for the researcher to be familiarised with background knowledge (Remenyi et al., 1998; Gill and Johnson, 1991). However, this chapter aims at having the desk study as the main method of research. The objective of this article is to adopt a deductive argument in order to conceptualise the role of enterprise social software in an integrated knowledge exploitation and knowledge exploration model. This model is later juxtaposed with secondary data of social software deployments inside organisations. Therefore, this chapter adopts a deductive desk research approach and involves the development of a theory that is subsequently subjected to a test (Collis and Hussey, 2003).

Through this preliminary exploratory investigation it is proposed that social software can be employed to support organisational knowledge exploration strategies. Yet, one cannot neglect the limitations of this particular approach and emphasise on the need to further investigate the suggested theoretical model to other companies and industry sectors, through primary data and field investigation methods.

EXPLOITATION AND EXPLORATION PERSPECTIVES OF KNOWLEDGE MANAGEMENT

Knowledge Exploitation and Exploration as Organisational Learning Strategies

Learning organisations are defined by Senge (1990) as places in which creative thinking is cultivated and continuous learning is fostered. Today's businesses face the challenge of continuous learning and usable knowledge generation in order to increase their responsive capabilities to market changes and advance their innovation outcomes. Therefore, current businesses – which in this chapter are approached as "learning organisations" – plan and implement various knowledge management strategies. Often these practices lay between two largely defined selections: knowledge exploitation and knowledge exploration (March, 1991; Liu, 2006). Knowledge exploitation strategies consist of organisational learning practices for the optimisation of existing processes and improvement of pre-existing knowledge assets. It mainly involves the deployment of resources the enterprise already holds on its possession (Sitkin et al., 1994). On the contrary, knowledge exploration strategies comprise organisational learning practices regarding the creation of new knowledge for the development of new products, services and processes. The latter often lead to the creation and addition of new resources and organisational knowledge assets (Sitkin et al., 1994). Knowledge exploitation reflects moderate yet definite and immediate returns on organisational performance by continuously adopting, synthesizing and applying current knowledge(Liu, 2006). On the contrary, the highly uncertain and unpredictable nature of knowledge exploration process reflects the capability of an organisation to create new core competences, by investing in flexibility, risk, experimentation and innovation (March, 1991; Liu, 2006).

There seems to be a tight link between organisational dynamic capabilities and the two abovementioned organisational knowledge management strategies (i.e. exploitation and exploration). Exploitation and exploration activities can be associated with key knowledge management processes that *create*, *validate*, *present*, *distribute* and *apply* knowledge-based resources of the firm through an iterative circle of change, renewal and exploitation (Bhatt, 2001; Nielsen, 2006). This dynamic interconnection between exploitation and exploration knowledge practices creates an iterative flow towards and from the firm's stock of knowledge-based resources. In particular, dynamic capabilities through knowledge exploration contribute to the organisational stock of knowledge – thus creating an "in-flow" stream to the firm's stock of knowledge. On the other hand, dynamic capabilities through knowledge exploitation practices utilise existing resources for the development of new products, services and procedures – thus creating an "out-flow" stream from the firm's stock of knowledge (Nielsen, 2006). Consequently, the knowledge lifecycle refers to the phases of knowledge process management that an organisation utilises in order to learn, reflect and act upon available resources (Bhatt, 2001): a) *knowledge creation* can lead to the generation of innovative ideas and uncover hidden solutions to existing problems; b) the *knowledge validation* phase provides revision and reflection upon available organisational resources in order to investigate whether these intangible assts are in line with the current state of the art or outdated by more recent developments; c) *knowledge presentation* depicts the means of knowledge illustration in organisational settings through a variety of procedures, media, departments and work practices; d) the *knowledge distribution* process allows knowledge to be shared across organisational boundaries by means of interaction between available communication technologies, management techniques and people; e) *knowledge application* usually refers to the embodiment of available knowledge resources in the organisational value creating system through its products or processes.

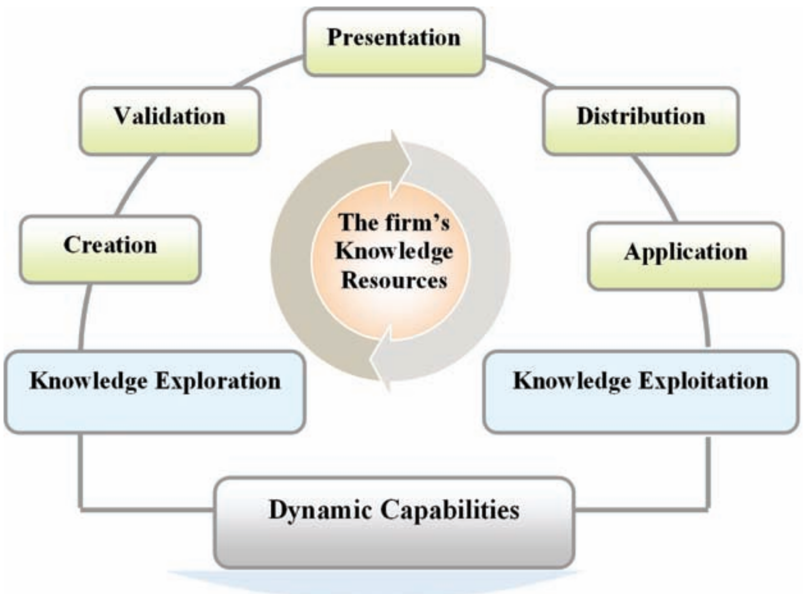
It is proposed that a vital aim of the knowledge lifecycle is to harmonise *knowledge exploration* and *knowledge exploitation*, where the five distinct stages of the knowledge process management appear to be an amalgamation of new knowledge formation (i.e. creation, validation and presentation procedures) with existing knowledge employment, iteration or removal (i.e. distribution and application) (Liu, 2006, Bhatt et al., 2005). The above figure (Figure 1) depicts the association of knowledge lifecycle with knowledge exploitation and exploration strategies in respect to organisational dynamic capabilities.

The Potential of Enterprise Social Software in Knowledge Exploration

It is argued that the use of a new breed of emerging collaborative environments in knowledge intensive organisations can facilitate knowledge work (Bibikas et al., 2008; Bughin, 2008; Ip & Wagner, 2008; McKelvie et al., 2007; Patrick & Dotsika, 2007; McAfee, 2006). These new digital environments for generating, sharing and refining knowledge are already popular on the Internet, where they are collectively labelled as "Web 2.0" technologies. Interestingly enough, these technologies are entering enterprise bounded environments for creating and sharing organisational knowledge (Bughin, 2008). Although "Web 2.0" technologies in organisational settings can be viewed from varying perspectives and can be referred to employing different names (i.e. social software, social computing, Enterprise 2.0, etc), their main general operations appear to be (McAfee, 2006):

- Search, to provide mechanisms for discovering information.

Figure 1. The role of knowledge lifecycle in forming the dynamic capabilities11311



- Links, to provide guidance to knowledge workers in order to discover the needed knowledge and ensure emergent structure to online content.
- Authoring, to enable knowledge workers to share their opinions with a broad audience.
- Tags, to present an alternative navigational experience exploiting un-hierarchical categorisation of intranet content.
- Extensions, to exploit collaborative intelligence and recommend to knowledge workers contextually relevant content.
- Signals, to automatically alert knowledge workers for newly created and relevant content.

From a technological point of view these technological features are hardly new (i.e. search, links, metadata and signalling technologies – such as electronic mail – existed from the very beginning of the Internet), yet they are becoming more and more easy to use. Perhaps more importantly, they convey a novel perspective regarding the process of utilising enterprise information and developing knowledge management systems in organisations. Unlike the design of current technologies, where particular tools usually predefine their employment (i.e. presenting certain business rules and specific procedural requirements), enterprise social software can be abstracted from its practical use, in a manner that the tools are not directly defining their utilisation. However, these applications cannot be considered "social" as such. Rather they provide functionality in order for the social constructs of organisations (i.e. individuals, teams, units, customers, partners, etc) to engage in social activities (Bouman et al., 2008). As an example, a wiki application can be utilised from formal business policy documents editing to brainstorming and realising meeting agendas. Similarly, a blog can be employed from business project activities reporting to posting personal work-related thoughts and reflections. Therefore, the deployment of enterprise social software can be eventually emergent according to adapting needs, ideas, organisational policies etc. We argue that the "social" attribute of enterprise "Web 2.0" tools, the fact that by design are intended to provide for interaction and communication, presents an opportunity for enhancing explorative knowledge strategies.

Often the design of enterprise IT/KM systems focuses on rigid procedural tasks and routine information in a structured manner. In transactional or computational business information systems this is can be desirable (e.g. Enterprise Resource Planning, Management Information System, Business Intelligence, etc). Pre-defined categorisation of users, access rights management and specified up front roles together with process replication mechanisms are all vital functionalities of such enterprise information systems. Yet, these functionalities are – by design – more focused on knowledge distribution and application. They convey the embodiment of available organisational knowledge resources in the firm's products, services and procedures for the creation of a process-based unified work environment (Brynjolfsson & McAfee, 2007). However, social computing tools can enhance knowledge exploration strategies, leveraging knowledge creation, validation and presentation processes.

Knowledge Creation Process

Knowledge creation is essentially associated with individual creativity and innovation capabilities (Bhatt et al., 2005). An organisation can create new knowledge through the embodiment of a deeper level of understanding that occurs when individuals question their own and shared mental models (Guzman & Wilson, 2005; Metaxiotis et al., 2005). As Argyris and Schon (1978) point out, knowledge creation effectively takes place when there is a conflict between one's "espoused theory" (i.e. mental models concerning values, behaviour, leadership style, etc), and one's "theory-in-use" (i.e. what an individual actually does). Enterprise social software can act as a dynamic and emergent repository of digital content where contributions can be under circumstances widely visible and persistent and invoke conversations and divergence of ideas and thoughts. The basic categorisation of user roles in enterprise social computing tools, as well as the absence of rigid structures of the knowledge resources which are meant to capture, in a sense can promote dissent or debate, or otherwise a conflict between one's "espoused theory" and "theory-in-use". These platforms through their conversation engagement functionality appear to compose a model for enhanced contextual understanding of the underlying philosophy of established organisational norms and routines: a critical process for achieving new knowledge creation (Bhatt et al., 2005; Argyris and Schon, 1978).

Knowledge Validation Process

As realities in the inner or outer organisational environment can be rapidly altered, knowledge validation process drives a continuous examination and supervision of available organisational knowledge assets (Bhatt, 2001). In this way outdated knowledge should be revised or discarded. Enterprise social software consists of digital environments which are initially freeform and largely avoid the "binary logic" of imposed roles, identities, workflows, or interdependencies. The social design element of these technologies can help generate flexible and experimenting practices inside businesses. Knowledge workers can be empowered to create, adjust and dismantle their processes across the organisation. McAfee (2006) calls the procedure of presenting "untested" knowledge using social computing tools and the subsequent dialectic examination and revision of such resources "knowledge episodes". Knowledge episodes are explained as the recordings of both the interactions of knowledge workers in a particular matter, as well as the actual output of their work practices (McAfee, 2006). The participatory design element of social computing tools as well as their initially freeform and loosely-structured character constitutes a promising element for element for maintaining both the relevance and currency of organisational knowledge.

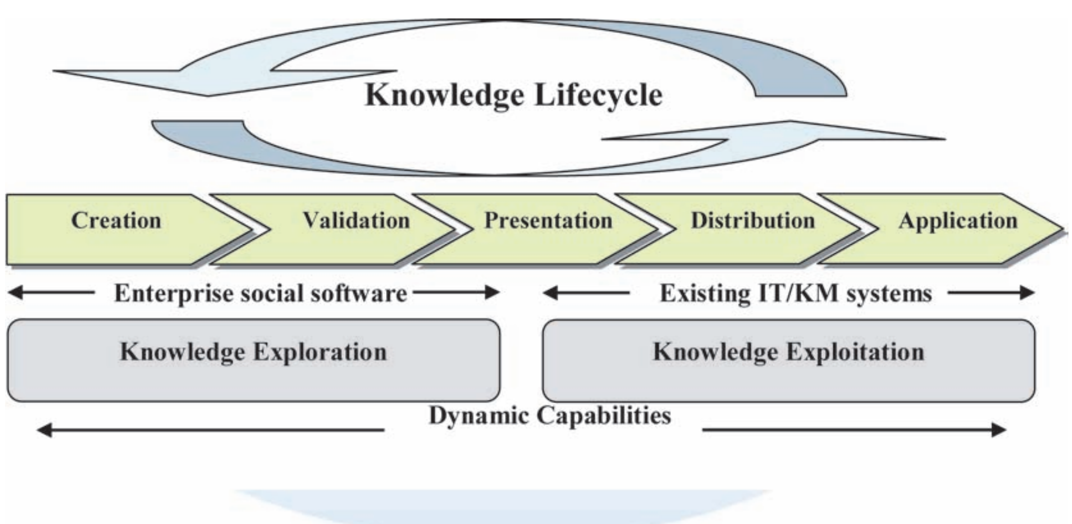
Knowledge Presentation Process

With regards to the knowledge presentation process, enterprise social software can contribute to the development of a unified work place and co-exist with other corporate IT systems. The functionality of enterprise Web 2.0 software of creating widely and permanently visible content appears to promote an integrated presentation scheme of organisational knowledge resources, regardless of corporation location, media and work practice. The goal of universally visible and persistent content within the organisation can effectively reinforce the rigidities of existing organisational boundaries, actively promoting the exploration of new knowledge.

"Legacy" enterprise IT/KM systems jointly with enterprise social software seem to effectively leverage all activities of the knowledge lifecycle. Social computing tools can be used in order to promote knowledge creation and validation through open discussion, communication and ideas exchange. On the other hand, traditional business information systems can focus on process replication mechanisms, such as the knowledge distribution and application processes. Hence, the combination of enterprise social software with existing corporate IT/KM systems can lead to an integrated view of the knowledge lifecycle process in organisational settings. This interaction of "legacy" IT systems and enterprise social computing in relation to the knowledge process management is depicted in the following figure. It presents the complementary role of enterprise social software in knowledge lifecycle and organisational learning in respect of dynamic capabilities formation.

Participative enterprise social software can co-exist with "legacy systems", such as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and Human Resource Management (HRM) (Brynjolfsson & McAfee, 2007; McAfee, 2006). These business information systems will continue to play a major role in everyday organisational operations (payments, orders, expense submissions, etc). Decision-making processes should still be based on highly structured systems and processes leaded by knowledge-based assets and business objectives (Goh, 2005). Yet, in parallel to these business operations, we suggest that knowledge workers should utilise social software technologies in order for informal collaboration and person-to-person interaction to take place. Structured data and information from "legacy systems" can be communicated and con-

Figure 2. Integrating knowledge strategies with existing and social software technologies.



sistently available through emergent participative technologies. Free-form and pre-defined structure can co-exist in bounded organisational environments employing an integrated setting in which knowledge exploitation and knowledge exploration strategies can effectively interact.

In the following cases the reader is introduced to some examples of social software utilization inside business boundaries. The cases illustrate the generic attributes of enterprise social software as pointed by McAfee (2006):

- Digital environments in which content can be persistent and widely visible.
- Lightweight deployment, in the sense that they are easy to implement and use.
- Emergent categorization of content in an evolving and self-organizing manner.
- Based on SLATES functionalities (search, links, authoring, tags, extensions, and signals).
- Can provide widely accessible content on both the process as well as the final output of collaborative work practices.
- Reliant on social constructs of organizations (e.g. individuals, teams, networks, etc).

International Bank Case

The international investment bank of the first case is established in Europe (London and Frankfurt) and provides a range of financial services. The company has approximately 6.000 employees internationally.

Employees of the company in different departments and geographical locations were used to working in a "walled garden" approach. Although groupware tools were formerly being used, they had only limited impact on content sharing and wider user engagement. Information was often isolated and not easily accessible. Therefore, the main challenge was to create a knowledge sharing digital environment without compromising on security issues. The company started with internal wikis and blogs deployment. At the beginning only the IT department employees were using these applications. However, the aim was to transform these technologies into a central hub for all departments – technical and non technical – to participate. A bottom-up publicisation approach was selected, mainly through e-mails and word-of-mouth. The first encouraging results did not take long to appear. Employees from a wide variety of backgrounds and responsibilities started to follow and contribute to the internal wiki articles and blog postings. Previously undiscovered knowledge resources were starting to be revealed. Employees with different competences were starting to add value to various subjects outside their every-day tasks. This is in line with the view of McAfee (2006) in which enterprise social software can accumulate widely and permanently visible knowledge assets through flexible and experimentation practices. Also the participation empowerment of the internal wiki deployment in this case agrees with the view in which enterprise social software encourages knowledge workers to create, adjust and dismantle processes across the organisation (McAfee 2006). Ideas, solutions to problems and knowledge assets were generated from various employees from different departments, levels and geographical locations. This "demand-driven" operational model of social software could potentially invoke new organisational competencies and empower expertise creation.

As the users of the internal enterprise social tools grew the company decided to offer short and informal training sessions. The fact that the guidance to use of these tools was speedy and "unofficial" agrees with the view of McAfee (2006) that social computing tools are easy to use and they require only a little or no training at all.

Legacy technologies were soon after integrated with enterprise social computing environment. Old intranet documents were transferred on wiki articles and employees of the bank revised out of date contents. With the help of the wiki there have been a continuous examination and supervision of available organisational knowledge assets as the knowledge validation procedure asserts. In this way outdated knowledge was revised and updated or discarded accordingly.

Furthermore, the wiki was used in order to effectively present inter-departmentally information of various types. Allegedly, the employees found the use of the wiki for presentation purposes more effective than other applications. The functionality of enterprise Web 2.0 software of creating widely and permanently visible content appears to promote an integrated presentation scheme of organisational knowledge resources, regardless of corporation location, media and work practice. Also, using the wiki the employees had the opportunity to collaboratively create, validate and present knowledge assets, developing therefore iterations between the exploration stages of the knowledge lifecycle.

In this case, social computing tools facilitated the creation of an open environment where content was permanently and widely visible, with employees creating, validating and distributing knowledge assets asynchronously and in parallel. Management played a significant role. Executive staff was the first to explore the use of such tools. They transfer information from the intranet to wiki articles and championed the use of social computing tools for various purposes (e.g. presentations, reporting, briefings, etc). Moreover, management planed for future utilisation of social computing tools. Their vision was not only to expand the use of such tools inside the firewall, but also to develop a dedicated area outside the company's intranet for customers and partners in order to promote discussion and to collaboratively develop documentation. This scope agrees with the suggestion of Shuen (2008) that in order to develop and sustain dynamic capabilities organisations should connect and interact with other companies and generate open ecosystems for managing digital syndications.

International Broadcasting Company Case

The broadcasting company of the second case is arguably one of the oldest and largest established broadcasting organisations world-wide. It is a multi-billion globalised corporation and offers many national television stations, international, national and local radio stations. Relationships and not static documents were seen as the essence of employees' daily knowledge work. The challenge in managing knowledge in such an organisation was to enhance its already relationship-based and conversational culture.

Contrary to the established approach of managing knowledge in such multifaceted and complex environments, the organisation did not select to deploy a large and expensive knowledge management system. What they focused on was the means by which they could facilitate relationship building and enhance conversational links among employees all over the world. Although that the company possessed centralised and formal directories with human resources and business information, they were rarely updated and did not reflect the dynamic connections between employees.

The organisation started experimentally to deploy social computing tools for the employees of all levels: blogs, wikis and social-networking tools. The first step in the social software deployment venture was the set up of fora and blogs. These tools were created with virtually no enforcement of work categorisation, output or structure. The ultimate goal was to empower flexibility, risk and experimentation. Employees of all levels used these tools for various reasons from setting up meetings and company excursions to discussing key strategy decisions. Blogs were deployed in a bottom-up fashion. Individuals, teams and executives that wished to create and maintain a blog, were free to do it with no other requirement except basic commitment to avoid unprofessional conduct. This implementation approach agrees with the view of McAfee (2006) that freeform and loosely-structured enterprise social computing tools, allow knowledge to eventually self-organise through day-to-day work practices.

The next step was to deploy company-wide internal wikis. The library department envisioned to generate a dynamic "knowledge base" in order to reflect the active relationships and linkages among business, units, teams and individuals inside the organisation. Although that an intranet infrastructure existed beforehand, the content was never updated in time and did not reflect the changes in the corporation. This would only happen if the information provided was easily updated from anyone inside the organisation. The library department should initiate the content creation procedure, yet the information had to be dynamically updated from members of all levels and departments. As a result, there were continuous iterations in which employees inside the organisation created, validated and presented knowledge assets in a collaborative and widely visible manner. The organisation had perhaps for the very first time a massive amount of knowledge assets created in a decentralised and speedy fashion. This outcome is aligned to what McAfee (2006) suggests on the facilitation capabilities of enterprise social software, i.e. that these tools can make experimentation procedures, interaction and knowledge exchange widely available inside organisations. This recorded output could eventually lead to the creation of new knowledge and novel organisational competences.

The corporation of this case proceeded with the utilisation of social computing tools for other purposes as well. Collaborative document editing and project management related tasks were also facilitated with the use of these technologies.

Again the role of the management played a key role. In this case executives started to use social computing tools and presented an early strategic intent, an act that gave the example to the corporation's units and individuals. Furthermore, these technologies were approached as a long term competitive advantage for the company and not as a short term and merely tactical tools. Business and technology executives of the organisation envisioned from the early beginning creating an ecology of open and conversational digital spaces for all partner-companies, units, teams and individuals.

Discussion

This chapter has explored the role of enterprise social software, not only as a novel perspective concerning the integration of knowledge exploitation and knowledge exploration strategies, but also its potential and a catalyst for effective dynamic learning capabilities leverage in corporate environments. It is argued that its demand driven and knowledge worker centric approach, allied with a capability to enable "on demand" knowledge management techniques offer the flexibility required to support the formation of knowledge exploration strategies (Bibikas et al, in press). At the same time, enterprise social software is amenable to integration with legacy systems that may already support well the exploitation of existing knowledge resources, leading in effect, to an approach that will enable to underlie the management of overall knowledge lifecycle activities in organisations.

There are practical managerial implications for the implementation of a strategy that encompasses this type of approach: in a first instance, this requires the adoption of an incremental process, starting with pilot and informal initiatives, allowing for collaboration and bottom-up process improvement; secondly, it entails the formation of an adaptive knowledge management strategy, based upon the study of existing formal and informal work practices of knowledge workers and their community interaction, as well as existing innovation process management activities; thirdly, there is the need for awareness towards a clear rationale for the allocation of resources for both exploitative and explorative activities. The direction and implementation of such strategies and the balance to be achieved needs to be contextual to the requirements of each organisation, depending upon environmental driving forces that affect it, such as policy, market and technology dynamism, as well as internal structures, know-how resources and culture. Further research, particularly at the empirical level, is required in order to identify how these balances are achieved, in a variety of organisational contexts, which strategies can effectively support them and how these new developments in enterprise social software can concretely underpin them.

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KEY TERMS

Dynamic Capabilities: It is the firm's ability not only to exploit its existing resources and organisational capabilities, but also its ability to renew and develop its organisational capabilities.

Enterprise Social Software/Enterprise 2.0: The use of social computing tools in organisational settings.

Knowledge Exploitation: Knowledge exploitation strategies consist of organisational learning practices for the optimisation of existing processes and the improvement of pre-existing knowledge assets.

Knowledge Exploration: Knowledge exploitation can be viewed as the employment of organisational learning activities involving the employment of resources the firm already holds on its possession.

Organisational Capabilities/Core Competences: Critical knowledge assets that form the basis for products and services offered by the firm.

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos; S. Warburton, pp. 285-297, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 6.6
Interrelationships Between Professional Virtual Communities and Social Networks, and the Importance of Virtual Communities in Creating and Sharing Knowledge

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ABSTRACT

This chapter presents the interrelationships between professional virtual communities and social networks, and analyzes how, and in what ways, these communities play a crucial role in the creation and sharing of knowledge. The chapter begins by outlining how virtual communities are gaining importance in the new environment. It explains what we understand as a professional virtual community and its importance and also the relevance of social networks in today's Knowledge Management age. The study then analyses how the development of social networks is crucial to the improvement of professional virtual communities, and also how virtual organizations can promote the improvement of social networks. Finally, the study examines how virtual communities are vital as mechanisms for creating and sharing knowledge.

DOI: 10.4018/978-1-60566-070-7.ch001

INTRODUCTION

The importance of information and knowledge as increasingly key aspects of competitive advantage in the activities of both individuals and organizations, is widely recognized by authors and practitioners. Modern society, based on systems of information and communication, has experienced vast changes that have affected society, industry, and "all economic entities, including people, organisations, and technologies" (Okkonen, 2007:7). Rapid progress in information and multimedia technologies, and the increasing acceptance and use of Internet, Intratet and Extranet, are paving the way for gradual innovation in diverse areas, generating flatter corporations with novel and improved communication platforms, as well as creating new business models for inter-corporation transactions of goods and knowledge, and cooperation. The new platforms are changing work practices and processes in corporate settings to support the lifestyle of individuals in their daily routines, and are also stimulating the proliferation of small offices and home offices. "New business styles based on such concepts as virtual teams and virtual community are representative of such a trend" (Kodama 2005:895).

The proliferation of network access and the rise of the Internet have facilitated the rapid growth of virtual communities (Chiu et al., 2006:1872), "as a new business model for online collaboration, as demonstrated by the proliferation of trading and education communities" (Moor and Weigand, 2007:223). Scholars such as Moor and Weigand (2007) point out that "virtual communities, such as e-business platforms and research networks, are crucial instruments for collaboration in today's networked and globalizing society" (p.244). According to these authors, "in an increasingly networked society, with ever more need for global and flexible ways of professional interactions, virtual communities are natural candidates to fill collaborative gaps in traditional, hierarchical organizations. With the advent of more user-friendly and powerful Web applications, business is also discovering the power of virtual communities" (ibid, p.223).

However, although "they could bring a lot of value and profit to the companies and most of the experiences studied have demonstrated very positive results" (Loyarte and Rivera, 2007:76), "formal research on Communities of Practice and their impact on organizations has been limited both in the way of finding results and in the research method used" (ibid, pp. 68). Similarly, Lin et al. (2007) agree that research into virtual communities, an extension of communities of practice, is still in its initial stages, and many areas remain open for researchers to investigate.

In an attempt to fill this gap, the present chapter will try to analyze the importance of virtual communities, and specifically professional virtual communities, explaining how they develop from communities of practice, and their interrelationships with social networks.

PROFESSIONAL VIRTUAL COMMUNITIES IN THE KNOWLEDGE MANAGEMENT AGE

Kalpic and Bernus (2006) state that "the pace of adoption of internet technology, especially the establishment of intranets, extranets, Web portals, etc., has created a networking potential that drives all of society and corporations to work faster, create and manage more interdependencies, and operate on global markets" (p.41). Above all, the importance of new networks is stressed in the role they play in developing Knowledge Management tools.

Perrin et al. (2007) identify "three different types of knowledge networks: technological networks (supported by technological strategy), social networks (socialization strategy), and individualized networks (personalization strategy)" (p.159) that may be related to different strategies. Their work is based on Hansen et al.'s, (1999) typology of knowledge strategies, which is the most widely supported and referenced typology and distinguishes between personalization and codification of knowledge, but with the inclusion of a third type that combines the previous two. Briefly, they distinguish: 1. technological, codification (Hansen et al., 1999), system-oriented strategy (Choi and Lee, 2003), or the technocratic school, which relies on technology and databases. Individuals make their knowledge explicit in order to transfer it via the database. According to Meroño-Cerdan et al. (2007:63), the codification strategy focuses on codifying knowledge using a “people-to-document” approach, with a heavy emphasis on information technologies. Moreover, system “orientation emphasizes codified knowledge, focuses on codifying and storing knowledge via information technology and attempts are made to share knowledge formally”. 2. Personalization, related to the spatial school (Earl, 2001), and which is conceived as a human-orientation approach (Choi and Lee, 2003), designed to promote the emergence of knowledge and dependent on face-to-face contact (Hansen et al., 1999). According to Meroño-Cerdan et al. (2007), the “personalization strategy focuses on dialogue between individuals, not knowledge objects in a database. Knowledge is transferred in brainstorming sessions and one-to-one conversation”, in addition, “human orientation emphasizes dialogue through social networks and person-to-person contacts, focuses on acquiring knowledge via experienced and skilled people and attempts are made to share knowledge informally” (p.63) 3. “The purpose of socialization combines both technological and personalization strategies and relies on communities of practices”, or communities of practice. “People inhabiting the same knowledge space share knowledge and experience in order to improve business processes” (Perrin et al., 2007:159).

However, according to Perrin et al. (2007), “KM theory has evolved this last decade from the technological dominance to the human orientation” (p.159). For instance, when Meroño-Cerdan et al. (2007) compare the two abovementioned strategies, they find that “personalization strategy is predominant in all kinds of firms, probable due to be more feasible in first KM adoption stages”(p.70). Perrin et al. (2007) compare the use of the three strategies in 1998, 2000, 2002 and 2004, and conclude that “our results are consistent with the human and social network trend” (p.159), since although the technological strategy was predominant in 1998, “62 per cent of firms surveyed are now using a mixed strategy based on socialization”… “socialization strategy asks for the better knowledge of the “knower”, the “sender” of the practice and the “receiver””(ibid, p.160).

The focus on this trend in the literature has stressed the importance of teams, communities of practice, and finally virtual communities and their human or social side, in order to enhance organizations’ capability to create and share knowledge, facilitate creativity and innovate.

Meroño-Cerdan et al. (2007:62) define a team as a small number of people with complementary skills who are committed to a common purpose, set of performance goals, and approach for which they hold themselves mutually accountable (Katzenback and Smith, 1993). These authors point out that team structure facilitates the assembling, integration, and implementation of individuals’ diverse knowledge and expertise at various locations, and by using their different functional knowledge, skills, perspectives, and backgrounds, they provide ideal conditions for generating new and useful products and processes. However, “formal departments, operational and project teams within an organization seem to become insufficient for prosperous creation, dissemination and utilization of knowledge. They require support of less formal communities” (Pavlin, 2006:136).

Another type of group used particularly in the KM context (Meroño-Cerdan et al., 2007), and considered as one of the most reputable (Pavlin 2006), is known as a community of practice (CoP) (Leve and Wenger, 1991; Wenger, 1999). The term “describes an activity system that includes individuals who are united in action and in the meaning that action has for them and for the larger collective” (Leve and Wenger, 1991; Loyarte and Rivera, 2007:67). Although there could be several CoPs within a organization, and most people belong to many of them, a CoP can be defined as a volunteer, or informal, group of practitioners, with common interests, values and beliefs, engaged in sharing and learning about a concern, a common set of problems, or with a passion for a certain subject, who work on the same topic but not necessarily on the same project, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis (Campbell, 1999; Meroño-Cerdan et al., 2007; Pavlin, 2006:136-137; Wenger et al., 2002:4). These authors argue that CoPs are categorized by their primary business intents. They can also be considered as "social spaces of learning", that "facilitate the integration of dispersed knowledge through informal social relationships irrespective of formal intra- and inter-organizational hierarchies" (Pyöriä, 2007:18), the purpose of which is to provide a forum for community members to help each other in solving problems in employment, to build, develop, exchange and disseminate best practice, guidelines and procedures, to turn practical information into knowledge and to develop members' capabilities, and their abilities to learn. Their target is to use, organize, manage and steward a body of knowledge from which the community members can benefit, to innovate, and create ideas, knowledge and practices. Loyarte and Rivera (2007:67, 72) define communities of practice as informal entities that exist in the mind of each member, that focus on thinking together to solve problems, that help to foster a collaborative environment in which knowledge can be used to solve problems naturally and to promote and improve effectiveness, efficiency, learning and innovation. These communities last as long as their members want them to last (Wenger and Snyder, 2000), and although frequency and formalization of collaboration vary substantially, they always make use of collaborative tools such as face-to-face meetings, or Web-enabled tools in order to facilitate interaction (Pavlin, 2006).

Finally a virtual community "includes anyone actively interested in, or associated with, a group formed around a particular domain of interest. Dispersed or local, the community requires electronic support to implement a continuous meta-improvement strategy in its services" (Bieber et al., 2002:14). A virtual community could be defined as a technology-supported cyberspace, centered on the communication and interaction of its participants and the building up of relationships among members, to generate specific domain knowledge that enables the participants to perform common functions and to learn from, contribute to, and collectively build upon that knowledge (Hsu et al., 2007:153; Lin et al., 2007). "The impact of virtual communities is increasingly pervasive, with activities ranging from economic and marketing to the social and educational" (Chiu et al., 2006:1872). However, the two most widespread types are virtual professional communities and education communities (Bieber et al., 2002:14; Moor and Weigand, 2007:223). According to Lin et al. (2007), professional communities can differ from general communities in many aspects. Members of a professional community generally share norms and values, carry out critical reflection, and continue professional dialogues with one another.

Professional virtual communities derive from or can be viewed as extended communities of practice (Bieber et al., 2002:14; Lin et al. 2007; Loyarte and Rivera, 2007:67). According to Bieber et al. (2002), "a professional society is a special kind of virtual community, in which members participate to better understand its domain and improve the way they perform community-related tasks. The virtual community of a professional society may include nonmembers and organizations and often is many times larger than the professional society's membership" (p.14). A professional virtual community aggregates and gathers together a dispersed group of people who share expertise and common interest in a specific topic and collaborate to achieve common objectives (Bressler, 2000; Hagel and Armstrong, 1997; Lin et al. 2007). Like virtual communities, communities of practice use the support of communication technologies to allow people to talk about their experiences and solve problems (Loyarte and Rivera 2007:67). However, traditional communities of practice use face-to-face interaction more frequently, and are usually intra-organizational entities, while virtual communities are inter-organizational systems.

SOCIAL NETWORKS

As pointed out above, although virtual communities are based on technological networks, the human or social part of the network plays an increasingly important role. As Pyöriä (2007) notes, "human relations are now more crucial than ever before due to the growing knowledge intensity of work and due to the deeper immersion of work organizations in information technology" (p.17).

Network analysis has developed from perspectives originating in the fields of psychology, anthropology and sociometry (Bradbury and Bergmann Lichtenstein 2000), and they have been studied extensively in the literature in these fields. In the management literature, network analysis, particularly the personal and social aspects of networks, is an increasingly relevant area of study. The ability to promote a context of psycho-social help (James 2000), the interconnections between managers and other individuals, and other aspects related to the importance of different networks are factors that are increasingly emphasized in the literature (Ellis and Mayer 2001). Its importance in the managerial literature began to grow following the work of Granovetter (1973), who stressed "the strength of weak ties", or Bandura's (1989) Social Cognitive Theory, that highlights an individual's behavior as a product of his or her social network (Chiu et al., 2006: 1873)[1].

The relevance of human or social networks in the Knowledge Management -or intellectual capital- arena derives from the works by Grant (1996) or Nonaka (1994). Nonaka (1998, cited by Girard, 2006) suggests that "new knowledge always begins with an individual" (p.26). Social networks are essential for organizations, because "tacit-to-tacit or person-to-person knowledge transfer is the most effective way to share tacit, complex knowledge.... Person-to-person knowledge sharing is also more likely to be internalized by the receiver than, for example, person-to-document-to-person knowledge transfer" (Endres et al., 2007:94). The development of research on the social capital of organisations, one of the three main "intellectual capitals" that researchers consider in organisations together with human and structural capital (Palacios and Garrigos, 2003) also stresses this aspect. Social capital is defined as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit" (Nahapied and Ghoshal, 1998:243).

The importance of human relations and networks has recently been studied in teams, communities of practice, different alliances between enterprises and virtual organisations. In this line, Lytras and Pouloudi (2006:66) point out that "knowledge flow is a dynamic concept... that relates to the characteristic of humans to constitute teams that share a common objective and thus facilitate the exchange of knowledge". Maguire et al. (2007:41) study the importance of Knowledge Management and communities of expertise within small and medium enterprises (SMEs), arguing that "small companies... tend to rely on formal and informal networks rather than utilising publicly funded sources of support". From their empirical research with a sample of over 200 enterprises, these authors find that SMEs tend to create tacit knowledge that "was derived from personal experience and wisdom, organically created and shared amongst individuals in the relevant department.... [and find] no evidence that a method to capture and acquire cultural knowledge has been used". However, Pyöriä (2007) states that "individual knowledge workers from "communities of practice" or professional subcultures... transcend formal and clear-cut organizational boundaries" (p.18). It is important to note that networking activities occur not only in firms, institutions or banks, or amongst lawyers and accountants (to name just a few) in a formal way (Das and Teng 1997); the formal and informal relationships between entrepreneurs, managers, organizational representatives, colleagues outside work (Paauwe and Williams 2001), personal relationships, families and other business contacts are also essential. Social relationships are important, because, according to (Hillman et al., 2000), one of the main tasks facing managers is to provide networks through their connections with the social environment. In this vein, Burt, Hogarth and Michaud (2000) argue that managers with links in separate groups are rich in the social capital of information and control the benefits associated with relationships that overcome the "structural gaps" in their information. In addition, social networks can be extended to all parts of organisations to embrace all personnel. Chiu et al. (2006:1875) report that Tsai and Ghoshal (1998) empirically justify how social capital facilitates resource exchange and production innovation within the organization, while Yli-Renko et al. (2001) examine the effects of social capital on knowledge acquisition and exploitation in young technology-based firms In addition, Wasko and Faraj (2005) examine how individual motivations and social capital influence knowledge contribution in electronic networks of practice. Kodama (2005) points out that "one of the keys to producing innovation in a knowledge based society is how organizations can organically and innovatively network different knowledge created from the formation of a variety of SCs (strategic communities, a concept similar to relationships between firms) inside and outside the organization, and acquire the synthesizing capability through dialectical leadership they need to generate new knowledge" (p.907). Finally, according to Perrin et al. (2007: 158), "best practices… may develop through benchmarking…, learning… or by "gleaning" skills from strategic alliance partners" (Hammel and Prahalad, 1988).

What, then, are the main components of social capital? In Chiu et al. (2006:1873), Nahapied and Ghoshal (1998) define three distinct dimensions of social capital: structural (the overall pattern of connections between actors), relational (the kind of personal relationships people have developed with each other through a history of interactions), and cognitive (those resources providing shared representation, interpretations, and systems of meaning among parties). Wasko and Faraj (2005) also follow Nahapiet and Ghoshal (1998) to classify social capital in three dimensions (structural, relational, and cognitive) but do not adopt Nahapied and Ghoshal's manifestations of each of these dimensions.

To begin with the structural dimension, authors such as Chiu et al. (2006:1873) or Nahapiet and Ghoshal (1998) use the construct "social interaction ties" in order to measure this dimension of social capital. Social interaction ties are considered as channels for information and resource flows (Tsai and Ghoshal, 1998), "network ties provide access to resources" (Nahapiet and Ghosal, 1998:252), and the more social interactions undertaken by exchange partners, the greater the intensity, frequency and breadth of information exchanged (Larson, 1992; Ring and Van de Ven, 1994). In summary, Chiu et al. (2006) conclude that "strong community ties could provide important environmental conditions for knowledge exchange" (p.1875). Granovetter (1973) describes tie strength as a combination of the amount of time, the emotional intensity, and intimacy (mutual confidence), and the reciprocal services that characterize the tie. Chiu et al. (2006) state that social interaction ties represent the strength of the relationships, the amount of time spent, and frequency of communication among members of virtual communities.

To consider the relational dimension, Chiu et al. (2006:1873), again following Nahapiet and Ghoshal (1998), use the constructs of "trust", "norm of reciprocity" and "identification" to measure this dimension of social capital. According to Al-Alawi et al. (2007:23), interpersonal trust is known as an individual's or group's expectation that the promises or actions of other individuals or groups can be relied upon. Trust is a powerful mechanism in coordinating group behavior, although it has some constraining factors such as longevity, especially in the context of knowledge work teams (Pyöriä, 2007:23, 26). However, trust between co-workers is an extremely essential attribute in organizational culture (Al-Alawi et al., 2007; Hsu et al., 2007; Pyöriä, 2007), which is believed to have a strong influence on knowledge sharing (Al-Alawi et al., 2007:23). In addition, "the effectiveness of IT in actualizing KM and organizational learning is significantly dependent on sustaining trust" (Sherif, 2006:75), where trust is identified as a "key element in fostering the level of participation or knowledge sharing in virtual communities" (Chiu et al., 2006:1875). Norms of reciprocity refers to knowledge exchanges that are mutual and perceived by the parties as fair (Chiu et al., 2006:1877). Chiu et al. (2006:1875, 1877-1879) report that authors such as Dholakia, Kankanhally or Bock find that group norms have a strong effect on we-intentions (group intentions) to participate in virtual communities and that reciprocity is positively related to the usage of electronic knowledge repositories by knowledge contributors, and have a positive effect on attitude and intention to share knowledge. If we finally consider identification, according to Chiu et al. (2006), "some studies found that a sense of community… and social identity…can enhance the likelihood of members' contribution and participation in a virtual community" (pp.1875-1879).

As regards the cognitive dimension of social capital, Chiu et al. (2006:1873), again following Nahapiet and Ghoshal (1998), use the constructs "shared vision" and "shared language" to measure the cognitive dimension of social capital (see also ibid, pp. 1878-1880). In addition to these three dimensions, other social capital dimensions not considered by these authors may be the diversity and breadth of relationships, the strength of the relationships, the quality of the relationships, or the emphasis on social ties such as information from friends and families (Garrigos, 2002).

IMPORTANCE OF SOCIAL NETWORKS IN DEVELOPING VIRTUAL COMMUNITIES

According to Lin and Hsueh (2006), "learning in virtual communities can be facilitated by the transactive memory system" (p.552), which consists of three components: knowledge map (represented by knowledge objects and their dependencies); social networks (formulated by individuals, their relationships, and the strength of relationship); and mnemonic functions (which include knowledge allocation, social network updating, knowledge maintenance and collaborative knowledge retrieval). From very diverse points of view, numerous authors stress the importance of many characteristics of social networks, and in general "the human side", in order to create, maintain and develop virtual communities. Many explanations have been given for the importance of these networks. Firstly, they stress the human side, which is increasingly important to understand the functioning of virtual organisations. Secondly, because these networks are heterogeneous, they can bring new perspectives and sources of knowledge to the virtual organisations, thereby increasing knowledge creation and creativity. Thirdly, "personal and organizational networks play an important role in accessing knowledge" (Christensen, 2007:38). The fourth reason given is that the establishment of social networks can increase trust or ties, thus helping to increase knowledge sharing and enriching virtual organisations. Finally, the common identity of the members of a social network can facilitate knowledge sharing. Some of these reasons are now analysed.

Lin et al. (2007) argue that humans are social beings and tend to form groups and alliances for protection and pleasure, and due to the rapid progress of technology, the concept of community has been extended to a virtual form. However, Pyöriä (2007:25) points out that "the field of information systems has traditionally been plagued by high implementation failures because the understanding of socially situated practices in knowledge work is incomplete" (Schultze, 2000:4). According to Pyöria, (ibid, p. 26) "one of the biggest challenges of the information age is that the more deeply we are immersed in IT, and the more routine work is transferred from men to machines, the more important it is to understand the human side of work…. In this respect there is a need for research that combines perspectives from technical, behavioral and social scientific disciplines".

More specifically, Pavlin (2006:138) emphasizes the importance of communities of practice and networks, and their heterogeneity as essential instruments to increase creativity and learning. Based on the work of Wenger (1999), Pavlin states that the structure of communities of practice is grounded on three components: (1) knowledge, "the domain as the area of knowledge that brings the community together"; (2) people or "the community as the group of people for whom the domain is relevant"; and (3) experience "the practice as a body of knowledge, methods, tools and stories that members share and develop together. On this basis, Pavlin considers networks to be essential because "the number of qualified experts (managers, scientists, ICT personnel, etc.) in a single organization (regardless of the size) may be insufficient to support the knowledge of a certain domain, that is not usually the case in a well-established network that associates the members from different organizations". According to Pavlin (2006) "acting within the same knowledge domain but from a different perspective can be an advantage for established practice. The members of our community are filling the holes in social structure between certain organizations… Networking across structural holes is clearly a form of social capital… in such a manner that competitive advantage is created for the members of the community and also for the organizations where they work. The theory of social capital emphasizes that the difference (as for example in education, occupation, employee organization) is the precondition for creativity and informal learning… we are not arguing that in the professional network the common experiences are not important, but that a "bit of difference in parity" is crucial" (p.139).

According to Christensen (2007), "without networks there is no opportunity for accessing knowledge" and similarly, "the sharing of knowledge is facilitated by some kind of personal or virtual network" (p.38). As we point out in this chapter, we believe that social and virtual communities can reinforce each other. In this vein, Christensen points out that these "networks can be maintained by formal or informal face-to-face meetings, or – the latest trend – by physical structures that do not allow individual cubicles, but emphasize transparent community spaces" (p.38).

On similar lines, Chiu et al. (2006) state that "the social interaction ties among members of a virtual community allow a cost-effective way of accessing a wider range of knowledge sources" (pp.1876-1877). Nahapiet and Ghoshal (1998) argue that "network ties influence both access to parties for combining and exchanging knowledge and participation of value through such exchange" (p.252). Furthermore, network ties provide the opportunity to combine and exchange knowledge. Recent studies have provided empirical support for the influence of social interaction ties on interunit resource exchange and combination (Tsai and Ghoshal, 1998), knowledge sharing among units that compete with each other for market shares (Tsai, 2002), and knowledge acquisition (Yli-Renko et al., 2001).

According to Endres et al. (2007), "when individuals are embedded in a strong social network, they are motivated to more freely share knowledge (Wasko and Faraj, 2005)" (p.96). As Hsu et al. (2007:154) point out, membership of virtual organisations is open, members voluntary contribute their knowledge without receiving monetary rewards, and most members are invisible, they do not provide guarantees that others will behave as they are expected to, and there is a lack of face to face communication and legal guarantees, which makes it harder for members to share their knowledge. It therefore follows that the existence of the social network, previous to the creation of the virtual community, is crucial for it to be effective, as this is a better way of creating and sharing knowledge.

Following similar criteria, Loyarte and Rivera (2007:72) stress the importance of "Social identity theory" in order to "cultivate communities of practice". "The concept of communities of practice has in recent years become one of the most popular tools for enhancing knowledge sharing – even though no one actually knows how to practice, or cultivate, a community of practice" (Christensen, 2007:37). Loyarte and Rivera (2007) illustrate the importance of social identity theory with some examples: "open software communities (i.e. Linux, Apache, etc.) are good examples where… members are motivated and not for lucrative purposes, but because they get to nourish their esteem. People have to feel valuable and they need to trust other members (World Bank). In this sense, it can be difficult… if members feel they can lose their hierarchical power or status… in an organization change or in an innovation process" (p.72).

According to Hsu et al. (2007), the biggest challenge in fostering virtual communities is the willingness to share knowledge with other members. In this respect, two issues are involved: personal cognition, which is based on self-efficacy and outcome expectation, and social influence, based on trust. They argue that knowledge sharing is affected by trust, "an implicit set of beliefs that the other party will behave in a dependent manner… and will not take advantage of the situation" (pp.153-154). The importance of trust, in all its varieties, together with the other two variables, is crucial in the social networks literature. Hence, all the literature about trust in the social networks literature is essential to better understand the behavior of a virtual organization, as Hsu et al. (2007) point out. For instance, these authors use a social cognitive theory-based model to explore the knowledge sharing behaviors within the virtual communities of professional societies, and suggest that further research should extend their model using the social capital theory "as a broad view in exchanging and combining intellectual capital—including structural, cognitive and relational dimensions".

The study by Chiu et al. (2006) also "draws on both the Social Cognitive Theory and the Social Capital Theory to investigate the influence of outcome expectations and facets of the three dimensions of social capital on knowledge sharing in virtual communities in terms of quantity and quality" (p.1873). Chiu et al., (2006) point out that "without rich knowledge, virtual communities are of limited value… clearly, the biggest challenge in fostering a virtual community is the supply of knowledge, namely the willingness to share knowledge with other members. It is then important to explain why individuals elect to share or not to share knowledge with other community members when they have a choice" (p.1873). In order to explain this fact, they use the Social Cognitive Theory and the Social Capital Theory. They argue that "it is the nature of social interactions and the set of resources embedded within the network that sustains virtual communities. Therefore studies on virtual communities address issues related to both personal cognition and social network and should be different from the … studies concerning computer use and internet behaviors, which focus only on personal cognition" (p.1873). In addition, they also introduce the Social Capital Theory to supplement the Social Cognitive Theory[2]. They point out, referring to Nahapiet and Ghoshal (1998), that "the Social Capital Theory suggests that the social capital, the network of relationships possessed by an individual or a social network and the set of resources embedded within it, strongly influence the extent to which interpersonal knowledge occurs"[3]. According to Chiu et al. (2006), "virtual communities differ notably from conventional organizations. There is no concrete reward system in place to reinforce the mechanisms of mutual trust, interaction, and reciprocity among individuals. However, online knowledge sharing activities cannot be successful without the active participation of online members. Lack of motivation from a knowledge contributor impedes the knowledge sharing. Under such circumstances, social capital becomes all the more important, because the resources inherent in the online social network mediate between the individuals and hence foster their intention and activeness to perform this voluntary behavior" (p.1876). Finally, the results of Chiu et al.'s (2006) study indicate that "outcome expectations and facets of social capital are helpful in explaining knowledge sharing in virtual communities"[4] (pp. 1884-1885). Hence, they conclude that "managers interested in developing and sustaining knowledge exchange through virtual communities should develop strategies or mechanisms that encourage the interaction and the strength of the relationships among members"[5] (ibid, p. 1885).

According to these measures, Moor and Weigand (2007) state that "virtual communities… are not governed by such a hierarchy, but instead should allow the interests of their members to be balanced by their unique social norms. To reduce these problems, systematic methodological support is needed for the required legitimate user driven specification process" (p.244). Hence, these authors argue that in order to improve virtual communities 1) "trust is essential for collaboration in these communities to occur" 2) "well-defined formalizations can help in the administration and facilitation of the change process, and the resolution of any breakdowns" and 3) "clear formalizations help to adapt the methodology without generating inconsistencies and incompletions" (p.244).

Finally, social networks facilitate virtual organisations because a common identity is shared between their members. In this vein, "common identity often facilitates knowledge sharing since individuals within one specialist group understand each other better than people from outside the group – they are more or less believed to possess the same absorptive capacity" (Christensen, 2007). According to this author, "apparently, a community makes it much easier to share knowledge, because people really care about their practice, are embedded in the same practice and, hence, talk the same (technical) language" (p.38).

IMPORTANCE OF VIRTUAL COMMUNITIES IN DEVELOPING SOCIAL NETWORKS, AND AS A MECHANISM TO CREATE AND SHARE KNOWLEDGE

Following the analysis of the importance of social networks for the development of virtual communities, we now demonstrate that virtual communities in today's environment are also a crucial instrument to create and maintain social networks, and a valuable system to create and share knowledge.

As Chiu et al., (2006) point out, "people who come to a virtual community are not just seeking information or knowledge and solving problems; they also treat it as a place to meet other people, to seek support, friendship and a sense of belongingness… In other words, they attempt to develop social relationships with other people inside the community" (p.1874). From an analysis of the Business Week / Harris Poll, these authors find that 35% of people involved in a virtual community consider their community as a social group.

A further important question is how virtual communities, with the use of new technologies, can be essential instruments to codify and disseminate certain knowledge. On this point, Sherif (2006) states that "tacit knowledge is best leveraged through social interaction… whereas explicit knowledge can be codified, captured, and disseminated electronically" (p.74). Hence, virtual communities can be used by their members as a mechanism to continually obtain new knowledge from new people and at the same time, codify and select this knowledge and the social network that is of interest at each given moment. This facet is important, since authors such as Girard (2006) refer to studies where managers complain of information overload and of wasting time in locating information, thus delaying decisions because of too much information and no mechanism to select this information. According to this author, managers "dwell on information that is entertaining but not informative, or easily available but not of high quality", which becomes a major problem since "the amount of data and information available will increase in the future" (p.27) . Girard (ibid) maintains that "this mountain of unprocessed data is becoming so large that it is smothering itself and preventing its metamorphosis to knowledge. Recent research suggests that it may be quicker for scientists to repeat experiments rather than search for previous results … One wonders how organizations that invested millions of dollars in programs to manage knowledge are now discovering that their managers are less efficient than before the implementation" (p.28).

Social networks can help to avoid this problem, and the use of virtual communities can also help in the development of these social networks, or as a mechanism to create or access the most relevant social networks for managers at each specific moment.

Social networks, more than merely the use of technology, and with them, the use of virtual organisations, is crucial, because, according to Pyöriä (2007) "technology as such is of little direct help in the process of augmenting human collaboration in knowledge work" (p.23). There is a "false conception of the utility of IT for enhancing interpersonal interaction by constructing new communication channels parallel to old ones… The true revolutionary nature of IT lies in its capacity to overcome limitations in our natural physical and mental capabilities by eliminating the need for communication"[6]. "Therefore, the elimination of useless interactions… can save time for developing its true creative strengths, which constitute the core of knowledge work. … It is in this distinctively human territory of creative problem solving and non-routine decision making where IT as such is least capable of increasing productivity" (ibid, p.24). Pyöriä (2007) stresses that "general beliefs in the communicative advantages of IT are highly overvalued… the speed with which these applications are being introduced, coupled with knowledge workers' lack of time and resources to internalize them, have resulted in a more or less chaotic situation….. for example, as numerous studies indicate, groupware and other intranet-base solutions rarely, if ever, work exactly as planned, and the systems are often used in an uncontrolled and impulsive manner" (p.26).

The debate about the importance of new technologies and Internet and whether it is useful in creating social capital is also considered by Chiu et al. (2006:1875). According to these authors "Putnam (2000) suggested that the Internet decreases social capital, while Wellmen et al. (2001) indicated that Internet use supplements social capital by extending existing levels of face-to-face and telephone contacts. Uslaner (2000) concluded that the Internet neither destroys nor creates social capital". However, these and other authors point out the importance of virtual communities to overcome these problems.

Firstly, Hsu et al. (2007) point out that the Internet facilitates the creation of professional virtual communities that enable knowledge sharing without their participants ever meeting. Hence, it facilitates the creation and development of networks. According to Djordjevic et al. (2007), virtual communities or organisations "span across organizational boundaries and enable the enactment of collaborative processes that integrate services, resources and knowledge in order to perform tasks that the virtual organizations partners could not undertake on their own" (p.634).

Kodama (2005) points out that "the dilemma faced by organizations is the need to reconcile rapid access and synthesis of relevant new knowledge, with the long time frames needed for knowledge creation and synthesis". In this vein, "Networked Strategic Communities based on deep inter-organization collaboration can offer a possible solution" (p.904). According to Kodama (2005), "knowledge, or management resources, aimed at innovation is created from SCs, a wide range of knowledge both inside and outside the company, including customers and strategic partners, is synthesized via the network, and new knowledge that never existed before is created to become a new source of competitive advantage" (p.906).

Bieber et al. (2002) state that "many researchers have observed that Knowledge Management primarily is about people and cultural change rather than technical development". They also maintain that "research on online communities concerns itself explicitly with supporting people networking together to achieve a goal. Through this networking, knowledge is created and exchanged. Technology now plays an important role by supporting activities, recording knowledge, and developing organizational memory" (p.15).

In this vein, two factors facilitate the growth of networks subsequent to the use of professional communities; the fact that participation in these communities is voluntary and involves members of different organisations, and the fact that in professional communities members are used to participating openly.

In relation to the importance of voluntary participation in virtual communities, Chiu et al. (2006) mention that "members in virtual communities differ from general Internet users in that virtual community members are brought together by shared interests, goals, needs or practices" (p.1875). With this premise, Endres et al. (2007) point out that "volunteer organizations or informal organizations outside normal firm boundaries may better facilitate fluid knowledge transfer at the individual level than within the traditional organization structure" (p.93). This fact can avoid the problem that knowledge inside closed organisations is more restricted than the knowledge found in open organisations. For instance, Endres et al. (2007) explain that "in contrast to the free and fluid flow of tacit knowledge in the Open Source community[7], knowledge sharing is often limited in organizations, especially knowledge that is complex and tacit" (p.97). In addition, Kodama (2005) points out that "the act of transcending boundaries stimulates deep, meaningful learning, which in turns opens possibilities for the generation of new knowledge" (p.904).

However, Chiu et al. (2006) mention that the character of virtual communities "begs the key question [of] whether the social capital developed in virtual communities is strong enough to stimulate members to overcome the barriers of complex knowledge sharing process and then share valuable knowledge, especially when no extrinsic reward is provided" (p.1875) . Nevertheless, this problem can be avoided, according to Endres et al. (2007), because although members in virtual communities may be unpaid, a person may acquire some degree of status and may have the opportunity for financial gain based on their in-demand persona. "The reward is not formal or assured, but may be a motivator to participate" (p.98). This fact, in addition, can strengthen the social network of community members, who know each other better, following their contributions to virtual organisations.

The second important point is the open participation in professional communities. According to Lin et al. (2007), community members can communicate and collaborate as groups. Members participate in virtual communities either openly or anonymously, depending on the kind of community it is. However, Lin et al. (2007) point out that in the professional virtual community, members participate in community activities openly rather than anonymously for professional purposes. This fact can go further to facilitate the importance of these virtual communities in enhancing social networks, and to facilitate the creation and sharing of knowledge.

Examples of communities of practice and virtual communities are various. For instance, in a case study, Pavlin (2006:137) shows how a small organization was able succeed in building an extensive network of top researchers, professors, high government officials, journalists and even interested individuals who share a passion or are differently influenced by the common knowledge domain. This author also mentions that the literature presents numerous cases of communities of practice and virtual communities, mainly in large international corporations such as Ford, IBM, Airbus, British Petroleum, Cap Gemini, Ernst & Young, Clarica, Hewlett Packard, McKinsey, Mercedes-Benz, Shell Oil, Siemens, Chevron, Xerox, etc.

To summarize, with the development of Internet technology, professionals and the public at large can communicate with each other via the Internet regardless of geographical distance (Lin and Hsueh, 2006:551). However, the importance of professional virtual communities lies in their value to create and share knowledge. For instance, according to Randeree (2006), "information systems researchers are currently looking at knowledge creation, knowledge acquisition and knowledge sharing" (p.145). Lin and Hsueh (2006) state that "the virtual community enabled by the World Wide Web (WWW) facilitates knowledge sharing and creation for communities of practice" (p.551). Hsu et al. (2007:153) point out that today, an increasing number of individuals participate in virtual communities to acquire knowledge to resolve problems at work, and that virtual communities are valuable systems that hold the key to Knowledge Management. Finally, authors such as Lin et al. (2007) study the knowledge sharing and creation process in a virtual community.

We now highlight the importance of virtual communities in creating and sharing knowledge.

Knowledge Creation

According to Sherif (2006), "knowledge creation is considered the most important of all KM processes (Lapre and Van Wassenhove, 2001)" (p.75). "Knowledge creation is concerned with the development of new organizational knowledge in the firm", although knowledge integration and exploitation can also contribute to the development of new organizational knowledge through (Nielsen, 2006:62). In the generation of knowledge, the actors translate the assembled array of tacit and explicit knowledge into a form suitable for transfer to others (Geisler, 2007:86)[8].

Sherif (2006) points out that "the general belief is that knowledge creation is an inherent trait of some organizations, an art of continuous change (Brown and Eisenhardt, 1998) that the majority of organizations may fail to imitate (Quin et al., 1996)… the majority conquer with the proposition that the process is highly tacit and cannot be captured" (p.75). However, virtual organisations can play a crucial role in the creation of knowledge.

Kodama (2005) argues that the rigidities of formal organizations make them a "poor vehicle for learning"; rather, in this situation the sources of innovation lie exclusively within firms' relationships. "Knowledge creation occurs in the context of a community that is fluid and evolving rather than tightly bound or static". "Knowledge creation is an extremely important issue that sees knowledge as a property of communities of practice…, ba…, communities of creation…, and networks of collaborating organizations… rather than as a resource that can be generated and possessed by individuals. When the knowledge base of an industry is both complex and expending, and the sources of expertise are broadly dispersed, the locus of innovation will be found in networks of inter-organizational learning rather than in individual organizations" (p.896).

Loyarte and Rivera (2007) state that "when people participate in the problem solving and share the knowledge necessary to solve the problems, it is possible to speak about the generation of knowledge in Communities of practice" (p.67). The same occurs with virtual communities. According to Pavlin (2006), the main purpose of communities of practice "is creating a platform, for supporting a structure for running the knowledge cycle (as described for example by Nonaka and Takeuchi,…..) within, among and between organizations. The community helps to disseminate and create knowledge, whilst the use (and also further creation and dissemination) of knowledge belongs to other more formal organizational structures like projects groups and teams" (p.141)[9].

Finally, Lin and Hsueh (2006), following Nonaka, point out that "organizational knowledge creation may start from the individual level via the collective (group) level tothe organizational level, and sometimes reach out to the inter-organizational level", in this way, "the inter-organizational learning process facilitated by a virtual community information system constructs distributed explicit knowledge, and weaves the social networks to connect tacit knowledge owned by individuals across organizations" (p.552).

Knowledge Sharing

According to Al-Alawi et al. (2007), "the process of Knowledge Management involves several activities" (p.22). The most commonly discussed activity in the process of Knowledge Management nowadays is knowledge transfer (knowledge sharing). The sharing of knowledge is a knowledge process that has been recognized as a subject of some interest by scholars (Geisler, 2007). According to this author, "the mode of transfer of knowledge is a component of the process in which actors in the organization transfer, share, and diffuse the knowledge they possess" (p.86). Randeree (2006:153) claims that knowledge sharing involves the dissemination of information and knowledge throughout the business unit or organization. From the same point of view, Hsu et al. (2007) state that "knowledge sharing is the behavior when an individual disseminates his acquired knowledge to other members within an organization" (p.154) . Virtual organisations can also help this process, since "the goal of knowledge sharing can either be to create new knowledge by differently combining existing knowledge or to become better at exploiting existing knowledge" (Christensen, 2007:37), and since they make available the use of new sources of knowledge .

Virtual communities can help in the process of sharing knowledge, both because of the importance of their social side in sharing knowledge, and also because of the fact that "knowledge is often shared with the help of the technology" (Wenger, 1999; Perrin et al., 2007:159). According to Lin and Hsueh (2006), "in the Internet era, explicit knowledge exists generally in hypertext on the Web or texts on the Intranet… . In order to shorten the learning cycle, an individual can exploit the experience of others to enlarge his or her experiences, which can be carried out by sharing explicit knowledge on the Internet". "Besides, well-structured knowledge objects reveal the relationship among knowledge, and reduce information overloading on knowledge sharing and creation" (p.552) . In addition, according to Randeree (2006) "knowledge sharing is as much of a people issue as it is technological". In this way, "technology can act as both a facilitator and a control mechanism to protect knowledge", and "firms see benefits to sharing knowledge and establish motivational approaches and communication mechanisms to share knowledge" (p.153). In addition, Endres et al. (2007) argue that there is an "inherent co-occurrence of informal and formal social networks in organizations… In a given organization, tacit-to-tacit knowledge sharing may occur in some groups but not in others. In addition, some informal, strong social networks that effectively transfer knowledge may be embedded in otherwise formal structures" (p.100). Hence, the use of technological and social sides can complement and strengthen the process of knowledge sharing.

Christensen (2007:38) identifies five problems in the literature inherent in organizational knowledge sharing: (1) the "stickiness" of knowledge, that refers to the epistemologically different faces of knowledge (mainly tacit versus explicit knowledge); (2) the absence of a common identity between the people who are trying to share this knowledge, a fact that hinders the knowledge sharing process; (3) the lack of any relation between the receiver and sender of knowledge; (4) a lack of willingness to share knowledge, an issue that mainly "deals with social dilemmas...as the trade of commons, and the power of possessing knowledge"; (5) and the lack of knowledge about knowledge[10].

Hsu et al. (2007) state that "prior research has highlighted the various factors that affect an individual's willingness to share knowledge, such as costs and benefits, incentive systems, extrinsic and intrinsic motivation, organization climate and management championship" (p.154). In the same vein, different authors have created models that emphasize the importance of various variables in the sharing of knowledge.

For instance, Al-Alawi et al. (2007:25-26) create a model including certain cultural factors that influence knowledge sharing, specifically: trust, communication between staff, information systems, reward system, and organization structure. According to their results, "trust, communication, reward system and organization structure all received strong literature support. However, information systems/technology received mixed support" (ibid, p.39). They state that "the relationship that proved to exist between knowledge sharing and trust communication, information systems, reward system and organization structure indicates the importance of such factors as prerequisites of the success of knowledge sharing" (ibid, p.37), and recommend and suggest some ways of emphasizing these aspects in the firm.

Lin et al. (2007) conducted a three-phase study on a teachers' virtual community in order to understand the knowledge flows among community members from different organisations. The objective of their study was to identify essential factors in individual, group, organization, and environmental contexts, which affect knowledge sharing and creation in the professional virtual community. Specifically, their model categorizes these factors as environmental, information technology, project, organizational, group and individual contexts, and defines the process of knowledge sharing and creation by the sequence of causal conditions[11], action/interaction strategies, and consequences (at the individual, group and organizational level)[12].

Finally, according to (Chiu et al., 2006), "some studies... suggested that individuals would share knowledge within virtual communities with the expectation of enriching knowledge, seeking support, making friends, etc. Butler et al... suggested that the primary reason for individuals to share knowledge is their expectation of being seen as skilled, knowledgeable or respected. Other studies suggested that individuals share knowledge with the expectation of helping the virtual community to accumulate its knowledge, continue its operation, and grow..." (p.1875)

However, literature and empirical studies that thoroughly address the problem are scarce; in addition, according to Lin et al. (2007), few studies have addressed the knowledge sharing and creation processes successfully by collecting data from commercial companies, and further research is therefore necessary.

CONCLUSION

The development of new technologies and information and communication systems, the expansion of network access, and the rise of the Internet have led to the proliferation of new business styles based on information and knowledge. This trend has facilitated the growth in importance of the construction of strong social networks and advances and effective professional virtual communities as a mechanism that can enhance competitive advantage for organisations.

Professional virtual communities can be conceived as an evolution of teams, and communities of practice, that combine a technological and a human orientation. The technological side is crucial to promote communication and to cross organizational borders in order to enhance knowledge creation and sharing capabilities, while the human and social side, which has emerged as the most important, stresses the relevance of social and informal relationships as a source of creativity and innovation.

With the increasing relevance of the human side, the understanding of social networks, as a source and as a consequence of the development of virtual communities, is stressed by the literature. Network analysis has developed from perspectives in the fields of psychology, anthropology and sociometry, and is an increasingly relevant issue in the literature of management because of the importance of individuals and their social relations and cultural aspects related to networks such as ties, trust, sense of community, shared vision or the existence of diverse relationships inside and outside the enterprise, to generate and share knowledge.

In the same vein, social networks, and all aspects related to their development, are crucial to developing virtual communities. Social networks can facilitate learning, collaboration, knowledge sharing and creation in virtual communities. The main aspects explaining the importance of networks in virtual communities are: the fact that they stress the importance of the human side of these communities; the importance of heterogeneity of networks to bring new perspectives and sources of knowledge to virtual communities, which increase knowledge creation and creativity; their importance because of their role in accessing crucial or tacit knowledge; and because of the importance of increasing trust, ties, motivation, willingness, and a common identity, facts that contribute to increasing the creation and sharing of knowledge.

However, virtual communities are also important in the development and maintenance of social networks and as an essential mechanism or valuable system for creating and sharing knowledge in today's technological society. In this way, virtual communities are essential places to meet other people with different perspectives, to seek support, friendship, and a sense of belonging, and in summary, to develop social relationships with other individuals. They are useful mechanisms to obtain a constant flow of new knowledge from new people, and essential instruments to codify and disseminate different knowledge, avoiding information overload and wasting time by their members in the search for selecting information. They are essential mechanisms to create or access the most relevant social network for managers or other professionals at each given moment, gaining more time to develop its true creative strengths. In addition, they can help to eliminate limitations in our natural physical and mental capabilities. The use of new technologies by virtual communities also helps to extend existing levels of face-to-face and telephone contacts, maintaining and developing social interactions, and facilitating the creation and development of networks across organizational boundaries, and collaboration among their members. They help to integrate services, resources and knowledge in order to perform tasks that the members of virtual communities could not undertake on their own, supporting people networking together to achieve a goal. The voluntary participation, and the shared interests, goals, needs or practices of virtual organizations members, together with the open participation of the professional members, enhance social networks, as well as facilitating the creation and sharing of knowledge.

If we turn to the importance of virtual communities in creating and sharing knowledge, creation is promoted by the open, voluntary and fluid character of virtual organisations, because through them, individuals can access broadly dispersed sources of expertise, and because they act as a platform that supports the running of the knowledge cycle, helping to combine different sources of ideas. In addition, the sharing process is encouraged as virtual organisations help to make available the use and exploitation of existing knowledge or new sources of knowledge. By combining the social side with the motivational approaches, with the help of technology that facilitates the communication and control of knowledge, the sharing of knowledge is promoted. In this vein, all the above-mentioned processes in virtual communities facilitate the common identity of their members, the relationships between the senders and receivers of knowledge, the communication and information systems, the trust and motivation to share knowledge, and the knowledge of knowledge, facilitating knowledge sharing.

FUTURE RESEARCH DIRECTIONS

This chapter has highlighted the relationships between virtual communities and social networks, and how they can enhance each other's development. Furthermore, the importance of virtual communities to create and share knowledge has been expounded. However, further research is necessary: firstly theoretical research that can complement and develop the ideas suggested in this chapter; and secondly, empirical research to develop hypotheses and test them with data from a range of virtual communities.

ACKNOWLEDGMENT

The authors acknowledge financial support from Fundació Caixa Castelló-Bancaixa (P1 1A2006-10), and Generalitat Valenciana (GV/2007/100).

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ENDNOTES

1 According to Bandura (1989) and Chiu et al. (2006), "The Social Cognitive Theory argues that a person's behavior is partially shaped and controlled by the influences of social network (i.e., social systems) and the person's cognition (e.g., expectations, beliefs)…" "Through close interactions, individuals are able to increase the depth, breadth, and efficiency of mutual knowledge exchange" (pp. 1874-1873). In addition, Lytras and Pouloudi (2006) point out that "Behavioral change… enlightens the way in which individuals transform their behavior according to feedback they gain from participation in bigger social construction" (p.68).

2 Chiu et al. argue that "Social Cognitive theory is limited in addressing what components are within a social network and how they influence an individual's behaviour"

3 Hence, as Chiu et al. (2006:1875) state, "according to the Social Cognitive Theory, the question—why do individuals spend their valuable time and effort on sharing knowledge with members in virtual communities, should be addressed from the perspectives of both personal cognition and social network".

4 "Facets of social capital positively relate to the quantity of knowledge sharing or the quality of knowledge shared by members…. Outcome expectations can contribute to knowledge sharing to some extent, but it is the social capital factors (e.g. social interaction ties, trust, norm of reciprocity, identification, shared language and shared vision) that lead to greater level of knowledge sharing in terms of quantity or quality…social interaction ties were significant predictors of individuals' knowledge sharing in terms of quantity".

5 For instance, "holding face-to-face meetings or seminars.. as a way of enhancing the social interaction ties among members.. or providing personal message boards and blogs as tools for enhancing online communication and interaction among members" .

6 According to this author, (ibid, p.24) "the efficient use of IT simply enables the automation of routine tasks and helps us to avoid useless communication…is the only way to win more time for collaborative problem-solving and other tasks that resist "the logic of the binary code""

7 "The purpose of the "Open Source" software community is essentially knowledge sharing and collaboration… the goal … is to develop, distribute, redistribute, and share source code of software that benefits individuals and organizations, with no discrimination and with restricted licensing (www.opensource.org) Software developed with a General Public License creates the freedom for people to copy, study, modify and redistribute software. It forbids anyone to forbid others to copy, study, modify and redistribute the software"… .According to this organisation (ibid, p.98), well-known Open source projects include the Linux operating system, Apache server software, Python coding language, and OpenSSL system secure communication software.

8 Geisler's paper proposes a model that links the generation of knowledge with its users. These process or "four modes or stages of knowledge processing are: generation, transfer, implementation and absorption" (ibid, pp.90-91).

9 According to this author, communities of practice, such as the virtual organisation, can link members to the strategic knowledge domain of the organization, develop core organisational competency through collaboration and learning, provide common development needs, distribute functional expertise, facilitate cross-generational and cross functional exchange of knowledge (Saint-Onge and Wallace, 2003:36-91), "CoP can present a toll of alignment in organizations, a forum for problem solving, center for knowledge creation, type of corganizational infrastructures" (Saint-Onge and Wallace, 2003:71).

10 According to Christensen (2007)… "the five problems are caused by either social dilemmas or knowledge dilemmas"; the two first represent knowledge dilemmas caused by the epistemologically different faces of knowledge, such as tacit knowledge making it somewhat difficult to both identify and transfer knowledge, while the other three are "social dilemmas caused by the behaviour, or misbehaviour – of persons" (p.38).

11 At an individual level (active asking for help, habit of cooperation, propensity to share, perception of communication media) and group level (group roles, knowledge creation roles, group norms, cohesiveness, and leadership style).

12 Their study revealed that different strategies, including collaboration strategies, using IT strategies, and knowledge sharing and creation strategies, led to different consequences. In addition, they identified phenomena of knowledge flow discontinuities, and designated possible causes which contribute to these discontinuities, proposing the concept of the knowledge buckle (based on the SECI model put forward by Nonaka, which views knowledge creation as a spiralling process of interactions between explicit and tacit knowledge, and the study by Lin et al. which traces knowledge flows (or the knowledge buckle) among socialization, externalisation and combination activities) to address these problems and to gain insight into the knowledge sharing and creation process.

This work was previously published in Connectivity and Knowledge Management in Virtual Organizations: Networking and Developing Interactive Communications, edited by C. Camison; D. Palacios; F. Garrigos; C. Devece, pp. 1-22, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Section VII
Critical Issues

This section addresses conceptual and theoretical issues related to the field of social computing. Within these chapters, the reader is presented with analysis of the most current and relevant conceptual inquires within this growing field of study. Particular chapters discuss ethical issues in social networking, security concerns that arise when individuals share personal data in social networks, and reducing social engineering impact. Overall, contributions within this section ask unique, often theoretical questions related to the study of social computing and, more often than not, conclude that solutions are both numerous and contradictory.

Chapter 7.1
Cyberspace's Ethical and Social Challenges in Knowledge Society

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INTRODUCTION

During the last years the issue of *digital divide* has received particular attention from international bodies like the UN, UNESCO, OECD (Bindé, 2005; OECD, 2001; UN, 2006). These organizations acknowledge that our planet is divided into "information haves" and "information have-nots" and that the effort to bridge this global gap is one of the main challenges of society today.

Interest in digital divide is also widely present in literature. In these last five years, research and empirical surveys on this subject have notably increased (Baker, 2001; Hargittai, Di Maggio, Neuman, & Robinson, 2001; Ranieri, 2006; Rallet, 2004; Sartori, 2006; van Dijk, 2005).

What does digital divide mean? What are the causes of the digital gap? How can education and technological research contribute to facing this challenge?

In this chapter, we shall first develop this concept, identifying through literature reviews its dimension and causes. We shall then focus our attention on the possible roles that education and technological research can play in order to overcome the gap, suggesting four main directions to be followed, with the help of concrete examples.

DEFINING DIGITAL DIVIDE: A LITERATURE REVIEW

The *Oxford English Dictionary Online* (2004) registered the first occurrence of the term "digital divide" in an article published in 1995 in the *Columbus Dispatch* (Ohio), giving the following definition: "the gulf between those who have ready access to current digital technology (esp. computers and the Internet) and those who do not; (also) the perceived social or educational inequality resulting from this."

Still during the mid-1990s, the term recurred in the reports of the U.S. National Telecommunications and Information Administration (NTIA) regarding the inequality of access to telecommunications.

DOI: 10.4018/978-1-59904-845-1.ch018

NTIA published six reports from 1995 to 2004 in a series entitled *Falling through the Net*. In the third NTIA report (1999) the profile of the *have-nots* was introduced and defined, and the following five different levels of inequality in Internet usage were identified: (1) between the minority of connected and the majority of unconnected; (2) between those who use the Internet for a wide range of activities with advantageous effects and profit and those who do not use the Internet; (3) between those who can use paid services and those who use the Internet's free research engines; (4) between those who use the net for e-commerce and those who do not effect any transactions on the Internet; and (5) between those who benefit from the broadband and those who cope with only slow connections.

In the following years the term became a very commonly used expression in European debates and eventually extended also to the developing countries. Some authors underline the ambiguous character of the term *digital divide* which is a very wide concept (going from access and non-access to telecommunication infrastructures and educational programs) used in reference to most diverse situations involving nations, regions, organizations, social groups, individuals, and so forth (Rallet & Rochelandet, 2004; Yu, 2002).

In the attempt to clarify it's meaning, three different accentuations can be identified in debates and in literature.

Initially, the accent was placed on technological equipment, and digital divide was conceived as a form of exclusion of those who did not have access to the information and communication technologies (ICTs).

A wider perspective enriches the semantic range of the term with other meanings. This vision is based not only on having or not having of the ICTs, but on the effective ability to use them. In this perspective, it is not important to increase the number of technological equipment and Internet connections, but to evaluate and improve their uses. If we considered the contextual, cultural, and knowledge resources available to individuals and groups, digital divide would therefore be the consequence of pre-existing inequalities and defines the gap between the ICTs users and those who do not use them. It would moreover be legitimate to speak not only of digital divide but also of digital inequality referring to the social and knowledge gaps that influence the diffusion and adoption of technologies (Sartori, 2006).

A third approach focuses on contents (knowledge, information, expertise) and the services to which the ICTs give access, independently from the technologies. Digital divide is therefore defined as the gap between those who have access to contents and services offered by the Internet and those who do not.

More generally, according to Baker (2001):

The digital divide can be conceptualized from a *user* standpoint as a suboptimal condition of access to technologies (the initial conceptualization of the digital divide), orientation on hardware, networking, and access to advanced IT/Telecom services:

- Content available, that is, what services and information can be accessed and
- Utility/awareness which relates to the actual value as well as the perceived value or awareness of the user/citizen/business of the use of ICTs and associated services.

The definition proposed by the OECD and to which the most part of studies refer, includes the various elements highlighted up to now: "the gap between individuals, households, businesses and geographic areas at different socioeconomic levels with regard to both their opportunities to access ICTs and to their use of the Internet for a wide variety of activities. The digital divide reflects various differences among and within countries. The ability of individuals and businesses to take advantage of the Internet varies significantly across the OECD area as well as between OECD and non-member countries" (OECD, 2001, p. 5).

In synthesis, according to this last definition the concept of digital divide is applied on a universal level, goes back to various geographic dimensions (international and intranational) and includes two distinct problems, that of access and use of the ICTs, and is ultimately conditioned by access to the resource infrastructures.

UNDERSTANDING DIGITAL DIVIDE

Digital divide is a multidimensional phenomenon. In order to examine the factors influencing its evolution, it would be useful to distinguish between two different levels of analyses: a macro analysis level, aimed at globally identifying the diverse economical, social and political conditions which characterize industrialized and developing countries; and a microanalysis level, aimed at evaluating the individual characteristics of Internet users (Sartori, 2006, p. 51).

The comparison between the industrialized and the developing countries shows that elements like income, education and training, investments in the sectors of research and development, and the costs of infrastructures, are crucial factors that can prevent or facilitate the diffusion of the Internet in various countries. An effective comprehension of the phenomenon is in fact possible only by integrating the various elements.

Let us start from the first factor. The degree of development of a country is certainly a decisive factor. For example, in observing trends in the map showing the extent of the use of the Internet by countries, we can see that its coverage goes hand in hand with geographic development. In other words, there is a close relationship between inequality in industrial development and inequality of access to information (Bindé, 2005). However, the wealth of a country, as fundamental as it can be, is not sufficient in itself to increase the use of the Internet (Norris, 2001).

Besides, digital literacy is fundamental. The international organizations agree that it constitutes, along with the educational background and the knowledge of languages, a prerequisite that can positively or negatively influence access to the Web.

In addition, the factors related to offers of new technologies are to be considered. Availability of infrastructures and the costs of computers and connections have a direct impact on the opportunities of individual users to access the Web. The costs are still very high especially in developing countries, where they are higher than in developed countries (Bindé, 2005).

Obviously, directives from local governments regarding public policies in the ICTs sector also affect costs. They can more or less be oriented towards the liberalization of services to favour greater competition between the *providers* with the consequent reduction of costs for the single user, or in support of a major intervention of the state and international organizations in defining tariff policies. The debate on the most effective policies to adopt for cost reduction is, however, still underway (Rallet et al., 2004).

An additional dimension to consider on the macro level is the relationships between politics and Internet, whereby some governments enact preventive censuring measures by filtering the information resources available and reducing universal access to information.

Going on to consider the differences between individuals and social groups, the main factors of access inequality are to be traced to family and individual income, age, degree of instruction, gender, language, residential geographic areas, professional status, and the physical-psychological abilities of the people involved (Bindé, 2005).

As mentioned earlier, the *costs* of computers, software, and connections can be discriminating for individuals and families with low income, both on the global and local level. Along with income, age can represent an obstacle when considering single users. The youth are often avant-garde in technological innovation and their applications, but are also more exposed to economic and social problems. As to the elderly people, the possibility of their education on the use of new technologies could be impossible due to the lack of specific training courses.

Besides age, *gender* also holds a relevant importance. Inequality between men and women in the face of new technologies constitutes another feature of digital divide. Almost two-thirds of the world's illiterate are women. In the developing countries, an average of one out of two women, is illiterate. If in the industrialized countries women represent a consistent part of the Internet users, there is a very high risk that in the developing countries women may accumulate disadvantages, thus losing almost all possibilities of access to the Net.

Another barrier is the affirmation of English as the language vehicle of globalization, leaving no room for other languages in World Wide Web. Together with language, educational, and social-cultural backgrounds play a most meaningful role in favouring or not, access to the Net. In the future, the post-industrial societies may require great investments to favour education and training, with the objective of reducing educational barriers, and cultural and linguistics gaps (knowledge gaps) that make the Internet an inaccessible goal for those populations living at the margin of globalization processes.

Another factor of inequality regards asymmetry between urbanized areas and rural zones. The latter, especially in developing countries, has remained excluded from the digital revolution that has taken over the urbanized areas. The nomadic technologies can offer great opportunities to allow the rural zones to move out of their isolation but their diffusion in these areas is still insufficient.

Ultimately, another element to be considered regards individuals with disabilities. The most part of ICTs results to be scarcely accessible, thus producing the exclusion of a great part of users with special needs. The ICTs instead could devise for these people, instruments which will allow them to participate in social life, continue to carry out their work activities and have access to training experiences.

THE ROLE OF EDUCATION AND TECHNOLOGICAL RESEARCH

How should digital divide be faced? What contributions can education and technology offer to face this problem?

Current literature shows a wide agreement on the importance of interventions in the area of training and education, in reducing the digital gap between individuals and social groups, either by offering free access to technological equipment or by delivering computer literacy programs. On the technological level, the adoption of open source approaches and investments in research geared towards enabling technologies are emerging as the most suitable solutions in the long run, especially in civil society. We here present some initiatives.

The Internet as a Public Service

The availability of public access to the network represents a preliminary condition in allowing economically disadvantaged individuals to make use of the ICTs. The Internet should be considered as a "public information service and not only as a commercial product" (Beccalli, 2004, p. 113).

Therefore, well-equipped schools and libraries can play an important role. They can in every way take part in solving the problem also for the countries of the OECD area, as already indicated in the 1995 NTIA report. In the industrialized countries many interventions have been implemented to this end.

In the developing countries the experiences of the Community Multimedia Centre (CMC) and the communitarian telecentres, have been significant (Guttman, 2003). The creation of the CMC was promoted in the last years by UNESCO. The CMC combines the use of local radios with that of computers connected to the Internet, e-mail, faxes and photocopy engines. Besides being free of charge and allowing shared access, the CMC experience is characterized by the notion that a relevant contribution to solving digital divide can be offered through the oldest media like books, radio or television. Old and new technologies do not substitute for one another, but are complementary. The former effectively contributes to the diffusion of knowledge by facilitating access to the latter.

The communitarian telecentres promoted for example by the Brazilian administration, are free-of-charge public centres in which people can access computers, printers, Internet, and so forth. One of the features is their location in peripheral and disadvantaged zones, and are autonomously self-managed by the community. There are already a number of examples of such structures globally, especially in Latin America, the Caribbean and Africa. They are often equipped with free software. Besides the lowering of costs of licenses, the use of free software allows the use of hardware that is not of the last generation, recovering in this way, the resources which would otherwise be lost. In addition, the opportunity to access the source code of the software enables technicians to intervene autonomously in technological problem solving and in the subsequent implementation of software, thus starting off a process which will also be sustainable in the long term.

Open Software and Content

As seen in the Brazilian experience with telecentres, the adoption of open-source software may constitute a crucial mean for equal opportunity to access. It promotes a kind of digital solidarity fundamental to bridging the technological gap. As observed by Berra and Meo (2001):

Through a modifiable technology distributed at low prices, if not free of charge, it would be possible to concretely conceive policies that can limit the social and geographical discontinuities in their diffusion and use. [...] The dream of reducing the "technological gap" seems to be more easily fulfilled through the diffusion of open-source software rather than by the world-scale extension of closed-source software produced by the big monopolistic industries.

As commonly known, free software is based on the freedom to modify the program according to one's own needs, and to distribute the modified versions so that the community may profit from the improvements implemented (Stallman, 2003). Thanks to this, free software is proving to be a solution that is particularly suitable to the contexts in which there is need to control the technologies used, the resources are limited, and it is necessary to find specific solutions.

The "openness philosophy" and software-sharing practices are also growing in the educational field. In the Internet there are a great variety of open source software (often free of charge) for education, that is, educational software, content management system (CMS) and/or learning management system (LMS) like for example Moodle, blog, wiki, and so forth.

While the open source regards the software, the open content adopts its philosophy but applies it to products like Websites, music, films, photographs, literature, and also educational contents. In this case, the author preserves the work's copyright, but allows its use by third parties under an open content license. There are various types of open content licenses. Usually the users can copy, publish and redistribute the work, provided that attribution is given to the original author and all modifications to the work are identified. The advocates of open content believe that the availability of free contents promotes collaborative work and contributes to increasing knowledge while reducing individual efforts. In addition, open content in education allows the improvement of instructional materials, and facilitates its reuse and adaptation. One of the most important initiatives is the Open Course Ware program promoted by the Massachusetts Institute of Technology (MIT). The program which began in 2002, provides free online access to educational course materials and contents. In the same year UNESCO introduced the term "open educational resources" at the Forum on the Impact of Open Courseware for Higher Education in Developing Countries.

Enabling Technologies

An ulterior step could be the development and implementation of technologies aimed at satisfying the needs of various global users, and therefore favouring and funding researches to this end. The design and implementation of innovative technologies more oriented towards the demands of currently excluded users, formulated in their tongue and distributed at low costs, could moreover find a market which is ready to receive them.

An example is the Simputer, a device which supports the functions of a PC, but in a simpler way. The Simputer does not need a keyboard and allows the user to interact with the PC by touching the screen to send commands and listening to its answers (vocal messages).

If the Simputer responds to the need of developing technologies enabling illiterate people in developing countries, the project *One Laptop per Child*, promoted by Media Lab of MIT in Boston, represents an effort to find enabling solutions for people living in zones without electricity, or wherever saving energy results to be important or decisive. Negroponte, Director of Media Lab, on the occasion of the second session of the World Summit on Information Societies (Tunisy, 2005), demonstrated the prototype of a laptop costing $100, that could allow thousands of children in developing countries to use a personal computer, thanks to expedients that reduce energy consumption and a lever device that can temporarily recharge the batteries.

Promoting Digital Competence

Access to an education, which includes computer literacy in the curricula, ultimately plays a crucial role. The European Community for example, has moved in this direction during the last five years. The Lisbon European Council (2000, March 23-24) emphasized that "Every citizen must be equipped with the skills needed to live and work in this new information society" and that it is therefore necessary that "a European framework should define the new basic skills to be provided through lifelong learning: IT skills, foreign languages, technological culture, entrepreneurship and social skills."

The ICT skills are expressly indicated by the Council of Lisbon as a basic skill. Coherent with this purpose, the key competencies framework was redefined, changing the number of required competencies from three to eight and including "digital competence" as one of the five new competencies. In the definition of this competence, it is pointed out that, "Digital competence involves the confident and critical use of electronic media for work, leisure and communication. These competences are related to logical and critical thinking, to high-level information management skills, and to well-developed communication skills. At the most basic level, ICT skills comprise the use of multi-media technology to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in networks via the Internet" (European Union - Working Group B "Key Competences", 2004, p. 7). In other words, digital competence does not only include the simple procedural skills, but also encompasses high-level abilities in logical and critical thinking, information management, and communication.

Moreover, in the field of initiatives undertaken to promote online education, the European Council Parliament started off the *e-Learning* program (2004-2006), to stress the need "to address the problems of social exclusion resulting from the inability of some individuals to take full advantage of the benefits offered by information and communication technologies (ICT) and the Internet in the knowledge society, the so-called "digital divide" which often affects young people, the disabled and elderly, and social categories who are already victims of other forms of exclusion". The program provides as frontline action the promotion of digital literacy. Action in this field must cover both conceptual and practical issues, from the understanding of digital literacy to the identification of remedial actions for specific target groups: "Digital literacy is one of the essential skills and competences needed to take an active part in knowledge society and the new media culture. Digital literacy also relates to media literacy and social competence, as they have in common, objectives such as active citizenship and the responsible use of ICTs." (Decision No 2318/2003/EC of the European Parliament and of the Council of 5 December 2003).

Two meaningful trends emerge from these recommendations. The first regards the need to promote educational programs on ICTs based on a wider concept of computer literacy. It should include not only procedural skills (as contemplated in ECDL), but also and above all the critical use of ICTs in daily life. This is also coherent with the concept of computer literacy suggested by ETS (2004), which developed a framework for ICT Literacy at international levels, commissioned by OECD.

The second concerns the currently emerging relationship between media/digital and social competencies: if citizens are to exercise a real citizenship in Knowledge Society, they must be enabled to read the new alphabets, decode the new languages, and the "cognitive citizenship" which both media and digital competencies help to acquire

CONCLUSION

Digital divide is one of the most urgent challenges today. In a world where information and knowledge represent an indicator of wealth, the exclusion from electronic networks within which these goods circulate, results in evermore-dramatic forms of social and cultural exclusions.

Educational systems and technological researches can contribute to facing the problem by:

1. Providing public access to ICTs
2. Adopting open approaches to ICTs and content delivery
3. Promoting technological research, oriented towards design and implementation of enabling technologies
4. Implementing educational and training actions in order to develop digital competence.

An area of great interest in the educational field is the designing of programs aimed at developing the ability to benefit ICTs in a critical way. Such a vision involves the notion of digital competence, which surpasses the traditional concept of computer literacy advocated by the ECDL and certainly opens out to new challenges in educational research.

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KEY TERMS

Digital Competence: Digital competence involves the confident and critical use of electronic media for work, leisure and communication. These competencies are related to logical and critical thinking, high-level information management skills, and well-developed communication skills.

Digital Divide: "The gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access ICTs and their use of the Internet for a wide variety of activities" (OECD, 2001, p. 5).

Open Content: As indicated in Wikipedia, this term "describes any kind of creative work (including articles, pictures, audio, and video) or engineering work (i.e., open machine design) that is published in a format that explicitly allows the copying and the modifying of the information by anyone […]" (Retrieved July 30, 2007, from: http://en.wikipedia.org/wiki/Open_content).

Open Educational Resources (OER): Refer to "educational materials and resources provided freely and openly for anyone to use and under some licenses re-mix, improve and redistribute." Open educational resources include learning content (i. e., course materials, learning object, documents etc.), tools (i.e., software for creation, delivery, use and improvement of open learning content) and implementation resources (i.e., intellectual property licenses) (Wikipedia. Retrieved July 30, 2007, from: http://en.wikipedia.org/wiki/Open_educational_resources)

Open-Source Software: A computer software with a source code available under a license that allows users to change and improve the software, and to redistribute it in modified or unmodified form. It is often developed in a public and collaborative way.

Simpute: An acronym for "Simple, In-expensive, Multilingual, People's Computer". It is a small hand-computer, designed and implemented for use in developing countries. The device was designed by the non-profit organization, Simputer Trust, founded in 1999.

This work was previously published in Encyclopedia of Information Communication Technology , edited by A. Cartelli; M. Palma, pp. 132-138, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.2
Security and Privacy in Social Networks

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INTRODUCTION

Web-based social networks (WBSNs) are online communities that allow users to publish resources (e.g., personal data, annotations, blogs) and to establish relationships, possibly of a different type ("friend," "colleague," etc.) for purposes that may concern business, entertainment, religion, dating, and so forth. In the last few years, the usage and diffusion of WBSNs has been increasing, with about 300 Web sites collecting the information of more than 400 million registered users. As a result, the "net model" is today used more and more to communicate, share information, make decisions, and 'do business' by companies and organizations (Staab et al., 2005).

Regardless of the purpose of a WBSN, one of the main reasons for participating in social networking is to share and exchange information with other users. Recently, thanks to the adoption of Semantic Web technologies such as FOAF and other RDF-based vocabularies (Brickley & Miller, 2005; Davis & Vitiello, 2005; Golbeck, 2004), accessing and disseminating information over multiple WBSNs has been made simpler (Ding, Zhou, Finin, & Joshi, 2005). If this has been quite a relevant improvement towards an easier sharing of information, it makes more urgent that content owners have control over information access. In fact, making available possibly sensitive and private data and resources implies that they can be used by third parties for purposes different from the intended ones. As a matter of fact, users' personal data and resources are regularly exploited not only by companies for marketing purposes, but also by governments and institutions for tracking persons' behaviors and opinions, and in the worst case, by online predators (Barnes, 2006).

It is then a challenging issue to devise security mechanisms for social networks, able to protect private information and regulate access to shared resources. In this article, besides providing an overview of the characteristics of the WBSN environment and its protection requirements, we illustrate the current approaches and future trends to social network security, with particular attention paid to the emerging technologies related to the so-called Web 2.0.

BACKGROUND

Usually, a social network is defined as a *small-world network* (Watts, 2003), consisting of a set of individuals (persons, groups, organizations) connected by personal, work, or trust relationships. Social networking is then a quite broad and generic notion, which in the Web context might be applied to any kind of virtual community. For instance, users registered to a Web service, such as Web mail, online journals, or newspapers requiring a subscription, can be considered as a social network. In the following, we adopt the definition provided by Golbeck (2005), according to which an online community's Web site can be considered a Web-based social network only if it satisfies the following conditions:

- Relationships are explicitly specified by its members, and not inferred from existing interactions (e.g., a mailing list can be used to infer implicit relationships).
- Relationships are stored and managed by using technologies, such as database management systems, allowing relationship analysis and regulating access and retrieval of relationship data.
- Members are able to access relationship information, at least partially.

Born in the late 1990s, in the last few years WBSNs gained increasing interest and diffusion. Although the first and most successful ones, such as MySpace, Friendster, and Facebook, were formerly designed for entertainment and socialization purposes, they are currently establishing themselves as a business model, through which institutions and organizations can set up a collaborative environment for specific purposes, and where it is possible to share resources at an intra- and inter-organizational level. Due to the great amount of collected data, WBSNs are currently the subject of great interest for statistical analysis (Wasserman & Faust, 1994; Freeman, 2004), since they may provide useful information not only to social researchers, but also for marketing purposes.

WBSNs may provide different kinds of services, ranging from information and contact sharing, to collaborative rating, collaborative work environments, and so on. However, independently from the specific purposes of a WBSN, members' relationships are the core information on which all the provided services are based. In fact, they can be used not only to create connections among people sharing similar interests, but also to customize WBSN services themselves. This is particularly true in WBSNs supporting collaborative rating: in such a context, ratings may be given different weights, depending on the relationships existing between WBSN members. For instance, it may be the case that a given WBSN member m_1 considers more relevant (or trustworthy) the opinions of member m_2 than, say, those of member m_3. For this purpose, some WBSNs allow their members not only to specify personal relationships (e.g., "friend of," "colleague of") but also to establish *trust* relationships, which express how much they trust the other members either with respect to a specific topic (*topical trust*) or in general (*absolute trust*). For a thorough discussion on trust relationships and how they can be used, we refer the reader to the work by Golbeck and Hendler (2006).

As far as security is concerned, current WBSNs enforce simple protection mechanisms, which only allow their members to label given information as public or private, or to make it available to WBSN members with whom there exists a direct relationship of a given type (friend, colleague, etc.). However, these solutions on one hand may dramatically reduce the possibility of sharing information, which is the basic function of a WBSN, and on the other hand, they do not necessarily grant the required protection to personal information. In fact, giving to WBSN members just the choice of stating whether a given resource is public or private may result in hiding a huge amount of information. Moreover, it may frequently happen that WBSN members make publicly available resources that are accessed by people different from the ones they intended—the most typical case is a student publishing photos or blogs in recreational WBSNs, without considering that they can be accessed by his or her teachers.

Additionally, personal information and relationships among WBSN members must be protected when WBSN data are analyzed by data mining tools, that is, tools capable of analyzing massive datasets of personal information with the purpose of extracting models of social and commercial interest.

SECURITY AND PRIVACY REQUIREMENTS IN SOCIAL NETWORKS

In this section we consider the security and privacy issues related to WBSNs from two different points of view. First, we discuss the privacy-preserving techniques adopted to allow statistical analysis on social network data without compromising WBSN members' privacy, and then we illustrate the current approaches aimed at enforcing privacy protection when performing access control.

Privacy-Preserving Social Network Analysis

Data collected by WBSNs are an important source for social and marketing analysis, which may provide useful information on the evolution of a social community, collaborative problem solving, information distribution, and so on. Additionally, they can also be used to optimize social network services and customize them with respect to users' preferences and interests. However, when analyzing WBSN data for statistical purposes, it is necessary to avoid as much as possible disclosing private information about WBSN members.

So far, this issue has been addressed by anonymizing the network graph according to two main strategies, namely, *node anonymization* and *edge perturbation*. The former strategy aims at hiding members' identities by labeling the corresponding network nodes with random identifiers (naïve anonymization). In case nodes are associated with attributes which can be used to identify the corresponding user, the possibility of using techniques based on k-anonymity (Sweeney, 2002) has been discussed−see, e.g., Zheleva and Getoor (2007). By contrast, edge perturbation performs a set of random edge deletions and insertions, which prevent an attacker from inferring the identity of network nodes based on the existing relationships but, at the same time, preserve the utility of the graph for network analysis.

It has been noticed that the proposed solutions to node anonymization do not grant total privacy protection. In particular, Backstrom, Dwork, and Kleinberg (2007) carried out an extensive analysis of the possible attacks, and argued that the most effective strategies for privacy protection are those based on *interactive* techniques. According to this approach, the anonymized network graph is not disclosed; rather it is analyzed by the social network management system itself upon submission of a query, and then the result is perturbed by adding noise to the real answer.

By contrast, edge perturbation, when combined with node anonymization, grants a greater degree of protection. Examples of how such techniques are applied are provided by Frikken and Golle (2006), Hay, Miklau, Jensen, Weis, and Srivastava (2007), and Zheleva and Getoor (2007). In particular, Hay et al. (2007) report experimental results which show that random edge deletions and insertions grant graph anonymity when the perturbation affects a percentage of graph edges ranging from 5% to 10%. By contrast, a perturbation rate greater than 10% dramatically increases information loss, thus making useless the results obtained by analyzing the perturbed graph. Although Zheleva and Getoor (2007) do not provide experimental results, they enhance the edge perturbation strategy by considering the different possible methods according to which it can be performed, and by evaluating the obtained perturbed graph with respect to information loss and link re-identification attacks.

Note, however, that graph anonymization is based on the assumption that the only information that can be obtained by an attacker is the one publicly released by the social network service. By contrast, this strategy is useless when applied to social networks, as most WBSNs are, to which any Web user can register, and where each member has a total or partial view of the network graph. In such a case, attackers can infer the network structure and members' identity with more or less accuracy by using techniques like *node bribing*, that is, by obtaining access to the partial view of the WBSN graph of one or more of its members, as illustrated by Korolova, Motwani, Nabar, and Xu (2008). The authors argue that it is possible to reduce the effectiveness of such attacks by limiting the neighborhood visibility of a member (his or her *lookahead* ℓ) to his or her neighbors ($\ell = 0$), and to the neighbors of his or her neighbors ($\ell = 1$). By contrast, in case $\ell > 1$, the possibility of obtaining correct information on the WBSN graph exponentially increases.

In conclusion, available privacy-preserving techniques, both those based on graph anonymization and those limiting WBSN members' lookahead, have the goal of preserving users' privacy when network data are analyzed through data mining tools. An additional issue is to enable a WBSN user to state which information should be public or private, and which members are authorized to access it. In this respect, current WBSNs enforce very naïve default protection mechanisms which cannot be personalized by WBSN members. We elaborate more on this issue in the next section.

Privacy-Aware Access Control

WBSN resources have protection requirements that cannot be enforced by simple mechanisms, as those currently adopted by WBSNs. An access control model for WBSNs should therefore take into account the specific characteristics of the application domain, in order to devise the most suitable access control strategies. In the following, we first discuss the main requirements for an access control mechanism tailored to WBSNs. Then, we survey the solutions proposed so far.

According to the traditional approach, access control requirements are expressed by *authorizations,* which in their basic representation are tuples of the form $\langle s, p, o \rangle$, where s is the subject authorized to access object o under privilege p (Bertino & Sandhu, 2005). However, such an approach is not suitable for dynamic and distributed environments, as WBSNs are, since a member may be required to update the authorizations applying to his or her resources whenever he or she knows new members, or if relationships he or she participates in are revoked. In such a scenario, it is preferable to *intensionally* denote authorized members by specifying the *requirements* they must satisfy to access a given resource. According to this strategy, whenever any modification to the state of the WBSN structure occurs, the set of authorized members will dynamically change, without the need to modify the existing authorizations.

So far, a variety of access control models have been proposed, which denote authorized users in terms of their characteristics, and not only by their identities. The role-based model (Ferraiolo, Kuhn, & Chandramouli, 2003) is the most popular one; others are those based on credentials (e.g., Winslett, Ching, Jones, & Slepchin, 1997; Agarwal, Sprick, & Wortmann, 2004) or certificates (e.g., Thompson et al., 1999; Palomar, Estevez-Tapiador, Hernandez-Castro, & Ribagorda, 2006). An analogous approach can be applied to WBSNs. In fact, WBSN members usually publish resources having in mind a specific audience consisting of, for example, their friends or colleagues. Therefore, in a WBSN context, *relationships* can be used to intensionally denote authorized members.

The enforcement of relationship-based access control requires addressing two main issues. First, it must be possible to verify the authenticity and reliability of information about relationships, in order to avoid security attacks based on forging faked relationships. Second, relationship information may have privacy protection requirements, and thus mechanisms should be enforced to regulate their disclosure.

A further requirement is related to the support of content-based access control (Adam, Atluri, Bertino, & Ferrari, 2002). Actually, the practice of 'tagging' resources is currently diffused among WBSN members, and content analysis is another possible solution to enforce content-based access control. However, since resource rating is performed by each single member and content analysis gives only probabilistic results about the actual content of a resource, strategies should be devised in order to obtain accurate and unambiguous descriptions, usable for access control purposes.

Finally, access permissions should take into account the possible operations to be performed on WBSN resources. Besides the traditional 'read' privilege, in collaborative environments WBSN members may be authorized to modify/delete a resource or add content to it. In such a case, it may be useful to support different types of 'write' privileges, such as 'modify' (authorized members can modify existing content or add new content), 'delete', and 'append' (authorized members can only add content, but not modify existing content). Additionally, when supporting 'write' privileges, it is important that any modification performed on a resource can be associated with the member who performed it. This means that supporting different privilege types requires enforcing accountability in the WBSN framework.

A last issue to be addressed concerns the access control architecture to be adopted. According to the traditional approach, access control is enforced on the side of the content provider. However, this solution may not be suitable to WBSNs, which may have millions of registered members and, as a consequence, the WBSN management service would be a bottleneck to the whole system.

As far as we are aware, the only two proposals of an access control mechanism based on WBSN relationships are the ones by Carminati, Ferrari, and Perego (2006) and Hart, Johnson, and Stent (2007).

In the proposal by Carminati et al. (2006), access control requirements are expressed by *access conditions,* which denote authorized members not only in terms of relationship types (e.g., friend, colleague), but also with respect to the relationship *depth* and *trust level.* The depth of a relationship corresponds to the distance between two members, considering only the edges labeled with a given relationship type. Thanks to this, it is possible to specify authorizations stating that a given resource can be accessed only by the friends of Alice, or by the friends of Alice's friends. By contrast, the trust level denotes how much confidence a member has on the fact that another given member does not reveal protected information to unauthorized members.

As far as access control enforcement is concerned, Carminati et al. (2006) adopt the rule-based approach proposed by Weitzner, Hendler, Berners-Lee, and Connolly (2006). More precisely, access authorizations are expressed by Horn-like clauses (rules), and it is the requestor who is in charge of demonstrating to the content provider of being authorized to access a given resource, by providing a proof of the corresponding access rules. WBSN resources and the corresponding access rules are managed by the resource owner, whereas relationship certificates are stored in a central directory, stored and managed by the WBSN management system. Whenever an access control request is submitted, the resource owner sends back to the requestor the set of associated access rules. The requestor then contacts the WBSN management system, in order to retrieve the relationship certificates concerning the relationships denoted by the received access rules. Then, he or she computes a proof, if any, demonstrating that he or she satisfies the rules. The resource owner sends the resource to the requestor only in case the provided proof is valid.

Also the access control model proposed by Hart et al. (2007) in their position paper uses existing WBSN relationships to denote authorized members, but only the direct relationships they participate in are considered, and the notion of trust level is not used in access authorizations. In addition, differently from Carminati et al. (2006), resources are not denoted by their identity, but based on their content. Information about resources' content is derived based on users' tags and content analysis techniques. Hart et al. (2007) do not provide any information about access control enforcement.

Both the approaches by Carminati et al. (2006) and Hart et al. (2007) assume that relationships are public. Later, Carminati et al. (2007) have extended their earlier research (Carminati et al., 2006) by proposing a privacy-aware access control mechanism, where the existing relationships are protected by a set of rules, called *distribution rules.* Such rules are used to regulate the distribution of relationship certificates to authorized members. Carminati et al. (2007) also address the issue of protecting relationship information that may be inferred by access rules, when enforcing access control. In fact, if an access rule states that, in order to be able to access a given resource, the requestor must be a friend of Alice, it is possible to infer that Alice participates in at least one relationship of type *friendOf,* otherwise no member will be able to access that resource. In order to deal with this issue, WBSN members are equipped with a set of group keys (Rafaeli & Hutchinson, 2003), called *relationship keys,* used to encrypt access conditions. More precisely, each WBSN member *m* holds a key for each type of relationship he or she participates in. These keys are shared by all the WBSN members in his or her social network group, that is, all the WBSN members connected to *m* by paths labeled with those relationship types. Whenever *m* receives an access request to a resource he or she owns, he or she does not send the corresponding access rules in plaintext. Rather, each access condition in the access rule is encrypted with the corresponding relationship key. For instance, if an access condition puts a constraint on relationships of type *friendOf, m* will encrypt it with the key corresponding to that relationship type. As a consequence, the requestor will be able to read that access condition only when he or she belongs to the same group of type *friendOf m* participates in.

It is important to note that all the approaches we have described so far support 'read' privileges only. Of course, they can be extended with other types of access modes, but enforcing accountability would require a relevant extension to the access control mechanisms described above.

FUTURE TRENDS

WBSN security and privacy is quite a new and challenging research area, and as such, the proposals discussed in this article are just a starting point. It is then difficult, given the state of the art, to provide an exhaustive summary of all the possible future trends and research directions. However, some general considerations can be done on the main open issues with respect to the topics discussed in the previous sections.

First of all, it is clear that privacy-preserving social network analysis and privacy-aware access control address WBSN privacy from two different points of view: the former, from an *external* perspective—that is, the one of an analyst carrying on social network analysis; the latter, from an *internal* perspective—that is, the point of view of WBSN members themselves. In privacy-preserving data mining, the goal is to provide, on average, an acceptable degree of privacy (e.g., by using anonymization techniques) to all the WBSN members to whom the data refer. By contrast, in privacy-aware access control, each WBSN member can explicitly state his or her privacy and/or access control requirements—for instance, some members may have stricter privacy requirements than others. This means that potential conflicts between social network analysis tools and WBSN privacy requirements may arise. Therefore, in the future it is desirable that these two research directions find some common points, in order to proceed towards the definition of a comprehensive framework, able to address all the privacy and security requirements of WBSNs. It must also be taken into account that social network analysis is carried out based on the assumption that the social network management system is able to release periodically, or upon demand, the network graph (or a perturbed version of it). This implies that the existing relationships must be stored in a central repository, accessible by the social network management system itself. However, this is not always the case. For instance, privacy protection mechanisms enforced in a WBSN might adopt approaches according to which relationship information is stored by WBSN members themselves, to avoid that the social network management system infers private information from the existing relationships. Therefore, privacy-preserving data mining tools must also take into account the different architectures according to which access control is enforced.

As far as privacy-aware access control is concerned, we argued in the previous sections that, when adopting a relationship-based approach to specify access control requirements, it is necessary at the same time that access to relationship information is regulated by proper protection mechanisms. The strategy proposed by Carminati et al. (2007) addresses this issue, but other solutions are also possible. For instance, instead of assuming that relationship information is directly distributed by the WBSN members involved in them, as in Carminati et al. (2007), an alternative is to support negotiations and privacy policies, similar to those provided by P3P (Cranor et al., 2006) and trust negotiation mechanisms. According to this approach, relationship information is held by WBSN members and released upon request after having verified whether the requestor satisfies given privacy protection policies, and/or whether he or she can be considered trustworthy about the use he or she will make of such information and the protection he or she can assure to it.

Content-based access authorizations are one of the other open issues. By using content-based access control, it is possible to simplify the task of policy specification as well as to express access control requirements related to the semantics of the protected objects. However, applying it to distributed environments such as WBSNs, where any member can use any vocabulary and any language (either standard or user defined) for describing resources, might make such strategy ineffective for access control purposes. Using content analysis tools has similar drawbacks, since, independently of the efficiency and effectiveness of the adopted tools, it may happen that a given resource is incorrectly described, thus granting unauthorized access to it or denying access to authorized members. Finally, the trade-off between accuracy and complexity in describing resources must be taken into account. Inaccurate and ambiguous descriptions are useless for access control purposes, but evaluating too complex descriptions may have computational costs that make unfeasible, in practice, the enforcement of content-based authorizations.

We think that a solution to this issue must satisfy two main requirements. First, resource descriptions should be encoded by using standard schemes, and the vocabularies used for describing resources must enforce semantic interoperability. Second, mechanisms should be devised that are able to confirm the actual validity of a description.

As far as the former issue is concerned, a possible solution might be provided by the outcome of the work currently carried on by the W3C working group named, "Protocol for Web Description Resources" (POWDER, 2007), which aims at defining a standard metadata format for describing the content/characteristics of a group of resources. In addition, POWDER aims at granting the accountability of such descriptions, referred to as *description resources* (DRs, for short), thus making any Web user able to verify their trustworthiness. Finally, DRs provide a simple mechanism for enforcing semantic interoperability. In fact, any Web user describing a resource can state that such description, independently of how it is specified, is equivalent to one or more given DRs released by other users.

However, POWDER DRs by themselves do not ensure the trustworthiness of resource descriptions. A possible solution is to use a content analyzer to validate the description provided by a given user. However, the results of a content analyzer are reliable when applied to resources all belonging to a given content domain, which is not the case of WBSNs. An alternative is to use social networking itself in order to validate resource descriptions, by exploiting *collaborative rating.* According to this strategy, WBSN members, on one side, can express their opinions on the trustworthiness of a description, and on the other side, can specify their personal descriptions of the same resource. The result is that, for the same resource, more descriptions are available, whereas a description is associated with ratings stating whether it is trustworthy. Given the huge population of WBSNs, it is possible to collect a data set having a size suitable to perform statistical analysis, which can provide a more accurate measure of how much the claims made by a given description can be trusted. Such an approach is currently under development in the framework of the QUATRO Plus EU project (*http://www.quatro-project.org*).

Support for different types of access privileges is another of the issues not addressed by Carminati et al. (2006, 2007) and Hart et al. (2007). As we mentioned, a key issue is the support for accountability, in order to be able to identify who performed which access operation on which resource. This is extremely important for 'write' operations, especially in collaborative environments where the members of the working group should be able to identify, for instance, who inserted/modified/deleted given portions of a shared document. Finally, it is worth noting that future WBSNs may rely on architectures different from the current one, where the WBSN management service is in charge of running almost all the supported services. In fact, from the privacy protection and access control approaches proposed by Carminati et al. (2006, 2007), it comes out that a decentralized architecture grants a more accurate protection to WBSN data. In such a scenario, WBSN members themselves store and manage their personal data, relationships, and resources, and are in charge of carrying on most of the tasks concerning relationship establishment/revocation and the enforcement of privacy and access control policies. By contrast, the WBSN management system provides just basic services, such as user registration, and may be used as a common space from which it is possible to access all the information WBSN members wish to share publicly. Such decentralized architectures pose challenging research issues with respect to security and privacy protection as well as efficiency.

CONCLUSION

With the increasing diffusion and usage of online social networks, protecting personal data and resources of their members is becoming a fundamental issue. Contributions to this research area are currently very limited, and can be grouped into two main classes: on one side, anonymization techniques able to protect the privacy of social network members when performing social network statistical analysis, and on the other side, privacy-aware access control mechanisms, making social network members able to regulate access to their data, relationships, and resources by, at the same time, protecting the privacy of their relationships. The proposed solutions are far from addressing all the privacy and security requirements of social networks, and not all the potential approaches have been investigated. Although it is difficult to predict with enough precision the possible evolution of this new research area, it is very likely that the enforcement of security and privacy mechanisms for social networks, more sophisticated than the ones currently available, may have two main relevant results. First, it might lead to the development of new security paradigms able to address the distributed nature of social networks. Moreover, it might determine a dramatic modification of current online social networks into a decentralized architecture, where the management of social network information, and of the social network itself, will be carried out collectively by its members inside a collaborative framework.

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KEY TERMS

Edge Perturbation: Graph anonymization technique aimed at hiding the actual social network relationships by performing a set of random edge deletions/insertions in the network graph.

Graph Anonymization: Technique aimed at hiding private information about social network members when performing social network analysis. Node anonymization and edge perturbation are the two main graph anonymization techniques currently used.

Node Anonymization: Graph anonymization technique aimed at hiding social network members' identities by labeling the corresponding nodes with random identifiers (naïve anonymization), or, in case nodes are associated with attributes which can be used to identify the corresponding user, by using techniques based on k-anonymity (Sweeney, 2002).

Privacy-Aware Access Control: In the context of social networks, denotes an access control paradigm where access control requirements of social network members are enforced without disclosing private information about the relationships they participate in.

Relationship Trust Level: In a social network, denotes the value associated with a trust relationship, providing a measure of how much a given member considers another member trustworthy. Depending on the purpose for which it is used, this notion may have different meanings. For instance, in a collaborative rating environment, it denotes how much a given member trusts the opinions of another member with respect to a specific topic (*topical trust*) or in general (*absolute trust*) (Golbeck & Hendler, 2006). By contrast, in an access control context, it has some similarities to the notion of *security level* used in mandatory access control models (Carminati et al., 2006, 2007).

Relationship-Based Access Control: An access control paradigm specifically tailored to social networks, according to which social network members authorized to access a given resource are denoted in terms of the relationships they must participate in to get the access.

Social Network: A *small-world network* (Watts, 2003) consisting of a set of individuals (persons, groups, organization) connected by personal, work, or trust relationships. Usually modeled as a graph, where nodes correspond to social network members, whereas edges denote the relationships existing between them.

Social Network Analysis: A discipline aimed at collecting statistical data from the analysis of social network topology (Wasserman & Faust, 1994; Freeman, 2004).

Social Network Relationship: A relationship concerning two members of a social network. In WBSNs, besides personal/work relationships (e.g., friend/colleague), also trust relationships may be supported which denote how much a one member trusts another. In the graph representation of a social network, relationships are usually denoted by edges, labeled with a relationship type and/or a relationship trust level.

Web-Based Social Network: A Web-based system that allows its registered members to establish relationships with other members and to share different types of information (e.g., personal data, contacts, multimedia resources). A precise, but not normative definition of Web-based social network has been provided by Golbeck (2005).

This work was previously published in Encyclopedia of Information Science and Technology, Second Edition, edited by M. Khosrow-Pour, pp. 3369-3376, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.3
Social and Legal Dimensions of Online Pornography

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INTRODUCTION

The dialectics between private pleasures and public needs raise various dilemmas, especially in the domain of the erotic and aesthetics. These are relative and abstract terms that can vary from individual to individual. However, in the public spaces of the Internet, the need for community standards of decency, acceptability, and taste often drag many of the debates about the Internet into a legal space, despite its description as a virtual sphere and the libertarian endeavours to keep it free from government and organizational control. While the Internet is a global resource it is often ruled through the laws of its physical embeddedness, and the global nature of the Internet also means that it is consumed and assessed through the differing cultural practices and norms that prevail in various parts of the world. The Internet as a communication and information platform is then subject to varying codes of ethical and moral conduct by different communities whether online or off-line. While the realm of the erotic is often equated with individual pleasure and psyche, the proliferation of pornography on a public platform raises social, moral, and legal concerns for communities, states, and governments. One significant element in the development of the Internet as a market place has been the availability of explicit sexual material, and these electronic networks continue to feed the pornography boom and facilitate new methods for consumers to interact with sexual content as "porn" (Spencer, 1999). These networks highlight the "privatising" potential of technology, especially in relation to sexual matters, while illuminating new forms of formal and informal exchanges (Jacobs, 2004, p.72; Spencer, 1999). The Internet, from being a rather unregulated enterprise a few years ago, has recently become the focus of multiple ethical concerns and debates and in some cases, it has amounted to moral panic (Bkardjieva & Feenerg, 2000; Cavanagh, 1999).

BACKGROUND

The emergence of gaming culture and the simulation of reality through the design of gaming technology raises the age-old issues about image and representation; the effects it can have on our cognitive senses, and how these can, as a result, affect or mediate our ability to reason and engage with interactive technology. These questions become ever more salient with regard to online pornography or sexually explicit material. The distinctive element about online porn is its use of multimedia, its ubiquity, and consumer access to it. Due to the anonymity of the Internet and the difficulties in regulating this transnational and anonymous medium, transgressive forms of entertainment, including pornography, have flourished online. According to Spencer (1999), the Internet is structured at one level around the economics and politics of consumption, at another level around the politics of individuality, and at another around communitarian concerns (p. 242).

Online pornography has been acknowledged as a relatively new form of pornography. Authors Stack, Wasserman, and Kern (2004) point out that there were about 900 pornography sites on the Web in 1997 and just a year later, the figure had burgeoned to between 20,000 to 30,000 sites, with revenues reaching US$700 million by the late 1990s. Its growth has been attributed to the "triple a-engine" of accessibility, affordability, and anonymity (Cooper & Griffin-Shelly, 2002, p. 11). Fisher and Barak (2001) agree that "spectacular growth in availability of sexually explicit material on the Internet has created an unprecedented opportunity for individuals to have anonymous, cost-free, and unfettered access to an essentially unlimited range of sexually explicit texts, moving images and audio materials" (p. 312). This increased accessibility and convenience, as well as the exploiting of e-commerce by pornographers, means that the Internet makes it easier for individuals to come into contact with porn. Some suggest that this has enabled the normalization of practices that may have otherwise been stigmatized in traditional markets, leading to a mainstreaming of cyberporn through its visibility and presence (See Cronin & Davenport, 2001, p.35; O'Toole, 1998). In the last few years, undoubtedly, there has been increasing heterogeneity and decentralization on the Internet as a wider variety of producers and consumers participate in the making of globalized markets, and a contemporary notion of pornography should capture such networked sexual agency and politics (Jacobs, 2004).

MAIN FOCUS

Diane Russell (1998) defines sexually explicit material as that which "combines sex and/or the exposure of genitals with abuse or degradation in a manner that appears to endorse, condone or encourage such behaviour" (p. 3). James Check (1985), on the other hand, terms pornography as "sexually explicit material" without further qualifying it. The Internet poses new questions about the reality, regulation, definition, and availability of pornography, as it has dramatically increased the accessibility of pornography, and of violent pornographic images in particular (Gosset & Byrne, 2002). The danger of pornography to adults is much more disputed, and often the arguments for pornography include freedom of speech and the expression of civil liberties, the right to choose, and the right to privacy (Kuipers, 2006).

Nevertheless, what constitutes pornography is often contested in societies. While in terms of ethics adult pornography is a contested terrain, child pornography, on the other, is almost universally prohibited. But in the online environment, a digital image can be manipulated and altered and consequentially it may be difficult to clearly define the distinction between adult and child images. Jenkins (2001) posits that child pornography can be accessed in various ways in the online environment, where it can be distributed via credit-card access Web sites, bulletin boards, and encrypted e-mails, as well as through peer-to-peer file sharing. These are constitutive of not only the new configurations between producers and users, but also of new forms of abuse (Oswell, 1999, 2006, p. 253).

A report by the Washington-based research and policy group, Third Way, highlights how this accessibility and presence can present new problems for Internet users, particularly children (cf. Whitehead, 2005). According to the report, only 3% of more than 450 million individual porn Web sites ask for proof of age. Additionally, a majority of these Web sites do not carry any warning of adult content, and nearly three-quarters display free teasers of pornography images on their homepages; it is therefore likely that children may accidentally come across a porn site while doing homework or surfing the Web. While child pornography is almost universally illegal, adult pornography is prevalent and easy to access on the Web. Whitehead (2005, p. 18) contends that unlike off-line pornography, which can be curbed through measures imposed by the community such as zoning laws and curfews, the politics of online pornography is very different, as online porn, through its technology, can be seen to be "everywhere and nowhere." This has meant the loss of power for parents to control what their children come into contact with.

The status of a photograph as a verifiable fact continues to linger with the Internet despite the radical impact of digital technology on photographic practice. This has been problematic as digital technology can manipulate and distort images, thus further compounding the relationship between reality and representation. David Oswell (2006) describes this as the ethics of virtual observation, where the referentiality of the image in representing the scene of abuse that is real, and our ethical response to it, is predicated by our perceptions of reality (p. 258).

In discussing the ethics of the virtual, Oswell (1999, 2006) observes that there are often epistemological inconsistencies and disjuncture between knowledge, law, and sociological perspectives. In the context of the US and UK, there is often an implicit understanding that child pornography is the record of actual child sexual abuse, and this has become widely used in legal discourses and public discourses of law enforcement charities and child protection agencies (Williams, 1991, p. 88).

According to Tate (1990), while child pornography has been a problem for decades, until relatively recently it has been a hidden crime (p. 1). In the UK, the principal legislation that addresses the indecent images of children is the Protection of Children Act 1978 (PoCA), which differentiates between different mediums representing the abuse. Photographic images are the subject of this specific legislation that focuses on child pornography, whereas all other mediums are treated as obscene articles and are subject to general obscenity legislation (Gillespie, 2005).

The ontological status of visual depiction has legal ramifications both in the context of the UK and the US. In the US, the Child Pornography Prevention Act (CPPA) of 1996 addresses the legal implications of visual depiction. In 2002, a ruling by the US Court of Appeals for the Ninth Circuit found that the CPPA ruled solely on the image without considering the set of contextual factors catered for in an earlier ruling in 1973, and in view of this, the CPPA's emphasis on the image was "overbroad" and "unconstitutional" (Oswell, 2006). It also reiterated that the proximity or distance of a photograph from the scene of the actual event is an important criterion in the legality of child pornographic images. The court also overruled the argument in the CPPA that virtual child pornography is "intrinsically related" to the sexual abuse of children as the link between the two is contingent and indirect. Harm here does not necessarily accrue from the image but is dependent on the potential for subsequent criminal abuse. The ruling showed the court's unease with the assumption that the image takes up the position of the "modest witness" whose account of the scene is "unadorned, factual and compelling" (Haraway, 1997, p. 26).

Virtual child pornography may have no link to crime or sexual abuse that has actually been committed, and in the same vein, the virtual image has no necessary link to future cases of abuse. As with child pornography, virtual child pornography cannot be prohibited on the basis of its possible harm to some children or the possibility some children may be exposed to it. In this sense, the CPPA defies the "principle that speech within the rights of adults to hear may not be silenced completely in an attempt to shield children from it" (Oswell, 2006, p. 251). In April 2002, the US Supreme Court found the Child Pornography Prevention Act (CPPA) unconstitutional. Though it remains illegal to make, show, or possess sexually explicit material of children, the court found that there were not compelling reasons to prohibit the manufacture or exhibition of pictures that merely appear to be children. As a consequence, two categories of pornography that were prohibited under the act are now permitted in the US. These include sexually explicit pictures of actual models who appear to be younger than they are and computer-generated sexually explicit pictures of children (Gillespie 2005; Levy, 2002; Oswell, 2006).

In contrast, the UK treats indecent pseudo-photographs of children "as indecent photographs of children." In the UK, the term pseudo-photography was introduced by the Criminal Justice and Public Order Act of 1994. This act defines a "pseudo-photograph" as "an image, whether made by computer graphics or otherwise, which appears to be a photograph" (cf. Gillespie 2005, p. 435). With the police finding images on computers that could not be readily verified as those of a child or an adult, the 1994 amendment became the rationale for addressing this problem (Hansard, 1994, cf. Gillespie, 2005, p. 435).

In UK legislation, while the indecent photograph and the indecent pseudo-photograph are not identical, they are treated as identical. This means that the act of downloading child pornography constitutes a crime, regardless of whether these images are records or not of actual abuse. This legal response to pornography intrinsically associates an image and a crime and provides a legal platform for the authorities to act. In contrast, the actual images are illegal in the US but not the virtual. Oswell (2006, p. 252) points out that such an equivalence creates challenges in a court of law as reservations can be raised as to the evidential status of the image, i.e. as to whether the image is an image of the incident of sexual abuse at all. Oswell contends that the photograph becomes the measure of the real and its observation, and hence, the implicit prioritization in UK law of virtual child pornography means the crime of possession, making, or distribution of child pornography (whether virtual or real) is a crime not only against a particular child but against all children, invoking it as a universal crime against childhood. The debates on adult pornography often delineate between the vague boundaries of erotics and aesthetics but these distinctions can be subjective and may influenced by the context of the immediate society, making them arbitrary criteria.

Prior to the Internet, the debate about pornography in the US centred on the First Amendment, and the need to regulate pornography was stressed on the grounds that pornography violates community standards. Under the US Constitution, it is legal for adults to own and distribute most types of pornography. However, since the 2002 Supreme Court Ruling over COPA (Child Online Protection Act), the US government has made serious efforts to monitor and impose restrictions on Internet pornography traffic by arguing that juveniles or minors (18 years or less) are automatically exposed to and harmed by pornographic images (Jacobs, 2004). As Taylor and Quayle (2003, pp. 159-163) point out, one of the principal elements of Internet-facilitated child pornography is an exponential growth in the size of the individual collection. Here the imaging and archiving features of Internet technology cannot be overlooked. In the UK, for example, legislation does not distinguish between accessing images for personal use (including downloading) and the creation and distribution of images (Gillespie, 2005).

Often censorship and obscenity laws have provided the basis to tackle pornography on the Internet, and this has been the case in the US, Australia, the UK, and France. In Australia, the Western Australia Censorship Act (1996) is designed to protect the local and state territory from the influx of pornographic material over the Internet (Jacobs, 2004:, p.71). On the other hand, South Australia's Censorship Act criminalizes any content that is deemed "unsuitable for children online," even if the content is intended for adults. This leaves content open to police interpretation, as authorities can evaluate and arrest users who post information that is deemed offensive to children.

Akedeniz (2002) stresses that there is a difference between illegal and harmful content, as the former is criminalized by national law while the latter is merely deemed offensive or disgusting by some sections of society. In tandem with this, Jacob (2004) queries whether community standards of decency can be transmitted from one place to another. With the Internet being perceived as a global resource, the issue of community standards creates different cultural and legal approaches to solving the issues at hand.

While there is often a societal acknowledgement of child pornography as a heinous and universal crime, there is, nevertheless, a difficulty in defining what constitutes child pornography as different jurisdictions can define it differently, and equally, the issue of obscenity can also be culturally mediated in different environments. The consensus in terms of what constitutes child pornography can emerge within the context of supra-national agencies such as the Council of Europe, which defines child pornography as "any audiovisual material which uses children in a sexual context" (Oswell, 2006, p. 246).

Akdeniz (2001) points out that the legal regulation of this sort of Internet content may differ from country to country, and this is certainly the case within the European Union, where member countries have taken different approaches to sexually explicit material. Akdeniz streses that in terms of Internet content and young users, harm remains a criterion, and this is accepted within the jurisprudence of the European Court of Human Rights. Harm in societies again is culturally defined. In terms of illegal or harmful content, the UK adopts a multilayered approach with the involvement of both national and international levels. The government also favours a coregulatory approach in which there is a role to be played by the industry's own self-regulation.

Before the Internet, the US already had some antipornography legislation that has since been applied to the Internet. In the US, pornographic sites are legally obliged to refuse access to minors (Kuipers, 2006). Until recently, further attempts to penalize or regulate Internet pornography failed due to the fact they conflicted with the First Amendment. Beyond legal restraints, countries can also encourage the use of technology to filter undesirable content deemed harmful to children. In June 2003, the Child Internet Protection Act (CIPA) was approved by the US Supreme Court to force libraries and schools to block pornographic sites. The CIPA requires public libraries to filter their computers if they want to retain federal funding, but such software is not completely reliable. Judith Levine (2002) has argued that it is important to promote media literacy and moral intelligence rather than to deal with the Internet through technology. This means that governments and societies should also invest in public awareness and education campaigns instead of phasing out controversial sexuality debates that can polarise the public.

FUTURE TRENDS

Online pornography in many countries has been regulated through existing censorship and decency laws. However, due to the complexity of the Internet environment and the availability of different technologies on one platform, there has been a need to enact and revisit what a photograph or "psuedo-photograph" can constitute in the digital environment and the consequences of admitting it as evidence in courts. The legal trajectories in the US and UK highlight the complexities of the digital image and its treatment in different legal contexts. In the future, new forms of technologies and the convergence of these on the Internet will pose more challenges for the legal domain. Societies would then have to enact new legislation to cope with legal systems that predate modern technologies and the challenges they present. It illuminates the sort of legal and moral dilemmas that have emerged from the Internet environment.

The criminalization of child pornography and the ubiquity of pornography on the Web raise legal issues for users as their private actions in their personal domain can have legal consequences. On an international level, in the domain of child pornography there has been cooperation at a global level between governments to share databases of perpetrators involved in child trafficking and pornography. The future as such alludes to both centralization and surveillance to curb criminal behaviour on the Web as well as to the rise of fragmented and diverse forms of pleasure-seeking on the Internet.

CONCLUSION

The issues of online pornography are entangled with private pleasures, community standards, increasing commercialisation of the Internet, and a proliferation of sites and images offering sexually explicit content. It raises the need to address numerous concerns and issues with regard to online pornography. Concepts of privacy, harm, offence, taste, decency, legality, and protection of children as a universal ideal as well as the evidential status of the digital image on the Internet compound the problems of online pornography. Online digital images, and their referential authenticity to the actual event or person, capture the complexities of the Internet as a medium where convergence of technologies and amalgamation of sound and images, as well as editing technologies, enable simulated realities and new forms of gaze and pleasures. These will continue to pose new moral panics and debates in societies and communities, particularly in terms of protecting the vulnerable and the young while catering to a well-established market that has capitalised on e-commerce and new forms of voyeurism.

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KEY TERMS

Cyber Porn: Sexually explicit material that is available on the Internet

Digital Image: A visual content constructed through pixels which can be altered or manipulated through technology.

Ethics: The code of conduct in a society or community that may be tacit or explicitly expounded

Pornography: Sexually explicit material that may be available in any medium

Regulations: Formal rules and legislation that are enacted to address a particular issue.

This work was previously published in Encyclopedia of Information Science and Technology, Second Edition, edited by M. Khosrow-Pour, pp. 3496-3500, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.4
Social Networking Site:
Opportunities and Security Challenges

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ABSTRACT

Social networking has become one of the most popular applications on the Internet since the burst of the dot-com bubble. Apart from being a haven for teenagers and online marketers, social networking sites are increasingly adopted by the corporate community. The trend makes viable many new business models and applications. The popularity of these sites has altered the way society interacts, but it also greatly heightened the threats of cyber crime. Safety and crime issues aside, the massive amount of user-generated content in these Web 2.0-enabled social networking sites are becoming fertile grounds for viruses. Furthermore, these sites pose great challenges on how to protect copyrighted works as they are havens for digital content sharing. Society must learn to balance the benefits of social networking with its drawbacks as the phenomenon is an inescapable global trend, expanding at the speed of light.

DOI: 10.4018/978-1-60566-132-2.ch015

INTRODUCTION

A social networking site is a category of websites with user profiles and persistent public commentary forming a traversable networked virtual community. A user profile contains identifiable information about the participant, such as, age, gender, interests and etc. The profiles have unique URLs that can be visited directly. Site visitors can also post comments or other information for everyone to see. Network participants have the ability to list other profiles as "friends", link to friend's profiles, and see comments posted by others. The comments are semi-permanent because they may disappear over a period of time or upon removal. All of the above functions generate a virtual network for social interaction where each node contains a link to the profile of the other person so that individuals can traverse the network through friends of friends.

Social networking sites bring people together in a virtual community to talk, gossip, exchange ideas, share interests and making new friends. The sites typically provide tools for posting messages, sharing photos and creating personal pages. The Internet is made of people, and people are social by nature. Embraced mostly by teenagers and young adults who find it irresistible, MySpace.com, a social networking site, launched only four years ago is now one of the world's most popular. In U.S., it ranks second only to Yahoo in page views, drawing almost 5% of all site visits, ahead of even Google, which drew only a little over 4%. According to a recent web metrics report (Tatham, 2006), one in every twenty U.S. Internet visits went to one of the top twenty social network sites in September 2006.

The popularity of social networking has altered the way society interacts, but it also greatly heightened the threats of cyber crime. Safety issues aside, the massive amount of user-generated contents in the Web 2.0 enabled sites are becoming fertile grounds for viruses. Furthermore, these sites pose great challenges on how to protect copyrighted material as they are now havens for digital content sharing. Society must learn to balance the benefits of social networking with its drawbacks as the phenomenon is an inescapable global trend, expanding at the speed of light.

Social Network Theory and Social Network Analysis

"Social network", a term coined by J.A. Barnes (1954), represents a web of relationships and flows between people, groups, organizations, animals, computers or other information processing entities. Social network theory differs from traditional sociological studies. In traditional theories, attributes of individual actors are assumed to matter the most. Social network theory takes a different approach, where individual attributes are less important than their relationships and ties with others within the network. Social network theory in Social Sciences began with the urbanization studies of the Manchester School (Barth, 2005). Started as an attempt to quantify social relationships, social network theory has been helpful in explaining many real life phenomena, from the success of individual business to the rise of political powers, and from the process of how juries reach consensus to the decision that countries pattern their trade.

Social network theory, deeply rooted in Sociology, has recently found a home in many business applications. Social network analysis helps us to understand the dynamic of informal networks. Social network analysis theory views social relationships in terms of nodes and ties. Nodes are individuals within the networks, ties are the relationships between the individual, and a social network is a map of all of the relevant ties between the nodes being studied (Scott, 1991). The International Network for Social network Analysis, http://www.insna.org/, is an academic association of social network analysts. New visualization tools are constantly being developed and many are available online for scholars to study the patterns of complex social interaction using graphical images of network models. A social networking service is a website specifically focused on providing and supporting online social networks for whatever purpose. As of April 2006, social networking sites claim an estimate of 68.8 million unduplicated unique participants, reaching 45% of active web users (Nielsen, 2006).

A Short History of Social Networking Site

Hammersley (2003) noted, "Given the right knowledge of the people between us, I could probably plot a chain of people between myself and you, wherever you are. If such information was available, and it turned out it might be advantageous for us to chat, then we could ask each of the middlemen in turn for an introduction and get on with it. Or we could skip the middle guys altogether. That's the idea of the growing number of social network sites on the net today."

The non-digital form of social networking has existed as long as human civilization. As the cliché goes, "It is not what you know, but who you know". The Small World Theory, or the Six Degrees of Separation, speculates that there are only six degrees, or levels, of separation between a person and everybody else in the world (Barabasi, 2003). A degree of separation is defined as an acquaintance or friend who separates one from someone else. Thus, zero degree of separation exists between one and one's immediate friends. It is a common human practice to use a network of friends to exchange information, enhance job prospects, or further one's career. With advent of the Internet, it is only natural that the traditional social network ceded the spotlight to digital social network, from contacting friends who might be able to help nearby, to friends in a broader sense on the Internet, i.e., the ultimate "network of networks".

Emerging technology always affects the society around it, and social networking site carries no exception. As technologies become more dynamic and participative, the social networks form around these communication channels also become more complex. The Internet can trace its roots back to the ARPANET, the first computer-mediated communication networks developed in the 1960s (Wellman, et al., 1996). The earliest digital social networks emerged on the ARPANET are small tightly-bounded groups making up of specially trained users. In the 1970s, e-mail mailing lists and bulletin board systems (BBS) were some of the pioneer technologies that enable mass social collaboration and interaction online. UseNet and Internet Relay Chat (IRC) extended the concept of messaging and enable newsgroup of users with common interest to dialogue in relatively unrestricted ad hoc manner. UseNet, the first virtual community in existence, was estimated to have over 8.1 million participants in 2000 (Rheingold, 2002). Instant messaging (IM) emerged in 1996, creating an almost synchronous messaging environment by fusing the functionality of real-time chat and e-mail (Huang & Yen, 2003). Unlike the UseNet which restricts membership to a global list, IM empowers users to define and maintain the social networks themselves. IM users maintain a list of people which they have a relation or desire to communicate, and individually, they can negotiate to add new contacts, restrict or remove the addition of one's name to other's list.

The earliest social networking commercial website was launched in 1995 (Wikipedia, 2007). Classmate.com, http://classmates.com/, was the first website that aimed at assisting members to find past friends and acquaintances from school, work and military throughout the U.S. and Canada using the Internet. Members were searchable by name, age, hometown, and institutions. The site provided a vehicle for friends to re-connect and keep-in-touch with tools such as personal websites, message boards and other tools for event planning and email exchange. With the success and growing popularity of Classmate.com, a new movement was spawned towards initiating and cultivating new relationships online. SixDegrees.com, from 1997 to 2001, followed Classmate's lead, but with added dimension of allowing members to meet their friends' friends. Modeled after the "Six Degrees of Separation" concept, members could send and post messages to people in their first, second, and third degrees, and see their connection to any other users on the site. The first site that really garnered popular appeal was Friendster.com, http://www.friendster.com/, launched in 2002, and it was followed by MySpace.com in 2003. MySpace.com allows users to personalize their profiles by uploading photographs and music as well as personalizing the backgrounds of their pages. Catered to teenage population much more effectively than previous sites, MySpace.com has attracted a huge membership from teens and young adults. It has become such a success that the company was acquired by News Corporation for $580 million in 2005 (Carr, 2007).

Most commercial social networking sites allow everybody to join, but some only allow those who are invited by an existing member. In any case, all the sites have certain mechanism to restrict links that are made with existing members. There are several common features in addition to the registration and invitation process. Each new member is asked to provide a profile of who they are: their interests, hobbies, skills, professional affiliations, and etc. The other members may browse through their personal network of linked members, or search for members within the network by any combination of the user-defined demographic and interest criteria. Members can then make inquiries using an internal interface, a form of anonymous messaging supported within the site's communication framework, to negotiate for unknown but potential relations. Increasingly, social networking sites are focused on providing a multitude of web content presentation supports, including journals and ratings; and the presentation of multimedia including graphics, photos, audio and video.

SOCIAL NETWORKING FOR BUSINESSES AND CORPORATIONS

While young people propel MySpace.com to become the most popular website on the Internet, there are now social networking sites for practically every niche. Some are by invitation only, and some are even for very pragmatic and practical purposes. Fueled by a stagnant job market, online business networking has generated serious attentions. A business professional joins a site by creating a personal profile, then e-mail friends and associates inviting them to set up their own profiles. Each person who accepts the invitation becomes a member of the personal social network. As other members solicit their own friends and colleagues to join, the person's network grows exponentially. These sites provide the benefit of an inherent filtering system and personal privacy is somewhat protected as network memberships are by invitation only (Kandra, 2003). Social networking sites are no longer just for making friends and meeting new people. People are using the sites for professional purposes: searching for jobs, making professional contacts, and expanding one's current business reach.

Social networking has profoundly impacted the corporate world, though most of the current hype and attention are focused on individual Internet users. Companies and organizations can capitalize on the growing trend of meeting people and maintaining relationships online just as much as individuals are benefited from using these sites. A recent study showed the top reasons for business blogging included publishing content and ideas, building community, promoting thought leadership, and getting information and feedback quickly to and from customers (Backbone, 2005). Similarly, a corporation can use social networking internally for applicant and staff research, and team build; and externally for the maintenance of business to consumer (B2C) and business to business (B2B) relationships.

The Internet is a public domain. If one can use the Internet to search for information on others, others can also be searching for one's information online. What if those others are law enforcement, principal, parents, spouse and even current and possible future employers? Social networking sites allow users to search for each other once registered and logged into service. Once an individual is found, their pages, posting blogs, pictures, messages and etc., are essentially open for public viewing. Companies can make certain inferences and stereotypes regarding someone's productivity and potential distractions from these materials. While the practice may be ethical questionable, it would be naïve to assume employers are not using them as a source of information on current and perspective employees (Finder, 2006).

The corporate intranet has long established as a platform for team building and delivering updated information to employees (Bansler, et al., 2000). Social networking allows an organization to broaden the scope of their intranets to encompass more interactive activities and streamline their internal business value chain. Connecting employees in a collaborative manner via an internal network can foster trust and reinforce organizational identification. They promote the company culture, organize events to unite employees, and help them connect in new non-work ways, all of which can boost company morale. Multinationals are at the forefront of applying this innovation because they are facing the challenge of connecting thousands of employees worldwide, who are speaking many different languages.

The popularity of social networking sites has made them magnets for advertising dollars. Corporations are constantly looking for the most efficient manner available to build their brand or push a new product. Web advertising now competes head to head with both print and television ads, and is an important component in any overall campaign. Companies are starting to use social networking and blogs as a way to promote their products and services. Some simply send their marketing people online to participate in blogs and social networking sites masquerading as consumers. Such tactic is unwise and can be serious backfired. They are often discovered and reported, and end up causing serious embarrassments and damages to the company's reputation (Barbaro, 2006). Honesty is always the best approach. A company can create its own social networking site, tell consumers who they are and what they want from them. Ask for opinions from visitors and give them current information about the company's products and services. Companies can get plenty valuable feedbacks by telling their potential customers about their products and new ideas in an open forum.

Apart from the traditional empowerment of employees to share their contacts and build relationships outside of the company, some organizations are using social networking sites for "crowdsourcing". Crowdsourcing is a new business model that delegate internal works to the outside of the company. Unlike outsourcing that is typically done by lower paid professionals, crowdsourcing relies on a combination of volunteers and temporary participants who use their spare time to create content, solve problems, or even research and development. For example, corporations can use their social network to outsource a complex scientific challenge facing the company to leading researchers from around the globe. Rather than invest in expensive research and development, the social network allows companies to build upon the previous, current, or future work of experts from all over the world. Potentially, this approach can produce a huge saving in time and money, and to solve even the most perplexing problems (Howe, 2006). Why reinvent the wheel if someone out there already has the answer?

Social networking sites are also becoming a valuable platform for entrepreneurs and professionals to connect with one another to find new partners, suppliers, and ultimately increase their own customer base. Musicians, celebrities, filmmakers, authors and comedians are already using these sites to promote their work and reach a larger audience or reinforce the fan base they already have. Professionals can network online to grow their current business and their own career network. Entrepreneurs can network to compensate for their lack of resources and remain competitive with larger firms. Small businesses can locate potential partnerships, share experiences, and leverage a global network of opinions and advices online. Several niche social networking sites cater just for such purposes. For example, LinkedIn.com (http://www.linkedin.com/) provides the ability for its members to host a "virtual trade show", overcoming the traditional resource barriers for conducting such events for individuals and small business owners.

Popular social networking sites such as MySpace.com are also creating its own ecosystem. Just like EBay, MySpace.com is populated with small businesses that do everything from helping users to decorate their profiles to creating tools that let advertisers target site members (Rosmarin, 2006). Companies are also developing new technology and business model to take advantage of the social networking phenomenon. For example, wallop.com, http://www.wallopcorp.com/, was started as a research project at Microsoft, which provides users a more lively and vivid experiences with Flash-based applications; eSnips.com, http://www.esnips.com/, is a startup social media sharing site where members can share any digital content they want, including photos, video, text and links. Progressively, people will have more options for interacting with other people. Furthermore, devices will automate an increasing variety and amount of intrapersonal communications. These new technologies have already changed the manner in which people meet, share information, do business and organize their lifestyles.

A NEW PARADIGM FOR SOCIAL INTERACTIONS

Social networking sites have a huge impact on the American society. They change the definition of networking, from that of face-to-face interpersonal event, to virtual meeting on the global village. Rather than meeting someone in person with the traditional physical contact, people are now using technology to interact and network from their very own homes anywhere in the world. Without the face-to-face exchanges that are the hallmark of traditional physical social interaction, computer mediated communication is based only on written text. The complexity and diversity of techno-modern life makes it difficult to evaluate the effect of social networking sites on the society. Some scholars believe virtual communities reinforce existing social ties because they enable easy reach to others. At the same time, others worry the reduction of face-to-face exchanges will have a detrimental effect on interactions between people.

Proponents of social networking sites note the many benefits offered by these sites to their users and to the society. These sites provide opportunities for users to meet new people with similar interests, essentially linking members of society together who may never have gotten the chance to interact (Wellman & Gulia, 1999). Social networking sites are not only valuable sources of information. They are also sources for companionship, social support, and most importantly, a sense of belonging. Because social networking sites provide simple and quick access to many people, these sites encourage more interpersonal interactions instead of lessen them. There are other benefits cited by proponents of these virtual communities. For instance, they provide simple and quick access to people and an endless amount of people to reach. Furthermore, relationships and dialogues can be built upon intellect and common interests, without the assumptions and bias of race or gender (Fernback & Thompson, 1995). Finally, these sites provide the opportunity for individuals to express themselves and preserve their uniqueness despite the conformity constraint imposed upon by the physical society. Such freedom of expression is important because liberty, autonomy and selfhood are the bedrock of any free society.

Traditional approaches to community are perhaps inapplicable to virtual spaces, but urbanization and modernization do threaten the traditional patterns of social life (Bender, 1978). While social networking sites allow one to connect with others more conveniently, they could conceivably encourage people to remain in their homes and away from other people. "Mouse potatoes" will replace "couch potatoes" and people will continue to hide from real life. Not only is there a loss of physicality, but the convenience of the Internet will also discourage people to interact face-to-face. Some scholars argue computer mediated communication is not a legitimate way to socially interact. "True" interpersonal communication explicitly reveals emotion. It is not that empathy, tenderness, reassurance, flirtation, sadness or happiness cannot be expressed in written text. Rather, it is the matter of eye contact, body language, facial expressions, vocalization and hugs that would be sorely missing (Nie, Hillygus & Erbring, 2002).

When one talk about networking, one tends to assume that more connectivity at lower costs are always better than less connectivity at higher costs. Such assumption may be incorrect. A lot of low cost friendships might simply means many low quality friendships. The arrival of online social networks has changed the social landscape by creating a new level of social structure. While the long term impact remains to be determined, oversimplifying and exaggerating of any new phenomenon are without exception dangerous. When telephone first became popular, some researchers suggested that people would no longer leave their houses, thus automobile traffic would be reduced dramatically. Yet, it turned out that people would not only use the telephone to call each other; but also to arrange meeting each other physically. It actually increased the level of face to face social activity.

Social networking has become one of the most popular applications on the Internet since the burst of the dot-com bubble. By serving the needs of a specific population, social networking sites enable advertisers to reach niche audiences. But looking beyond banner ads and page views, online marketers see social networks as free focus groups and social networking sites as treasure troves of consumer data. Big players such as Google have started to add social networking applications on top of the existing features, for example, utilizing existing buddy lists and connecting them to profiles. The scope of social networking is expanding at hypersonic speed. While some people may not be technologically savvy enough or feel comfortable enough to network online. The trend setting demographic of 15 to 40 year old, who have spent most of their lives using the Internet, are undoubtedly avid online social network users. It is unavoidable that the society must come to terms with balancing the benefits of such new networking opportunities verse its inherent risks.

Privacy, Web Safety and Cyber Crime

Social networking can create an illusion of privacy where none actually exists. By not really knowing who is watching, one could easily post more information on one's profile than one would otherwise give to a common stranger. This leaves users, especially younger ones, susceptible to those with ill intentions. The phenomenal popularity of social networking sites has greatly heightened the concerns over sexual predators lurking in them. Parents, educators and police have become increasingly worried that teens are finding troubles at these sites. MySpace.com has gotten the brunt of the publicity given its prominent position and with 20% of its members under the age of 18. In June 2006, the mother of a 14-year-old who said the 14-year-old was sexually assaulted by a 19-year-old user sued MySpace.com, seeking $30 million in damages. The lawsuit, filed in a Texas state court, claims the 19-year-old lied about being a senior in high school in order to gain the child's trust; and MySpace.com is not doing enough to protect minors from sexual predators (Rawe, 2006).

Self-reported identity system is often problematic but reliable verification requires expenditures and restricting access results in a smaller user base. For example, a credit card can be used to demonstrate a user's age, but credit verification incurs cost, and not everyone has a credit card. Although more robust techniques can verify user provided addresses, birth dates and other information against public databases, but minors do not possess as many unique identifiers as adults do, and their records are strictly under guard by states and schools for privacy and security reasons. To create a safer environment, social networking sites can restrict access only to those with a valid e-mail address from a school, college or participating company. It can even require parents to submit identity vouching for their children.

On a positive note, social networking sites can be a helpful tool for law enforcement. For example, police officers can set up sting operations by posing as teens that are targeted online by adult predators (Cressman, 2006). The government is also developing new laws regulating these websites. The Deleting Online Predators Act of 2006, or HR 5319, was brought before the U.S. Congress as an amendment to the Communications Act of 1934 (Fitzpatrick, 2006). The statue requires schools and libraries to limit and monitor a minor's access to social networking sites. Ultimately, parents must be proactive, by setting limits on how much time their children can spend on social networking, what activities they can participate in, and what the appearance and messages are in their profiles.

While the dangers minors facing on social networking sites have been well documented, adults' behaviors on social networking sites could also increase their risk of becoming a victim of cyber crime and identity theft. In a recent survey by the National Cyber Security Alliance, 83% adults who use social network exposed themselves to hackers by downloading and opening unknown files from these sites, 74% have given out some sort of personal information such as their email address, name, birthday, and some even their social security number, 57% received unsolicited or phishing emails asking for money, requesting account information, informing users of lottery winnings, or asking users to download a video. Surprisingly, 31% of those who received such emails actually responded to them (Russell, 2006).

In this Information Age, personal information is a highly valued commodity. It is captured and compiled, bought and sold in ways never imagined before. The level of privacy one can expect from offline activities usually is clear from the nature of that activity. Online activities are less obvious. Many users expect their online activities to be anonymous and private. In reality, they are not. Social networking sites are billboards in cyberspace, so it is important to guard one's financial, personal and other sensitive information with extra care. Since it is hard to judge people by self-posted photos or information, one should be cautious about meeting a new cyber friend in person. Social networking sites are fast becoming the hunting ground for criminals to hack into financial records and compromise personal information to commit identity thefts and frauds. For this reason, people need to beware of the scams and con artists lurking in them.

Creating a safe virtual community has its costs and appeals. Managing a limited population and keep them all safe, instead of looking for a million unique members, can be a viable business model. Safety experts warn that creating too many barriers could drive teens to other social networking sites with fewer controls, or perhaps free-for-all chat rooms. Furthermore, ineffective solutions could give parents and children a false sense of security, ending up increase dangers. While technology alone would not be the solution, it could be very helpful in resolving the dilemma. Perhaps some sort of V-chip technology can be devised just as when violence on television was the hot button issue of the day. Other promising technology may involve blog patrol armed with artificial intelligence that scan and approve every posted word. Parents must also get more involved in what their children are doing. In the end, education is the only way that teaches children to be proactive, which will stay with them forever even when social networking is replaced by the next big fad.

Web 2.0, Hackers and Malwares

Safety and crime issues aside, security experts worry the massive amount of user-generated content in social networking sites make fertile grounds for viruses. It may even make such content sharing sites a more common vehicle than e-mail for virus propagation. As users flocked to social networking sites, it is only a matter of time before these sites attract the interest of hackers. In the past year alone, MySpace's visitors have been the repeated target of attacks, falling prey to everything from cross-site scripting (XSS) to phishing. MySpace.com was forced to shut down hundreds of user profiles after a combination worm and phishing attack that compromises the visitor's "About me" page (Kawamoto, 2006). Last fall, the site was hit by the Samy worm, the first attack to exploit a XSS vulnerability (Mook, 2005). This attack highlights the opportunity for a self-propagating worm to take advantage of the XSS technologies. The malicious code injects itself into sites with the aim of being parsed and/or executed by browser or e-mail clients.

XSS is a type of second generation Internet based software coined as Web 2.0, which emphasizes online collaboration and sharing among users (O'Reilly, 2005). Lacking a precise definition, Web 2.0 is an umbrella term uses to describe a number of technologies that empowered websites to be more than just plain, static pages. The key to Web 2.0 is a programming technique called AJAX, or "Asynchronous JavaScript and XML." AJAX enables web pages to render without a complete page refresh by decoupling user interaction with the browser from the browser's interaction with the web server.

AJAX builds web applications by combining Extensible Hypertext Markup Language (XHTML) and Extensible Stylesheet Language (XSL) standards for presentation; and using Extensible Markup Language (XML) and XSL Transformation (XSLT) for data interchange. AJAX follows the Document Object Model (DOM) to interact with items on a webpage by treating the items as platform and language independent objects. Finally, the XMLHttpRequest (XHR) is used by AJAX to establish asynchronous exchange of data to and from the web server using standard Hypertext Transfer Protocol (HTTP) connection; with JavaScript to bind and tie all these components together (MDC, 2007).

In a standard web application, the interaction between browser and server is synchronous. When a user clicks on a link on the browser, a request is sent to the web server. The server then processes the request and sends data back to the browser while the user waits. Under AJAX, the presentation control logic is embedded as JavaScript code in the webpage. When a page is loaded, AJAX handles most of the basic tasks such as data validation, data manipulation and display rendering. Requests from the user does not necessary have to wait for a request respond cycle to the server. If additional data is needed from the server, AJAX will do so using an asynchronous request without the interrupting the user's interaction with the browser. AJAX allows interaction with the browser and user asynchronously and independently; and the transfer of data between browser and server is not dependent upon actions of the user.

While offers richer user experience, AJAX enables XSS attacks that anti-virus software, intrusion detection system and firewall are ill equipped to protect against. One could lose control of one's site in the rush to create an attractive surfing experience. By exploring poorly designed AJAX code, a hacker can initiate XSS by downloading and running script on the victim's browser. The malicious script might steal cookies, launch phishing attacks or even make request as that user. Such XSS attacks can be activated either by a user unwittingly clicking on a fraudulent link or by simple visiting a webpage with embedded malicious code. Typically, a hacker will create multiple profiles and the links on their sites. Each link can take the unsuspected users to sites that will either download or drive-by download the malware. Websites that permit users to manipulate code is inherently flaw and posting a huge security risk to everyone (Kaplan, 2007).

Rich Site Summary (RSS) is another type of XML document which often used to share web contents. RSS has been adopted by news syndication services, weblogs, webcasting and online information services. RSS is thus also known as "Really Simple Syndication". While around for many years, RSS is now quickly gaining momentum due to its active "content-push" technology. It has become a staple of the Web 2.0 pantheon.

However, RSS is susceptible to malicious script being embedded in the XML feeds too, particularly for one with a vulnerable feeder (Microsoft, 2006). Users should refrain from routinely accepting feeds, putting the RSS readers in their Outlook, and downloading content automatically into their mailboxes without security control and validation.

While Internet users can protect themselves to some extent using PC security software, such applications are typically effective only after an attack has surfaced as they are mostly signature based system. Firewalls are not designed to prevent software installed internally from doing what it is supposed to. A firewall's function is to keep external intruders out. The ultimate countermeasure against malicious code has to be security awareness and the practice of safe browsing. At a minimal, browser's Internet Security settings should be set to medium or higher with the following options for ActiveX and plug-in objects:

- Disable initialization and scripting ActiveX controls that are not marked as safe
- Prompt signed and disable unsigned download of ActiveX controls
- Prompt running of ActiveX controls and plug-ins
- Prompt scripting ActiveX controls marked as safe

While AJAX makes web pages and sites more interactive, it also opens ways for hackers to hack into a web server, exploit the site and attack its visitors. If enterprises do not demand basic security capability in Web 2.0 applications and do not adapt existing security processes and controls to the new concepts, waves of security incidents and business interruption will wipe out any increase in productivity or customer value provided by the technology. For Web 2.0 developers, they must be careful not to make security an afterthought in the rush to add features and abilities. The key to security is awareness, training and practices. Like all software development, developers should always address security first and build products with the user's best interests in mind.

On a positive note, deploying fixes should be easier in web applications as downloads are automatic and user actions are typically not required. Web 2.0 sites must also be more proactive and work closer with vendors to ensure security, track down problems and get fixes to users promptly. Adjusting to new technology will be invariably challenging. Developers are facing a learning curve as working inside a browser is a departure from the traditional browser/server development environment. Moreover, business adoption could be a slow and long process. While technological savvy users may love the new technology, less experience workers might resist applications that have different controls, layouts, looks and feels (Hoover, 2006).

Copyright in the Age of MySpace.com

New technological developments always pose challenges on how to protect copyrighted works and how to create new business models to deliver those products to consumers securely, conveniently and cost-effectively. Some argue Internet has marked the end of intellectual property and copyright. Countering the trend of downloading illegal copyrighted material on the Web, the Digital Millennium Copyright Act (DMCA) was enacted. The act criminalized both the development and employing hardware or software that cracks digital copy-protection schemes (USG, 1998). While the development of hardware or software may be in itself legal, the action could facilitate others to access materials that are copyright protected, and thus break the copyright laws. Based on DMCA, the Universal Music Group filed a copyright infringement lawsuit against MySpace.com recently, charging that much of MySpace's content is often "user-stolen" intellectual property of others, and MySpace.com is a willing partner in that theft.

It alleges MySpace Videos being a vast virtual warehouse for pirated copies of music videos and songs (Leed, 2006).

Some would argue the current copyright laws, such as DMCA, has become outdated as its provisions never addressed the rampant file-sharing taking place across the Internet. The e-commerce paradigm is both an opportunity and challenge to business. While delivering contents via the Internet can be efficient and economical, content owners risk losing control of their intellectual property. Digital content providers, such as the music industry, are reevaluating their business models, opting to move away from a traditional buy-and-own to a pay-per-use model. Any business that wishes to control access to and use of its intellectual property is a potential user of Digital Rights Management (DRM) technologies. The entertainment industry is leading the charge for DRM adoption as a mean to preserve their copyrights.

DRM refers to protecting the copyright of digital content by restricting the actions a recipient may take with regard to the content. DRM gives owners the ability to securely distribute their valued content and to control the use of this content, preventing it from unauthorized distribution. Whether the content is books, photographs, music or video, DRM can be used to manage access and identify content (Russ, 2001). Encryption is used for setting and automatically limiting user behavior. After downloading the content, one may have the right to use the work, but the user has to authenticate his or her legitimacy whenever and wherever the digital content is used. While DRM does not raise privacy issues in itself, to require server authentication each time digital content is accessed can constitute the worst sort of privacy invasion. Information garnered by DRM systems in our highly networked society can be used to build a dossier of user's preferences and usage patterns. Such information could in turn be sold to online marketers or even obtained by the government to keep a tight watch on its citizens (EPIC, 2002).

Information goods are characterized by negligible marginal costs, making the Internet a perfect medium for their delivery. Few would argue against the right of copyright holders to control how their content is distributed and for how much. Social networking sites put the end-user at the center of the digital universe, but those who wish to consume and share digital media are hamstrung by a pre-digital age copyright law and business model. Content owners need to come up with a digital age business model that discourages piracy but does not alienate consumers. Undoubtedly, social networking sites and media companies stand to benefit by working together. While a reexamination of the DMCA may be in order, government mandates must be fashioned with great care because they may limit the ability of innovators to introduce new technologies as well as the ability of consumers to purchase goods on the free market (McCullagh, 2006).

FUTURE TRENDS AND CONCLUSION

Society is learning to balance the benefits of social networking with its drawbacks. Apart from security risk, potential problems might include loss of productivity at school or workplace and an overall lack of real human interaction. A knee jerk reaction to social networking sites may be to severely restrict its availability, blocking access from the home, school or corporate networks. This reactive solution is only a band-aid on a much larger problem, as resourceful users can always find ways around access restrictions. Moreover, government regulations will unlikely be enforceable as international companies are not abided by American laws assuming the servers are hosted outside of the U.S.

The Metcalfe's law states that the value of a telecommunications network is proportional to the square of the number of users of the system. Metcalfe's Law can be applied to more than just telecommunications devices. It can be applied to almost any computer systems that exchange data, including telephones, facsimiles, operating systems, applications and even to social networking websites. Society's future consists of a vastly expanding landscape of online social networks. The current phenomenon is only at its infancy. As more people participate in these sites, the more powerful they will become. Although most people are aware of the phenomenon, most participants are relatively young. Will social networking persist as these participants grow older, develop professionally, and start families? Is this a phenomenon just for relationship hungry college kids? Such questions remain awaiting for answers. An inescapable reality is that online social interaction forums are not a U.S. specific phenomenon. As popular as these sites are for Americans, they will have equal appeal abroad. Online social networking is a global trend, happening before our eyes, and moving at the speed of light.

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KEY TERMS AND DEFINITIONS

Cross-Site Scripting (XSS): Cross-site scripting is a type of computer security vulnerability typically found in web applications which allow code injection by malicious web users into the web pages viewed by other users.

Digital rights management (DRM): Digital Rights Management is anti-piracy technology that allows digital copyright owners to control who and how gets to access and copy their work.

Instant Messaging: Instant messaging is the ability to exchange messages in real time with others over the Internet. Typically, it requires one to be connected to the Internet and with access to instant messaging software.

Social Network: Social networks are a way to describe systems as composed of multiple elements. Each element, or node, may or may not have a relationship with the other nodes. The most common social network is a node of people and relation between them.

Social Network Analysis: Social Network Analysis is the techniques used to study social networks. While traditionally sociologists focus on the individual elements in their study, social network analysis emphasizes more on relations between individuals.

V-Chip Technology: V-chip is a technology that blocks objectionable television for younger viewers. The V-Chip reads information encoded in the rated program and blocks programs from the set based upon the rating selected by the parent.

Virtual Community: An online or virtual community is the gathering of people, in an online virtual space where they come, communicate, connect, and get to know each other better over time.

Web 2.0: Web 2.0 is based on the idea of the Web as a platform. Instead of thinking of the Web as a place where browsers viewed data through small windows on the readers' screens, the Web was actually the platform that allowed people to do things.

This work was previously published in Handbook of Research on Social and Organizational Liabilities in Information Security, edited by M. Gupta; R. Sharman, pp. 243-255, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.5
Emerging Cybercrime Variants in the Socio-Technical Space

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ABSTRACT

This chapter examines the gaps that arise between reactive social control systems and proactive technology systems. The authors further link these gaps to cybercrime patterns and growth, by a theoretical framework that depicts the role that cybercrime plays in different gaps. This further suggests a typology of cybercrime, based on instrumental vs. expressive differences between offenses. Recent and emerging criminal activities and formal and informal control responses are reviewed and evaluated to illustrate this cybercrime framework and typology. The result is proactive strategies that can help prevent cybercrime from occurring in the disjoints between social and technical systems.

The world has become too dynamic, complex and diversified, too cross-linked by the global immediacies of modern communication, for stability of thought or dependability of behaviour to be successful.

—Timothy Leary (1920-1996).

DOI: 10.4018/978-1-60566-264-0.ch014

INTRODUCTION

The advent of the Internet has undoubtedly revolutionized the way we work, communicate, entertain, learn, and think in the physical world. The Internet and its associated technology have created numerous, unprecedented forms of human interaction in a new, virtually constructed space, known as **cyberspace**. This social cyber milieu is invisible and intangible, but like oxygen, we know it exists in the human community (Rho, 2007). Relying on the Internet's interconnected computer networks, users can practically transmit information to one or countless recipients any time of the day or night over continents without physical constraints. This unbounded ability to communicate has created virtually limitless opportunities for innovators, resulting in new ways of human relations and interactions expressed in a variety of forms.

Yet like most innovations which have a tendency to crime (Merton, 1968), the Internet holds potential for misuse and abuse of information in human interactions. Crimes committed on or through the Internet, so-called **cybercrime**, are common and indeed soaring (Cisco, 2007). A survey of computer security officials discovered that about half of responding companies experienced increased numbers of security incidents between 2004 and 2006 (Computer Security Institute, 2007). The survey further showed that as the incidents of cybercrime increased, the financial losses caused by these crimes escalated as well. These facts attest to the rising severity of crime resulting from the social system's inability to match the rapidly progressing technical system. How is this mismatch between the social and technical systems formed? How has cybercrime grown and expanded in this gap between the two systems? Finding answers to these questions is an important step in combating cybercrime and in some way helping to achieve a balance between the social and technical systems.

This chapter attempts to examine the evolution and growth of cybercrime in the gaps existing in the socio technical space. The chapter starts with a conceptualization of cybercrime and the creation of a classification scheme. The classification explains the role that information plays in variations of cybercrime. Next, a framework is introduced to depict how types of cybercrime have evolved in the socio-technical space. Recent cybercriminal activities are evaluated to illustrate the framework. Social responses in terms of formal and informal controls are also examined to assess their effectiveness in cybercrime mitigation. The main purpose of the analyses is to identify strategies which can better control crimes already active on the information superhighway and prevent the emergence of new variants of cybercrime.

DEFINING CYBERCRIME

The term cybercrime can be defined in a variety of ways depending on the perspective from which research is taken. The prefix "cyber" in Greek refers to navigation (Pangaro, 1991). Literally, cyber techniques are an art of steersmanship (Guilbaud, 1959). The cybernetics literature has built the foundation for the notion of a cyber system (Parsegian, 1972). In this cybernetic frame of reference, complex systems of technology, sociology, biology, psychology, communication, and many other fields can be combined to explain interconnectedness of human and machine. Cybercrime, as a member of the interrelated network, is thus confounded with numerous elements in the social and technical systems.

From a sociological point of view, cybercrime is not different from other types of crime. (Emanuelsson-Korsell & Söderman, 2001). Both are crimes of opportunity committed by a motivated offender against a suitable target under an unguarded condition (Cohen & Felson, 1979). However, cybercrime is also a technology offense. As Brenner (2007:386) stated, it is "the use of computer technology to commit crime." Because of the continuous breakthroughs in Internet technology, cybercrime can evolve into a new generation of criminal acts unseen and inexperienced. In this chapter, we take into account the socio technical aspects of cybercrime, and define it as a law violation involving abuse or misuse of information explicitly on or through the Internet. The specific function that information plays in a cybercrime can determine the nature and type of the illegal act. For instance, a 1994 report published by the U.S. Department of Justice included the following three categories of **digital crimes**: information as contraband, information as an instrumentality, and information as evidence (Casey, 2004). In this classification, a cybercrime is investigated based on the presence or absence of contraband information (e.g., an encryption software), information means (e.g., virus codes), and records of information (e.g., Internet access logs). A study by Emanuelsson-Korsell & Söderman (2001) focused on five types of information-technology crimes: computer viruses, unlawful access to computer systems, manipulation of data, theft of information, and fraud. Criteria relating to abused data or financial gains were employed to classify these crimes. Similarly, Moitra's study (2004) of cybercrime taxonomy categorized crimes and victims by type of harm—either physical or information related. Each of the two types of harm can further be categorized as individual, such as spamming, or essentially organizational such as defacement of a corporate webpage. Moitra also provided a classification for cyber criminals according to their motivations. These include material and symbolic gains; examples are money, thrills, reputation and ideology.

Cybercrime, nonetheless, does not exist in the cyberspace. But information does. In the virtual ecosystem, information is infused to facilitate each and every aspect of digital interchanges. Information is passed around in all directions for human expression and interrelation. This infusion can be propagated for psychological gratification, monetary gain, or other fruits of crime (Casey, 2004) such as illegal software. The content of the information in a crime therefore reveals the motivation of the offender and type of targets to which the information is delivered. Given that cybercrime is substantiated by the information embodied, it is imperative to consider the target and potential gains of such information in the construction of a cybercrime typology.

Table 1 displays a taxonomy for a dichotomy of instrumental and expressive cybercrime. The classification logic is similar to the categorization initially adopted by Chambliss (1967) in his analysis of effects of differential sanctions on instrumental and expressive crimes. According to Chambliss, crime for gain is "instrumental to the attainment of some other goal" (1967:708), and expressive crime is committed because "the act was satisfying in and of itself" (1967:718). Likewise, **instrumental cybercrime** is committed primarily for material gain; the goal is to maximize the profit with minimum effort. Gains may vary from the acquisition of money, merchandise, and data, to non-tangible items like services and confidential information. **Expressive cybercrime**, on the other hand, focuses on human relations rather than profit. These crimes maybe committed for fascination, friendship, revenge, or other interpersonal reasons such as pleasure. Expressive cybercrime may also be related to political ideology, environmentalism, or passion for social justice. Both categories of cybercrime can be further broken down into either individual or organizational types, depending on the target being victimized. Individual cybercrime is more likely to occur than its organizational counterpart because of the larger potential pool of Internet users and their weaker resources for protection. The four cybercrime categories are classified generally according to the basis of potential gains obtained from the crime, and the victim type.

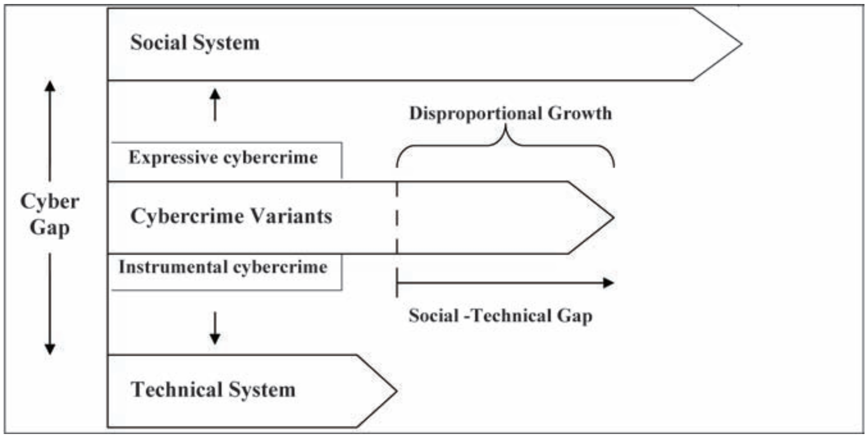
Table 1. Cybercrime classification and examples

Target of the misused information	Instrumental Cybercrime	Expressive Cybercrime
Individual	Crimeware Identity theft	Child exploitation Online stalking
Organization	Denial of service attack Corporate espionage	Warfare terrorism Website defacement

CYBERCRIME IN DIFFERENT GAPS

As Internet technology and innovation continue to progress with high demand from the general public, cybercrime evolves quickly with new information absorbed during the progression. This evolution is evident by the recent adjudication of cases by the U. S. Department of Justice (2007) and from studies by computer companies (Cisco, 2007; Symantec, 2007). While cybercrime is growing at high speed, responses of the criminal justice and legal systems are ordinary and passive. The essence of social and legal responses is mainly reactive, regardless of the nature or seriousness of cybercrime variants. In contrast, the technological system is a proactive one driven by initiation,

Figure 1. A cybercrime framework of social and technical systems



competition, and expertise of innovators. Once a technological product is invented and manufactured, social control agents then respond to the technological innovations by applications on crime prevention and criminal justice administration. This lag is inherent between social responses and innovative technologies.

In addition to the response difference between the reactive and proactive systems challenging cybercrime mitigation, the freedom of personal space on the Internet poses another hazard to social control. The proximity and scope that traditionally have restricted offenders to local crimes with single victims have broadened to international arenas where the number of victims is at liberty (Jones, 2007). The general axiom of offender-to-victim relation of a physical crime has also changed in cybercrime (Schlegel & Cohen, 2007). Personal acquaintance and socio-economic similarity between offenders and victims, which traditionally have been factors in crime, do not apply to cybercrime. These revolutionary features associated with the cyber technology have not only produced new crimes but also propel these emerging crimes at a rapid rate. This discrepancy between the proactive/fast Internet technology and the reactive/slow social system in the virtual space has created a cyber gap which breeds crime. The triple-A Engine of accessibility, affordability, and anonymity of the Internet (Cooper, 2002) may have been advantageous to offenders rather than the police in this cyber gap.

Figure 1 depicts the cybercrime gaps that form between and along the social and technical systems. The Figure is based on a theoretical framework initially developed by Ackerman (2000), Whitworth and de Moor (2003), and Whitworth (2006). The socio-technical gap in their studies of online community refers to a mismatch between what the social system is supposed to do and what the technology can support. They maintained that individuals in the social system have utilized the web of computer networks for interaction, expression, communication, expectation, and other needs. In their views, the needs of society have not been met because of the deficiencies in technology capabilities.

In the framework of cybercrime as diagrammed in Figure 1, we maintain a similar assumption that agents of the social system manage and propel elements in the technical system. However, the Figure implies that the technical system represents not only the computer hardware, software and their associated technology, but also the virtual space defined by the interrelated networks of machines. The socio-technical gap in this cybercrime framework is a lagging condition of the social control system correspondent with a less-supportive technology.

This lack of technological support has resulted in such a gap where nonconformities and outlaws have increased too fast to be kept under control by the social response system. As indicated by the horizontal lag, the disproportional growth is conditioned on the developmental speeds of the social and technical systems.

Another margin of space shown in the Figure is the upright, virtual distance called the **cybergap** located between the social and technical systems. This gap signifies the inherit discrepancy existing between the physical and virtual environments. Like the socio-technical gap, nonconformists can exploit this cybergap, victimizing individuals and organizations over the Internet for either gratification or instrumental reasons. The Figure suggests that crime variants in the cybergap are distributed according to the nature and kind of **human computer interactions**. The degree of variations will increase with both the importance of human relationships in the social system and the diversity of invented products in the technical system. The popularity and dominance of either system in the cybergap to some degree determine the share of the cybercrime distributions.

As Figure 1 suggests, expressive cybercrime will take over more space in the cybergap when human relations in the social system are intensified. Imagining an information warfare between two countries, website defacements could be a highly common tactic used by either side. By the same token, a greater proportion in the cybergap will lean toward instrumental cybercrime when the technology system is more prominent than the social system. For example, the popularity of peer-to-peer (P2P) file sharing platforms has led to overwhelming illegal downloads of copyrighted products in our generation. This global prevalence is infused mainly through technology instead of meaningful human interactions. The current cybergap is obviously dominated by violations committed for instrumental gain rather than human expression.

EMERGING AND GROWING CYBERCRIME VARIANTS

The following examples illustrate in more detail the role of social and technological interconnections in defining the modern variants of cybercrime. Two examples of instrumental crime—crimeware, identity theft—and one for crime of expression—child exploitation—are examined. These crimes have been forecasted to be more threatening in the near future (Taylor, Caeti, Loper, Fritsch & Liederbach, 2006).

Crimeware

The uninvited interference codes that enter a computer system have evolved over time by methods of intrusion and motivation. In their first generation, unwanted codes are penetrated into a user's computer by means of disks, email attachments, graphs, and downloads. These malicious codes turn into viruses, worms, trojans, and time bombs attacking the computer's memory and storage, leading to the breakdown of computers, servers and even the entire network. Since the mid-1990s, when more Windows-based programs became available, we have witnessed screen pop-ups generated by adware and spyware as we have surfed on the Internet. These unwelcome pop-up ads represent a transition from hidden codes to visible advertisements, and from not-for-profit hacking to commercialization for profit. In response to the vast presence of these unwelcome advertisements, computer hardware and software have been developed to enhance the protection of computers from unauthorized intrusion. The appearance of unwanted materials on screen has reduced significantly due to these protection devices. But as the security environment improves, the technology that controls access to the computer and Internet become more sophisticated. Wireless connection coupled with the P2P file sharing networks, in particular, provide abundant windows of opportunity for criminals to invade and control someone's computer from a distance.

In recent years, we have observed a new round of transformation in which **malware** is able to take possession of an infected computer and use it to perform illegal activities. The computer security industry has warned that this new type of attack, performed by "botnets," is one of the top threats to Internet security (Cisco, 2007; Symantec, 2007). Short for robot, a bot is a computer program used to gain unauthorized access to vulnerable computers through P2P sharing channels or trojans. Botnet refers to a network of compromised computers called "zombies" configured to launch attacks from command-and-control servers operated by remote hackers. A botnet can infect millions of computers via the formation of the army of zombies. Botnet herders can also use the unnoticed codes to track signals of keystrokes entered on the infected computers, scan credit card numbers and owner names, uncover account names and passwords, and steal other confidential information. Furthermore, botnet owners can use the zombie computers to launch spamming or initiate denial of service attacks on behalf of others, harvest email addresses, and engage in many other schemes including wiretapping and defrauding banks. Recent "botware" products have begun to create zombies through channels used by MySpace and MSN Messenger (Vaas, 2007). Considering the potentially large number of users of these services, the attacks can be more extensive as bot intrusion techniques advance.

The evolution of malware from virus to botnet suggests that the exploited information by criminals is moving toward more control and greater gains. The real driving force of the movement is profit. Viruses, worms, trojans, and many malicious codes have been commercialized for sale; spyware and adware are popular tools for marketing products. In this profit-driven process, both technology and socially defined gains have mutually created new variants of crimeware.

Identity Theft

An introduction of how we identify individuals in the civilized world is necessary before analyzing changing features of identity theft. Crume (2000) and Foster (2005) have discussed three general principles commonly used to determine or verify the identity of an individual. The first principle is that the individual must *know* something, such as his or her ID and password in order to access information. This method has been broadly applied to secure email accounts and other types of personalized services, such as online banking and financing. The second is that the individual must physically *have* something, such as a key, a piece of a document or a smart card. Holding a passport to go through customs is an example. The third is that the person must *be*—biologically—who they are claiming to be. In this method verifying a person's identity involves the use of biologic characteristics such as fingerprints, iris, odor, voice, and hand geometry. The third method may be the most secure method of the three, but it is also probably the most expensive because of the advanced technology required and the relatively large space needed to store identity information. Two or more of these principles can be adopted simultaneously to better protect personal information and belongings. The ATM card is an example of the combination of the first two identification principles — a user needs to present an ATM card (*have* something) and type in a password (*know* something). This dual combination can increase the level of protection of personal access (Crume, 2000).

Today, the majority of online activities only use the first layer (*know* something) to verify a user's identity. Hence, obtaining information about an individual—including but not limited to a user name and password, government-issued identification numbers, bank account numbers and credit card numbers—has become the only requirement for potential identity thieves to access others' personal information and pretend to be another person online. Further financial and credit damages can be done easily once a thief gains access to critical information, such as Social Security number and date of birth. For instance, identity thieves may "**breed**" further identities, creating more widespread and long-lasting damage. In this context, the term "breed" refers to the unauthorized use of identification means to generate and/or acquire additional fraudulent means of identification. It has been estimated that the financial harm toward victims is seven times more than the visible financial loss if the stolen identities are used by breeders to open new accounts, compared to abusing just existing accounts (Synovate, 2003). The above mentioned activities can be done easily and exhaustively in the cyberspace.

A recent example which illustrates the large scale of identity stealing acts is the underground online market for warehousing and selling stolen information. Symantec (2007) reported that underground economy servers, which are used by criminals and criminal organizations to sell stolen identity information of individuals, have emerged as a growing problem. For example, Symantec observed more than eight thousands unique credit cards advertised for sale in the first half of 2007. In addition, underground data warehouses have exchanged bank accounts, email addresses and passwords, Social Security numbers, and some other confidential personal information. The "price" of this illegally obtained information ranges from US$30 to $400 for a bank account, $5 to $7 for a Social Security number, and $0.5 to $5 for a credit card. The digital information of different kinds of identities stored in underground market servers has generated unprecedented opportunities to make profits from illegal transactions of this information.

Another widely used technique to steal personal identity information is **phishing**. The term phishing originated in early 1996 on the alt.2600 hacker newsgroup, where members discussed computer hacking and telephone phreaking on the posting board (Anti-Phishing Working Group, 2007). Hackers who knew how to crack the telephone network to make free long distance calls were called phreakers, and a hacked account was named "phish." During the early stage of phishing, phreakers routinely traded active AOL phish for free software. But just as crimeware evolved into profit-making practices, the simple stealing of AOL dialups has become a greedy act solely for monetary gain. The contemporary operation of phishing scams has adopted spamming emails in conjunction with fraudulent websites to steal pieces of confidential personal information. This stealing form, also known as a **social engineering**, is where fraudsters design and implement logical procedures to persuade victims to supply confidential information to a spoofed entity (Rhodes, 2006).

As the social aspects of phishing scams diversify (i.e., growth in the number of fraudulent emails, websites, and the types of targeted financial institutions), so does phishing technology. A variety of techniques have been used by phishers to evade anti-spamming or other phishing detections. For example, one evasion technique used by a phisher is to deliver the deceitful message in an email as a picture rather than text to avoid text-based anti-phishing filters. This hiding technique has been expanded to other formats such as PDF, MP3, Excel files (Mail-Filters, 2007). Technical sophistication is also reflected in the recently discovered toolkits studied by Symantec (2007). These toolkits are highly automated in terms of creating and sending phishing email messages and setting up websites that can spoof legitimate entities of different brands. The professionally-made kits can establish multiple fraudulent websites on the same compromised computer. These features enable phishers to generate a large number of phishing emails and fake multiple brands in a short period of time.

Complicating the social engineering scheme is voice phishing, known as **vishing**. Vishing goes beyond routine phishing by using Internet telephony's voice messages to facilitate the social engineering engagements with victims. This new scheme emerges as a result of the IP-based voice technology VoIP, short for Voice over Internet Protocol. With the assistance of VoIP technology, it is easy for phishers to increase automation and versatility in contacts with victims while maintaining their anonymity. In addition to emails, phishers employ mobile text messaging, voice-mail, and live phone calls to initiate and execute their attacks (Ollmann, 2007). The full-fledged employment of these verbal and non-verbal methods is expected to gain a much higher rate of success than text-based phishing. Ironically, this more personalized scheme is accomplished mainly through automated harvesting on victim data. The professionalization of phishing products combined with the personalization of vishing will undoubtedly increase the chances of success of this type of instrumental theft.

Child Sexual Exploitation

Sexual exploitation of children and the Internet have become almost inseparable in this information age. During the pre-Internet era, child sexual images shown in photographs, films, and videocassettes were distributed through traditional delivery methods such as the postal service, adult stores, or commercial dealers. Although these conventional means of distribution remain operational, their role has been replaced largely if not entirely by Internet transmissions. Sentinel data have clearly demonstrated a persistent upward trend in the distribution of **online child exploitation** images over the past decade (Internet Watch Foundation, 2006).

A great concern accompanying this growth is the blending of the child pornography producer and victim. A New York Times reporter (Eichenwald, 2005) in his investigation of Webcam child pornography discovered that several hundred pornographic websites were created by teens to advertise pornographic showings of themselves. Within a week, Eichenwald was able to identify Webcam images of 98 teenagers. This discovery suggests that gratification from money, gifts, fame, and other profits received by the operating teenagers, plus the ease of site creation and networking, will drive more youngsters to operate online pornography businesses by themselves. To predators, the interactive nature of live broadcasting makes sexual displays more exciting and participative. Instant images also allow predators to evaluate whether the subject is a minor or not. Webcam technology has made the delivery of images more appealing to predators, while making it more difficult for the police to catch pornography consumers with decoy operations.

The growing popularity of social networking sites such as MySpace, Facebook, LiveJournal, Xanga, MyYearbook, Friendster, etc. have worsened the nature and scope of child exploitation. Some online child pornographers have gradually changed their role from passive possessors to aggressive producers or predators (Taylor and Quayle, 2003). It is well known that peer networking sites, especially MySpace, have been utilized by perpetrators to target and groom children for erotic and sexual behaviors. Our keyword search on cases related to child pornography and MySpace in the LexisNexis newspaper database resulted in only 14 records in 2005. The same search criteria generated 244 records in 2006 and 349 records for 2007. The increasing numbers suggest that social networking sites have been utilized as a platform by predators for preying on minors. Online profiles, which teenagers post on the websites, provide entry points for predators to connect with their targets. Blogs, photos, videos, and chat rooms featured at the sites have unfortunately become tools exploited by predators to enhance their interpersonal relationships with innocent children. This exploitation in any form must be punished and prevented in a social system of civil expression.

SOCIAL RESPONSES TO PROACTIVE TECHNOLOGY

The fundamental difference between the proactive technology system and the reactive social control is given by nature. The question, therefore, is not whether the gap is removable, but how we can better control the emerging and progressing technology with the tendency to breed new forms of crime in the gaps. Answers to this question may first be addressed through a review of current efforts of social control, followed by a discussion of proactive approaches of social control.

Reactive Social Control

A society can exercise controls over its members through formal (e.g. courts and law enforcement agencies) and informal (e.g. community and personal networks) paths (Garland, 2001). In the "real" world, people have opportunities to craft physical interactions in which controls are enforced and reinforced. In the borderless and largely anonymous cyberspace, the types of interaction are more abstract and subtle. As a result, social control activities in the cyberspace are usually executed by conventional means in the physical world but are barely enforced online. This section demonstrates the emerging phenomenon of adopting internet technology as a formal means for greater **social control**, particularly crime control.

Traditionally, our crime control system has been designed to record and trace offenders based on their physical, demographic, and other characteristics on the assumption of a real space. The recording devices include those for identification purposes and relational systems in support of the investigation and apprehension of criminals. The Automatic Fingerprint Identification System, Combined DNA Information System, Facial Recognition Technology, and other biometric measures enable the social control system to identify offenders accurately with digitalization technology. Once an identity is confirmed, relational databases can be sought to check records, such as pending warrants, prior arrests, aliases, driver's license, and vehicle registrations, that associate with the particular individual.

Nowadays the police can use not only automated technology but also surveillance software to investigate crimes involving the Internet. Controversial programs such as Carnivore and Magic Lantern allow officers to intercept email communications or install spyware for capture of keystroke signals (Foster, 2005). Investigators can also use public data on the Internet to search for valuable information on suspects. For instance, Anywho.com can find information on prior addresses and relatives of a fugitive; Whois.com stores information about registered owners and their usage of websites; the Wayback Machine searching tool can look for unused Web pages published before a present investigation (National Institute of Justice, 2007). The supports for social control and information gathering have been improved and expanded continuously over the years; some collaborations have also been made to integrate various automated systems (Griffith, 2005).

But so far this reactive formal control system remains small scale and limited to traditional criminals. Factors like platform and data comparability continue to restrict social control agencies in information sharing at various levels of governments (Griffith, 2005). A noticeable amount of survey studies have indicated that many police agencies lack the equipment and resources to tackle the needs for enforcement of computer-related crimes (Burns, Whitworth, & Thompson, 2004; Hinduja, 2004). Police officers have perceived training in operating system, networking, and forensic tools as critically needed (Hinduja, 2004). These results suggest that today's formal control system is too slow to fill the gaps with resources and training to meet the social needs. Offenders in the cyberspace are at large exploiting a wide array of technological innovations in their crime commission while law enforcers are chasing behind.

Proposed Proactive Social Responses

One approach to narrow the gap is to move forward the reactive response of social control by introducing more proactive, informal practices. **Online community** policing has been suggested that computer users or third party actors can actively contribute to the prevention and deterrence of cybercrime (Jones, 2007; Williams, 2007). One strategy derived from Jones' (2007) user-based crime control model is to increase the distribution and use of open-source software that enables users to help defend the Internet system. Advances in system technology should be able to increase the security and reduce the opportunity for offenders (Williams, 2007). The other strategy of the user-based crime control model is to invite citizens participate in criminal detection and investigation online, which has been practiced recently by law enforcers and citizens. Through the posting of pictures or videos of offenders on MySpace and YouTube, police have received tips of suspects or gathered criminal evidence to make successful arrests (Kasindorf, 2007). MyYearbook and a few other social networking sites have begun to post the "Report Abuse" icon on every page of their sites. Still another proactive strategy under this framework is to utilize the multimedia-interactive features and informative resources of the Internet. Foster (2005) and Griffith (2005), for instances, have suggested that social control agencies should accelerate their pace in e-government to provide crime prevention services appealing to common citizens.

Another proactive approach to countering cybercrime may be to resort to private sectors in the technology industry. As the inventors and producers of computer hardware, software, and related equipment, these providers are adaptive to the constantly challenging environment and have the professional knowledge to supersede computer savvy criminals. The private sector's supporting role in digital and automated technology, therefore, can complement police tasks in many aspects (Rebovich & Martino, 2007). Forensic toolkit development, construction and management of databases, system integration, and digital monitoring are just a few examples. Byrne and Rebovich (2007) have envisioned an expansion of private sectors taking over the crime control role of public sectors in the areas of crime prevention, offender control and monitoring.

One shortcoming of this approach is the uncertainty over how much the public sector should be held accountable in a highly hybridization of private and public sectors in crime control (Marx, 2007). The recent civil litigation of the wiretapping orchestrated by AT&T and the nation's preeminent cryptology center National Security Agency (NSA) is a vivid example of such constitutional breach (Electronic Frontier Foundation, 2008). Without a warrant, private communications were rerouted to a NSA office with AT&T's technical assistance for surveillance. The question concerning the degree to which the social control system can police the technology ought to be answered and examined thoroughly by federal legislators and the U.S. courts. This requires a transparency system that oversees the twin entities to be institutionalized to protect interests of the citizens.

A more radical, direct approach to tackling cybercrime is the "strike-back" method used to retaliate against offending perpetrators (Rebovich and Martino, 2007). One of the well-known instances was a denial-of-service attack that was launched against the host of the World Trade Organization (WTO) website in late 1999 when the WTO had its meeting in Seattle, Washington. The WTO's hosting Web service was able to detect early and repel the attacks, subsequently redirecting the incoming packets to the source server for revenge. However, this approach has been criticized by security professionals for its possible wrongful attack against innocent servers and it may also lead to a series of backfires (Landergren, 2001).

DISCUSSION & CONCLUSION

The social control mechanism is constructed on the assumption of people's rational choice from alternative actions and their assessments of consequences. Within this system full of rationality, the next highly relevant question is: Is cybercrime deterrable?

In his taxonomy of instrumental and expressive crimes, Chambliss (1967) argued that punishments may have differential effects on instrumental and expressive crimes. Instrumental offenses, being the crimes of gains, are rational and predictive. These offenses are more responsive to deterrence. Expressive crimes, on the contrary, are less deterrable due to their innate, psychological nature. Assuming this thesis holds, instrumental cybercrime such as crimeware exploitation, identity theft, and Internet fraud are subjected to deterrence via a more severe, certain, and swift punishment. On the other hand, control and prevention of expressive cybercrime will be most effective with the inclusion of the behavioral aspects of treatments. Online child sexual predators and digital terrorists are the least deterrable group given that their commitment to conventional "crimes as a way of life" is low (Chambliss, 1967: 713). However, child pornography distributors who gain profits from the instrumentation of child exploitation are deterrable because of the highly conventional rationality in their offenses.

The invention and power of the Internet have undoubtedly expanded the scope, opportunity, and distribution of crime. As computer hardware and software continue to ameliorate, a new generation of cyber deviance will develop greater challenges to the technical system. These challenges can be best addressed by collaborative efforts involving governments, private sectors, and Internet designers. Online community, groupware, and other collaboration technology ought to be employed to increase human interactions via computer among experts and concerned professionals (Mulder and Slagter, 2002; O'Day, Bobrow, & Shirley, 1998). The cooperative groups can be transformed into an open and informal social networking where connections and dependability of the above stakeholders are established to reduce cybercrime in the gap between the social and technical systems.

As to the strengthening of the formal control, it must be sensitive enough to align sanctions and enforcements with proactive consideration of the essence of cybercrime. Crime control agencies should work to cooperate professionally with Internet industry providers in the investigation and conviction of cybercrime cases. Law makers have to act more quickly to keep up the full control of the Internet outgrowth. Educators and public libraries can offer Internet safety awareness programs to teach students, their parents, and the general public about the hazards of online communication. Meanwhile, citizens should be vigilant in reporting criminal acts in the cyberspace to hotlines and authorities. Only by a fully cooperative effort can the social system help to protect the citizens, users, and infrastructure of cyberspace.

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KEY TERMS AND DEFINITIONS

Breed: to use without authorization identification means to generate and/or acquire additional fraudulent means of identification.

Cybercrime: law violations involving abuse and misuse of information conducted on or through the Internet.

Cybergap: the virtual discrepancy between the proactive technology and reactive social control systems.

Expressive Cybercrime: a type of Internet crime committed mainly for gratification purposes such as fascination, revenge, ideology fulfillment, social justice, or other reasons for human expression.

Identity Theft: the act of obtaining another person's identifying information and using it without the person's knowledge to commit crimes.

Instrumental Cybercrime: an indication of how and to what extent Internet technology is used as an instrument for the pursuit of profit or gain from the crime.

Internet Child Sexual Exploitation: the production, possession and/or distribution of digital child pornography and other sexual offenses against a minor through the Internet.

Organizational Cybercrime: criminal attacks against organizations via the Internet.

Phishing: a scam using fraudulent emails and websites to steal personal information for financial gain.

Social engineering: the design and implementation of logical procedures to persuade victims to supply confidential information to a spoofed entity.

This work was previously published in Handbook of Research on Socio-Technical Design and Social Networking Systems , edited by B. Whitworth; A. de Moor, pp. 183-194, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.6
A New Approach to Reducing Social Engineering Impact

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ABSTRACT

In recent years, the security research community has been very active in proposing different techniques and algorithms to face the proliferating security vulnerabilities. However, social engineering remains an alarming threat to the most secured networks. Security administrators are certainly aware of the gravity of the human factor, whatever is the strength of the technological measures. The human factor is still a difficult-to-surround notion and a difficult to quantify concept. It is rarely considered in the early stages of the development lifecycle of software, assuming traditional security considerations have been taken into account. In this chapter, we discuss the added-value of context as a way to deal with social engineering. Based on a case study describing a typical attack, we provide a first attempt to model this parameter.

DOI: 10.4018/978-1-60566-132-2.ch012

INTRODUCTION

Most of us have already been the target of social engineering attacks, whatever they succeeded or not. Emails asking for bank accounts passwords, grabbing user credentials by directing him to fake websites, or extracting passwords by false pretext phones are all examples of social engineering attacks. Kevin Mitnick in his book "*The art of deception: controlling the human element of security*" states that "*Social engineering uses influence and persuasion to deceive people by convincing them that the social engineer is someone he isn't, or by manipulation. As a result, the social engineer is able to take advantage of people to obtain information with or without the use of technology.*" (Mitnick & Simon, 2003). Even if some application like medical systems and bank websites are more targeted than others to such attacks, social engineering is gaining ground in other fields. Curiosity, trust and intimidation are all examples of human weaknesses the social engineer takes advantage of. For example, the well-known "ILoveYou" virus email exploited the weakness that curious people would click on an e-mail attachment with such an attractive subject was one of the factors that allowed this virus to have such a big impact (Edmead, 2002) even if it also used technological tools. A worsening factor for social engineering impact is the discrepancy with the technical dimension i.e. the evolution of ICT (Information and Communication Technology) often left an increasing number of persons on the side. The social-technical gap is the difference between social needs/expectations and computer system capability. It is the degree software fails to meet social requirements. Additionally, the fact that duration of work with others is limited, and the turnover is increasingly important and that on the Internet one is not always sure of the identity of the other (use of pseudo), trust becomes a key element in all transactions.

In this chapter, we discuss the added-value of context as a way to deal with social engineering. Two things are worth developing, the focus and its context of validity. Generally in security one is concerned by the focus only. Our claim is to learn how to recognize the context of the current focus, to identify it and to determine what the legal actions are authorized in relationships to the focus in the current context. For example, some attacks use URLs or Web pages very close from those of enterprises. One example is "BankOfAmerica" instead of "Bank_of_America". Another example is to write the real URL on a web page and hide another link when the user clicks.

As social engineering is now admitted to be the weakest link in the security chain, several efforts have been made in order to study its different ways of operation and to try finding defenses against this threat. From these contributions, users' awareness to information security and training emerge as the agreed upon ways for facing the attacks. Related work includes (Lafrance, 2004) which considers psychology as a valuable security tool. The author argues on the understanding of employees' psychology in order to be able to face their potential attacks. He proposes a set of 'psycho-security tips' and shows how they can apply to real situations. More focused on information security awareness, (Manjak, 2006) examines the various social engineering tactics targeting employees that an InfoSec Awareness campaign is designed to counter.

In this chapter, we will first define context and show how it can be considered as an operational factor for modeling the human element in security. Based on a case study of an attack preparation and execution, we show how the previous list of countermeasures (user's awareness, training) can be extended. A list of best practices is derived for the sake of reducing the impact of human element on information security. Then, a summary of previous contributions on the use of context in security is presented. Finally, the last section concludes the paper with a summary of future research.

BACKGROUND ON CONTEXT

This Section is intended to provide a summary of theoretical study of context.

The term context has been extensively defined and commented in recent research. However, there is not yet a commonly accepted definition of context (Bazire & Brézillon, 2005). Nevertheless, a consensus begins to appear around "*Context is what constrains a problem solving without intervening in it explicitly*" (Brézillon & Pomerol, 1999). This definition suggests that the context is always let implicit and tacit, and is rarely mentioned explicitly.

Then, the authors consider it by extension as the focus of an actor. Several elements justify this definition, the three main elements being that:

1. Context is relative to the focus,
2. As the focus evolves, its context evolves too, and
3. Context is highly domain-dependent. As a consequence, one cannot speak of context in an abstract way.

In a recent publication, Brézillon (2007) shows that the focus at a given stage, allows the division of the context into external knowledge and contextual knowledge. The latter constitutes a kind of tank where the contextual elements are to some extent related to the focus in a flat way, whereas the former has nothing to do with the focus. At this conceptual level, the focus acts as a discriminating factor on knowledge in a similar way as for social networks. The focus evolves because a new event occurs (e.g. an unpredicted event) or as a result of a decision made at the previous stage of the focus. The notion of context impacts more on the relationships between knowledge pieces than upon the pieces themselves. The following publication (Brézillon & Brézillon, 2007) provides greater detail about the relationship between a context and a focus.

A context-based formalism has been developed and is introduced in (Brézillon, 2005). This formalism known as contextual graphs allows a uniform representation of elements of reasoning and of contexts. A contextual graph is a representation of a task execution. Contextual graphs are oriented, acyclic, without circuits, with exactly one input and one output, and a general structure of spindle. A path (from the input to the output of the graph) represents a type of execution of the task with the application of selected methods. There are as many paths as practices. Different solutions can be associated with the unique output corresponding to the current context. A contextual graph is an acyclic graph because user's tasks are generally in ordered sequences. For example, the activity "Make the train empty of travelers" is always considered at the beginning of an incident solving on a subway line, never at the end of the incident solving. A more drastic divergence in the type of output (e.g. the execution of the task is stopped like "Error 104" in information retrieval) must be considered at a upper level in which the contextual graph at hand is a branch of an alternative (a contextual element such as "Are the conditions required for the task execution present? If yes got to the contextual graph otherwise does not consider this contextual graph). In contextual graphs, the two types of context identified earlier can be easily distinguished. Namely, contextual knowledge, which is represented in the graph by a set of contextual elements, and proceduralized context which is an ordered set of instantiated contextual elements.

In this chapter, we point out that the consideration of context in security is getting importance. The need for taking into account the *security context* has been dictated by the need for changing policies according to changes into the environment. In a previous work, we define a security context as "*set of information collected from the user's environment and the application environment and that is relevant to the security infrastructure of both the user and the application.*" (Kouadri, 2004) The word relevant means that has direct or indirect effect on the security policy. What is really relevant is application-dependent. This information may include user's identity, membership, resource location, date, time, the user's interaction history with the system, social situation, etc.

Wireless applications and on-demand services have been the main consumers of security context as we will show in Section "Related Work". As a result, context-based access control and adaptive authentications schemes emerged as solutions to the security requirements of these specific environments.

In our previous work on context-based security (Kouadri, 2004), we noted that it should be considered as "*a new trend that may face future more subtle security attacks.*" We also stated that *"the force of a good security system should not rely only on the force of security protocols but also on the way it copes with new and completely unpredictable situations or at least learn from new situations and updates its behavior accordingly.*"

In prior contributions related to this idea, we mainly concentrate on context-based access control solutions and proposed in (Kouadri &

Brézillon 2006) the contextual graphs formalism discussed earlier as a model for security contexts. Contextual Graphs have been used in various real-world applications. They allow a uniform representation of elements of reasoning and of contexts for describing different human tasks such as troubleshooting and interpretation. In our situation, a contextual graph represents a security task realization. These tasks include access to remote services, establishing a secure communication between heterogeneous communicating parties, etc. Its paths represent the different ways of reaching this realization, each way corresponding to a practice developed by an actor realizing the task. Our focus was on expressing fine-grained requirements for dynamic security policies.

In this chapter, we extend the other aspect of security context and discuss its role in reducing the impact of social engineering in information systems.

CONTEXT PROFILE IN SOCIAL ENGINEERING

In order to demonstrate the relevance of our claim, we stress in the following the typical modus operandi of a hacker for realizing a security attack. It should be noted that the described scenario represents a generic case-study with an internal environment protecting some assets and served by actors with different roles.

We summarize the process into four steps. The next sections show how context is used to grab this process and then, how it can be used for profiling social engineering attacks.

Attack Preparation and Execution

- First, the attacker tries to get closer to an actor in the target enterprise in order to get familiar with the different aspects of the enterprise. Such actor may represent an employee or any tier person involved into the activities of the enterprise. This step aims at developing a shared context by establishing privileged relationships with the tier. This shared context may be based upon common and general interests such as political/ideological preferences, sport, etc.

In an alternative way, the focus could be pushed on a specific topic in order to find an agreement (e.g. I like science-fiction, political men are all the same, TV is boring, etc.). The aim of manipulating the shared context is to develop strong ties with the other, the attacker looking for a tie of which the nature will be important for the tier as discussed in the area of social network (Granovetter, 1983). Note that here the shared context is not related to the hacker's focus but tries exhibits some general ties between the two actors.

- The hacker than tries to shrink this shared context into a more restrained one around professional interests by exploiting some of the various psychological approaches. For instance, by establishing a neophyte-expert relationship (i.e. I don't have enough knowledge in this field but you do). Or, by pretending the need for help to solve a given problem. This is achieved by establishing a community of practice between peers (i.e. we are both in the same domain, so if I have a problem you can help me solve it) always embedded in the general shared context established previously. In the second step, the hacker begins by moving the shared context by introducing contextual elements related to the hacker's focus (I have a problem that is certainly a toy problem for you because I know that from our shared context building).
- The hacker then tries dragging the tier person along to the focus of the shared context developed earlier. In practice, this is equivalent to the hacker getting closer to the focus of interest (i.e. the target asset to attack). Here the goal is to introduce in

the shared context a foreigner element in a way apparently normal, when in a usual situation the tier will react against it. This situation is very close from medicine and biology with virus. This third step is a kind of synthesis of the two first steps by introducing the focus (i.e. hacker's focus) in the initial shared context, that is in the opposite way that two normal actors interact (with first agreeing on the common focus, and then developing a shared context around this focus).

- When the attack is launched, the hacker locks the system in a way that prevents the abused tier from establishing a connection with the information he/she provided (i.e. the context focus) and which are for the tier a set of unrelated contextual information given in an extra-professional circumstance. In this fourth step, the hacker puts the tier to accept that the "sensible" focus in the shared context is naturally explainable in term of the shared context elements, when in the real context of the focus; the tier will react in a totally different way.

While the presented scenario can be seen as an industrial-espionage attack, it actually, represents a pattern for attacks in any information-based system. The differences are mainly the assets: business documents, credit card numbers, healthcare private information, etc. The tier may represent respectively: a business partner, an employee, a nurse in a hospital, etc. Also, most of these domains make use of computer-based systems, so even if they take benefit of human weaknesses, the assets are typically stored as digital data, so the attacks are mainly performed using technological means as discussed earlier.

Defenses

The main approach to reduce the number and/or the impact of social engineering attacks is to break the process described in the previous section. This can be achieved by following the set of countermeasures described in the following. Where some of them are technical, others are more social-oriented.

- ***Information Security Awareness***: A common error made by actors is to think that as long as the two "individual" contexts (related to the enterprise and the hacker respectively) are not intersecting, the risk of attacks is small. In fact, this risk is increased using his/her own context. Indeed, the actor's context intersects with both other contexts and constitutes the shared one which connects the two others. It is thus, important to establish an effective users' awareness of the context of their tasks within the enterprise, especially the different changes of this context as a consequence of external events. With the notion of shared context, one needs to develop a notion of exclusive contexts. As a concrete example, a nurse should be aware of the different cases (context) where information about patients is likely to be disclosed. A concrete precaution is to prevent copying patients' records to personal devices or sending it outside the hospital network.

In practice, it is important to learn how to maintain disjoint contexts and how to identify any new contextual element that may provoke a shift of the working context.

- ***Managing Internal Actors***: Statistics show that most of the social engineering attacks are performed by internal actors or through their help. The enterprise should be aware of conflicts and dissatisfaction of actors within the enterprise in order to avoid expressing their dissatisfaction outside the enterprise boundaries causing the internal context to flood outside.

- ***Minimum Processes Principle***: This principle suggests running the minimum set of computer processes for a specific task within the enterprise. This implies blocking unnecessary ports and assigning minimal privileges on assets for users. This is equivalent to reducing the context attached to each task, reducing this way the type of attacks that can be performed. A special attention should be given to the underlying sub-tasks, the data they handle and the information they send over the internet.
- ***Fine-Grained Security Solutions***: to constraint the actor context with fine-grained security in a way that make the latter an integral part of its tasks. An example of fine-grained security is context-based access control where access is no longer *only* dependent on users' credentials but also constrained by the time of the access, geographical location of the requester, the frequency of access requests, etc. This approach helped several banks to detect credit cards frauds by comparing the geographical locations of a requester during a short time interval. Here a short time is relative to the reasonable time a credit card owner needs to travel from a location to another. Thus, a use by the same card in France and than in China in a day interval is somehow suspicious and leads to alerting the issuing bank for a potential problem.
- ***Prepare the coming of new ICT in the enterprise***: The increase need for higher computer performance and more complicated software functionalities leads enterprises to continually adopt new technologies. It is of primordial importance to prepare the actors (employees) to these new technologies in order to give them the right information about potential threats on the software and how to face them.
- ***Use a modeling of actors' activities in a formalism allowing a uniform representation of elements of reasoning and of contexts***: This guideline suggests an explicit consideration of contextual information in controlling actors' actions on assets. An example of such formalism is contextual graphs. Information on contextual graphs may be found on the web site dedicated to it (CxG's Software, 2007).
- ***Consider the context of a focus like a dressing of this focus****:* which allows the identification of differences between the behavior prescribed by security policies and the effective behaviors of actors. A detailed discussion of this aspect with an example in road safety domain is given in (Brézillon & Brézillon, 2007).
- ***Contextualize identities instead of trying to personalize the users*** A possibility could be to reinforce the technology-mediated approach of social systems.

A similar work to our current contribution is presented in the paper by (Gragg, 2002) which proposes a multi-level defense against social engineering. The author discusses the psychological triggers leading to a successful social engineering attack. He then lists a set of defense measures to handle these weaknesses. While the objective is the same, this specific work aims at incorporating social psychological research into the task of resisting social engineering.

RELATED CONTRIBUTIONS: CONTEXT IN SECURITY

The first attempts to integrate context into security systems put the focus on context-based RBAC (Role-Based Access Control). A related contribution was made by (Masone, 2002) who designed and implemented a simple programming language RDL (Role Definition Language) to describe roles in terms of contextual information. The strong characteristics of RDL are simplicity of use and extensibility. An extended form of authorization policies where conditions corresponding to context are represented using programs rather than expressions is proposed by (McDaniel, 2003). (Georgiadis & al., 2001) propose TMAC which stands for team-based access control. It provides an access control model that supports collaborative activity being accomplished by teams of users and includes contextual information.

Another related contribution is C-TMAC; a hybrid access control model that takes advantage of role-based permission assignment of RBAC and yet provides the flexibility for fine-grained activation of permissions for individual users on individual object instances. This fine-grained access control is dictated by a set of constraints (or context). For example, in a healthcare setting a doctor may have the permission to prescribe certain medications. However, the doctor should not be allowed to prescribe for anyone. Rather, he/she should be allowed to prescribe only for the patient's he/she is taking care of.

In the same direction, (Covington et al., 2001, 2002) propose an approach to design security services that use security-relevant "context" in order to provide flexible access control. The main application of their approach is intelligent home environments such as the Aware Home described in (AHRI, 2007). The authors make use of the context toolkit (Dey, 2000) a software that aims at leveraging the development of context-aware applications and provides software components for collecting environment variables and interpreting their associated values. Access policies are based on environment roles (Covington et al., 2001) and encoded into the eXtensible Markup Language (XML). The contributions towards integrating context with a security service other than access control are fewer. It is worth mentioning the work by (Pierson et al., 1999) which introduces context-agile encryption as a technique that provides a different encryption (in terms of key lengths, type of encryption algorithm, etc) according to the applications needs and to hardware capabilities. For example, some web services in high speed communication networks may be able to tolerate long times to encrypt/decrypt information, but may also need to protect that information for a long period of time. Other types of web services, dealing with data that is sensitive while useful, but quickly becomes stale, might benefit from short encryption/decryption times that may accompany a less cryptographically robust algorithm.

Bellavista et al. propose a context-centric access control middleware for mobile environments called COSMOS (Bellavista et. al., 2003). The middleware dynamically determines the contexts of mobile proxies, and rules the access to them based on a set of data such as user profile and system/user-level authorization policies. COSMOS has been tested in the design and implementation of a context-centric movie assistant which aim is to allow mobile users to find nearby cinemas and to exchange opinions about cinema characteristics such as seat comfort, air-conditioning, sound and screen resolution.

As one can deduce from the previous summary of earlier work, the consideration of context in security has been mainly encouraged by the need for security to fit within the very nature of emergent applications. Adaptability to users' needs and preferences and to hardware capabilities has imposed a need for security solutions following the same pattern of flexibility. However, these contributions towards integrating context into security have been proposed without being explicit about its broader use.

CONCLUDING REMARKS AND FUTURE WORK

In this chapter, we presented a novel approach to understanding social engineering using context as an operational parameter. Our aim was twofold: a) to give a generic view over the diverse social engineering attacks. This is approached by looking at a common parameter – context -, and b) to help giving the abstract nature of a social attack a concrete face so further investigations can be pursued in order to reduce the impact of these attacks.

As stated in the chapter, the definition of *context* is tightly related to the application domain. For example, in an e-health application, the role of the user within the hospital (i.e. treating physician, nurse, administrator, etc) is a relevant contextual information used to regulate the access to patients' records. In the other hand, it is difficult to exhaustively enumerate its content. However, a good practice is to identify the maximum of this context by learning from similar applications before setting up a security solution so it becomes possible to block most attacks or, a least not create back doors to hackers.

It is interesting to note the interest of the security community in social engineering and in the same time the lack of effective solutions. Daily news and technical publications are full of real stories describing security attacks where human deception is the main tool. In the other hand, and apart from users training, there is no concrete parameters the security community can use to model and thus to study and evaluate proposed solutions. In the current chapter, we sketched the context profile during an attack and deduced a list of countermeasures.

This new approach is a first attempt to quantify the social aspect of security for the sake of a better understanding and management. In the following we summarize the main research directions that may be pursued as a future work.

- Developing techniques for the automatic discovery of relevant security contexts. For example, in the credit card fraud scenario discussed earlier, data mining techniques and case-based reasoning can be used to devise what context is worth taking into account. The location from where the user uses his card for e-transactions, his buying preferences, are examples of common elements emerging in fraud scenarios. They can be used to profile the use of a card by a hacker.
- Developing tools for the visualization of context evolution during an interaction scenario (e.g. access to a resource). This may help for a better understanding of the role of context. The tool can be used as a training mean for information security awareness.
- Devising techniques for the formal verification of the completeness of security context for a given application i.e. to devise the percentage of the contextual information already taken into account in the establishment of the security solution and thus deducing the percentage of missing context.
- Devising ways for establishing trust with context providers. Since a security context is built from a set of information (e.g. user' location, interaction history with the system) gathered from different sources, the system to secure should be able to gather context only from trusted sources.
- Proposing a uniform way for documenting social engineering attacks and their corresponding involved context for each specific application. These reports can be used to help similar applications to develop a defense against these attacks. This is equivalent to antivirus that needs to update its virus definition file regularly.

Having presented our proposal in considering context as a key element in profiling social engineering attacks, we believe that further investigations may shed the light on other factors that can be combined with context, for the sake of better understanding of social engineering and thus, being able to face the proliferating attacks. It is our hope that this first step provides a starting point for further advancements.

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KEY TERMS AND DEFINITIONS

Case-Based Reasoning: A technique that helps solving a specific problem based on past similar ones.

Data Mining: A set of techniques that analyze data for the sake of finding patterns and relationships.

E-Health: Electronic health is the result of the involvement of electronic in providing health services such as patient record and health plan description.

Human Factor: Influence of human behavior on information security.

Security Asset: Any valuable resource protected by a computerized infrastructure.

Security Context: Set of information collected from the user's environment and the application environment and that is relevant to the security infrastructure of both the user and the application.

Trust: The degree of confidence an entity has in another entity.

This work was previously published in Handbook of Research on Social and Organizational Liabilities in Information Security, edited by M. Gupta; R. Sharman, pp. 193-202, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.7
Effects of Digital Convergence on Social Engineering Attack Channels

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ABSTRACT

Social engineering refers to the practice of manipulating people to divulge confidential information that can then be used to compromise an information system. In many cases, people, not technology, form the weakest link in the security of an information system. This chapter discusses the problem of social engineering and then examines new social engineering threats that arise as voice, data, and video networks converge. In particular, converged networks give the social engineer multiple channels of attack to influence a user and compromise a system. On the other hand, these networks also support new tools that can help combat social engineering. However, no tool can substitute for educational efforts that make users aware of the problem of social engineering and policies that must be followed to prevent social engineering from occurring.

DOI: 10.4018/978-1-60566-036-3.ch009

INTRODUCTION

Businesses spend billions of dollars annually on expensive technology for information systems security, while overlooking one of the most glaring vulnerabilities—their employees and customers (Orgill, 2004; Schneier, 2000). Advances in technology have led to a proliferation of devices and techniques that allow information filtering and encryption to protect valuable information from attackers. At the same time, the proliferation of information systems usage is extending access to more and more of the employees and customers of every organization. The old techniques of social engineering have evolved to embrace the newest technologies, and are increasingly used against this growing pool of users. Because of the widespread use of information systems by users of all technical levels, it is more difficult to ensure that all users are educated about the dangers of social engineering. Moreover, as digital convergence integrates previously separated communications channels, social engineers are taking advantage of these blended channels to reach new victims in new ways.

Social engineering is a term used to describe attacks on information systems using vulnerabilities that involve people. Information systems include hardware, software, data, policies, and people (Kroenke, 2007). Most information security solutions emphasize technology as the key element, in the hope that technological barriers will be able to override weaknesses in the human element. Instead, in most cases, social engineering attacks succeed despite layers of technological protection around information systems.

As technology has evolved, the channels of social engineering remain relatively unchanged. Attackers continue to strike in person, via postal mail, and via telephone, in addition to attacking via e-mail and online. Even though they arrive over the same attack channels, new threats have emerged from the convergence of voice, data, and video. On one hand, attacks can more easily combine several media in a converged environment, as access to the converged network allows access to all media types. On the other hand, attackers can also convert one information channel into another to make it difficult to locate the source of an attack.

As we review these new threats, we will also describe the latest countermeasures and assess their effectiveness. Convergence of voice, data, and video can also help in combating social engineering attacks. One of the most effective countermeasures to social engineering is the continued education of all information systems users, supplemented by policies that enforce good security practices. Another powerful countermeasure is penetration testing, which can be used to evaluate the organization's readiness, but also to motivate users to guard against social engineering attacks (see for example Argonne, 2006).

Throughout this chapter we will mainly use masculine gender pronouns and references to maleness when referring to attackers, because statistically most social engineering attackers tend to be men. As more women have become proficient and interested in using computers, some of the hackers are now female, but the numbers are still small. Nonetheless, there are some striking implications of gender differences in social engineering attacks, and we discuss those differences as appropriate.

SOCIAL ENGINEERING

Social engineering includes any type of attack that exploits the vulnerabilities of human nature. A recent example is the threat of social engineers taking advantage of doors propped open by smokers, in areas where smoking is banned indoors (Jaques, 2007). Social engineers understand human psychology (sometimes only instinctively) sufficiently well to determine what reactions they need to provoke in a potential victim to elicit the information they need. In a recent survey of black hat hackers (hackers inclined to commit computer crimes), social engineering ranked as the third most widely used technique (Wilson, 2007). The survey results indicate that 63% of hackers use social engineering, while 67% use sniffers, 64% use SQL injection, and 53% use cross site scripting.

Social engineering is used so widely because it works well despite the technological barriers deployed by organizations. Social engineers operate in person, over the phone, online, or through a combination of these channels. A report on the Australian banking industry in *ComputerWorld* claims that social engineering leads to larger losses to the banking industry than armed robbery. Experts estimate these losses to be 2-5% of the revenue, although industry officials decline to comment (Crawford, 2006). Social engineering is also used in corporate and military espionage, and no organization is safe from such attacks. A good overview of social engineering attacks and possible countermeasures can be found on the

Microsoft TechNET Web site (TechNET, 2006).

According to Gragg (2003), there are some basic techniques common to most social engineering attacks. Attackers tend to spend time building trust in the target person. They do that by asking or pretending to deliver small favors, sometimes over an extended period of time. Sometimes, the trust building is in fact only familiarity, where no favors are exchanged, but the victim and attacker establish a relationship. Social engineering attacks especially target people or departments whose job descriptions include building trust and relationships (help desks, customer service, etc). In addition to asking for favors, sometimes social engineers pretend to extend favors by first creating a problem, or the appearance of a problem. Next, the social engineers can appear to solve the problem, thus creating in a potential victim both trust and a sense of obligation to reciprocate. They then use this bond to extract confidential information from the victim. Finally, social engineers are experts at data aggregation, often picking disparate bits of data from different sources and integrating the data into a comprehensive, coherent picture that matches their information gathering needs (Stasiukonis, 2006b; Mitnick & Simon, 2002).

Although the description might seem complex, social engineering can be as simple as just asking for information, with a smile. A 2007 survey (Kelly, 2007) showed that 64% of respondents were willing to disclose their password in exchange for chocolate (and a smile). Using "good looking" survey takers at an IT conference led 40% of non-technical attendees and 22% of the technical attendees to reveal their password. Follow up questions, drilling down to whether the password included a pet name or the name of a loved one elicited passwords from another 42% of the technical attendees and 22% of the non-technical ones. While the survey respondents might have felt secure in only giving out passwords, user names were easier to obtain, because the full name and company affiliation of each survey respondent was clearly indicated on their conference badge. An earlier survey cited in the article reported similar statistics in 2004.

Another paper urging organizations to defend against social engineering illustrates the high levels of success of even simple social engineering attacks. Orgill (2004) describes a survey of 33 employees in an organization, where a "researcher" asked questions about user names and passwords. Only one employee of the 33 surveyed escorted the intruder to security. Of the 32 others that took the survey, 81% gave their user name and 60% gave their password. In some departments, all the employees surveyed were willing to give their passwords. In one instance, an employee was reluctant to complete the survey. A manager jokingly told the employee that he would not get a raise the next year unless she completes the survey. At that point, the employee sat down and completed the survey. This is a clear indication that management can have a critical role in the success or failure of social engineering attacks.

Statistically, an attacker needs only one gullible victim to be successful, but the high success rates mentioned above indicate that finding that one victim is very easy. If such "surveys" were to be conducted remotely, without a face to face dialog or even a human voice over the phone, success rates would likely be much lower, but the risks would also be lower for the attacker. Convergence of data, voice, and video allows attackers to take this alternative route, lower risk of detection at the expense of lower success rate. Given the ability to automate some of the attack avenues using converged media, the lower success rate is not much of a drawback. We will show how most social engineering attacks resort to casting a broad net, and making a profit even of extremely low success rates.

The basic tools of the social engineer include strong human emotions. Social engineers aim to create fear, anticipation, surprise, or anger in the victim, as a way to attenuating the victim's ability to think critically. Additionally, information overload is used to mix true and planted information to lead the victim to believe what the social engineer intends. Reciprocation is another strong emotion social engineers use, as we described earlier. Finally, social engineers combine using guilt (that something bad will happen unless the victim cooperates), transfer of responsibility (the social engineer offers to take the blame), and authority (where the social engineer poses as a supervisor or threatens to call in a supervisor). These are basic human emotions used in all social engineering attacks, whether using converged networks or not. This chapter will focus on how attackers use these emotions on a converged network, combining data, voice, and video.

SOCIAL ENGINEERING ON CONVERGED NETWORKS

Social engineering has seen a resurgence in recent years, partly due to the convergence of voice, data, and video, which makes it much easier to attack an organization remotely, using multiple media channels. The proliferation of computer peripherals and of mobile devices, also driven by network convergence, has further opened channels for attacks against organizations. In this section we discuss new attack vectors, combining some of the classical social engineering channels (in person, by phone, by e-mail) and show how they have changed on a converged network.

Social Engineering Attacks Involving Physical Presence

The classical social engineering attack involves a social engineer pretending to be a technical service person or a person in need of help. The attacker physically enters an organization's premises and finds a way to wander through the premises unattended. Once on the premises, the attacker searches for staff ID cards, passwords or confidential files.

Most of the in-person social engineering attacks rely on other information channels to support the in-person attack. Convergence of voice and data networks allows blended attacks once the attacker is within the victim's offices. Before showing up at the company premises, the attacker can forge an e-mail message to legitimize the purpose of the visit; for example, the e-mail might appear to have been sent by a supervisor to announce a pest control visit (applekid, 2007). Alternatively, the attacker might use the phone to call ahead for an appearance of legitimacy. When calling to announce the visit, the attacker can fake the telephone number displayed on the caller ID window (especially when using Voice over IP, Antonopoulos & Knape, 2002).

After entering the premises, an attacker will often try to connect to the organization's local area network to collect user names, passwords, or additional information that could facilitate subsequent stages of the attack. Convergence allows access to all media once the attacker is connected to the network; even copiers now have network connections that a "service technician" could exploit to reach into the organization's network (Stasiukonis, 2006c). Connecting to the company network using the port behind the copier is much less obvious than using a network port in the open. Finally, another powerful attack may involve a social engineer entering the premises just briefly, connecting a wireless access point to the organization's network, and then exploring the network from a safe distance (Stasiukonis, 2007). This way, the attacker can remain connected to the network, but at the same time minimize the risk of exposure while in the organization's building.

Social Engineering via Email, News, and Instant Messenger

One example of how convergence is changing the information security threats is the increased incidence of attacks using e-mail, HTML, and chat software. This is attractive to attackers, because it bypasses firewalls and allows the attacker to transfer files to and from the victim's computer (Cobb, 2006). The only requirement for such attacks is a good understanding of human weaknesses and the tools of social engineering. The attackers spend their time devising ways to entice the user to open an e-mail, to click on a link or to download a file, instead of spending time breaking through a firewall. One such attack vector propagates via IRC (Internet relay chat) and "chats" with the user, pretending to be a live person, assuring the downloader that it is not a virus, then downloading a shortcut to the client computer that allows the remote attacker to execute it locally (Parizo, 2005).

Because of the wide use of hyperlinked news stories, attacks are beginning to use these links to trigger attacks. In a recent news story (Naraine, 2006b), a brief "teaser" concludes with a link to "read more," which in fact downloads a keylogger by taking advantage of a vulnerability in the browser. This type of attack is in addition to the fully automated attacks that involve only "drive by" URL, where the malicious content is downloaded and executed without any intervention from the user (Naraine, 2006c). Analysis of the code of such automated attacks indicates a common source or a small number of sources, because the code is very similar across multiple different attack sites.

Convergence allows e-mail "bait" to use "hooks" in other applications. For example, an e-mail message with a Microsoft Word attachment may take advantage of vulnerability in Word and rely on e-mail as the attack channel (McMillan, 2006). Other vulnerabilities stem from more complex interactions between incompatible operating systems and applications. The recently released Microsoft Vista operating system has vulnerabilities related to the use of non-Microsoft e-mail clients, and requires user "cooperation" (Espiner, 2006). As such, Microsoft views this as a social engineering attack, rather than a bug in the operating system.

Other attacks are purely social engineering, as in the case of e-mail messages with sensationally sounding subject lines, for example, claiming that the USA or Israel have started World War III, or offering views of scantily clad celebrities. While the body of the message is empty, an attachment with a tempting name incites the users to open it. The name might be video.exe, clickhere.exe, readmore.exe, or something similar, and opening the attachment can run any number of dangerous applications on the user's computer (Gaudin, 2007). Other e-mail messages claim that the computer has been infected with a virus and instruct the user to download a "patch" to remove the virus (CERT, 2002). Instead, the "patch" is a Trojan that installs itself on the user's computer. The source of the message can be forged to make it appear that the sender is the IT department or another trusted source.

Finally, another way to exploit news using social engineering techniques is to send targeted messages following real news announcements. An article on silicon.com cites a phishing attack following news of an information leak at Nationwide Building Society, a UK financial institution. Soon after the organization announced the theft of a laptop containing account information for a large number of its customers, an e-mail began circulating, claiming to originate from the organization and directing recipients to verify their information for security reasons (Phishers raise their game, 2006). This is a much more pointed attack than the traditional phishing attacks (described next), where a threatening or cajoling email is sent to a large number of potential victims, in hope that some of them will react. Such targeted attacks are known as "spear phishing."

Phishing

Phishing is a special case of e-mail-based social engineering, which warrants its own section because of its widespread use (APWG, 2007). The first phishing attacks occurred in the mid 1990's and continue to morph as new technologies open new vulnerabilities. The classical phishing attack involves sending users an e-mail instructing them to go to a Web site and provide identifying information "for verification purposes."

Two key weaknesses of the user population make phishing a highly lucrative activity. As a larger percent of the population is using Web browsers to reach confidential information in their daily personal and professional activities, the pool of potential victims is greatly increased. At the same time, the users have an increased sense of confidence in the information systems they use, unmatched by their actual level of awareness and sophistication in recognizing threats.

A survey of computer users found that most users overestimate their ability to detect and combat online threats (Online Safety Study, 2004). A similar situation is probably the case for awareness of and ability to recognize phishing attacks. As phishers' sophistication increases, their ability to duplicate and disguise phishing sites increases, making it increasingly difficult to recognize fakes even by expert users.

More recently, pharming involves DNS attacks to lure users to a fake Web site, even when they enter a URL from a trusted source (from the keyboard or from a favorites list). To mount such an attack, a hacker modifies the local DNS database (a hosts file on the client computer) or one of the DNS servers the user is accessing. The original DNS entry for the IP address corresponding to a site like www.mybank.com is replaced by the IP address of a phishing site. When the user types www.mybank.com, her computer is directed to the phishing site, even though the browser URL indicates that she is accessing www.mybank.com. Such attacks are much more insidious, because the average user has no way of distinguishing between the fake and the real sites. Such an attack involves a minimal amount of social engineering, although, in many cases, the way the attacker gains access to the DNS database might be based on social engineering methods.

In particular, pharming attacks can rely on converged media, for example, using an "evil twin" access point on a public wireless network. By setting up a rogue access point at a public wireless hotspot and by using the same name as the public access point, an attacker is able to hijack some or all of the wireless traffic though the access point he controls. This way, the attacker can filter all user traffic through his own DNS servers, or more generally, is able to mount any type of man-in-the-middle attack. In general, man-in-the-middle attacks involve the attacker intercepting user credentials as the user is authenticating to a third party Web site and passing on those credentials from the user to the Web site. Having done this, the attacker can now disconnect the user and remain connected to the protected Web site. True to social engineering principles, these types of attacks are targeted at the rich. Evil twin access points are installed in first-class airport lounges, in repair shops specializing in expensive cars, and in other similar areas (Thomson, 2006).

Social Engineering Using Removable Media

In another type of social engineering, storage devices (in particular USB flash drives) might be "planted" with users to trick them into installing malicious software that is able to capture user names and passwords (Stasiukonis, 2006a). This type of attack is based on the fact that users are still gullible enough to use "found" storage devices or to connect to "promotional" storage devices purporting to contain games, news, or other entertainment media. Part of the vulnerability introduced by such removable storage devices is due to the option of modern operating systems to automatically open certain types of files. By simply inserting a storage device with auto run properties, the user can unleash attack vectors that might further compromise their system. In addition to USB flash drives, other memory cards, CDs, and DVDs can support the same type of attack.

Social Engineering via Telephone and Voice Over IP Networks

Using telephone networks has also changed. The basic attack is often still the same, involving a phone call asking for information. Convergence, in particular the widespread use of digitized voice channels, also allow an attacker to change his (usually) voice into a feminine voice (bernz, n.d.), which is more likely to convince a potential victim. Digitally altering one's voice will also allow one attacker to appear as different callers on subsequent telephone calls (Antonopoulos & Knape, 2002). This way, the attacker can gather information on multiple occasions, without raising as much concern as a repeat caller.

The wide availability of voice over IP and the low cost of generating and sending possibly large volumes of voice mail messages also enable new types of attacks. Vishing, or VoIP phishing (Vishing, 2006) is one such type of attack that combines the use of the telephone networks described with automatic data harvesting information systems. This type of attack relies on the fact that credit card companies now require users to enter credit card numbers and other identifying information. Taking advantage of user's acceptance of such practices, vishing attacks set up rogue answering systems that prompt the user for the identifying information. The call number might be located in a different location than the phone number might indicate.

The use of phone lines is also a way for attackers to bypass some of the remaining inhibitions users have in giving out confidential information on the World Wide Web. While many users are aware of the dangers of providing confidential information on Web sites (even those who appear genuine), telephone networks are more widely trusted than online channels. Taking advantage of this perception in conjunction with the widespread availability of automated voice menus has enabled some attackers to collect credit card information. Naraine (2006a) describes an attack where the victim is instructed via e-mail to verify a credit card number over the phone. The verification request claims to represent a Santa Barbara bank and directs users to call a phone number for verification. The automated answering system uses voice prompts similar to those of legitimate credit card validation, which are familiar to users. Interestingly, the phone system does not identify the bank name, making it possible to reuse the same answering system for simultaneous attacks against multiple financial institutions.

A vishing attack even more sophisticated than the Santa Barbara bank attack targeted users of PayPal (Ryst, 2006). PayPal users were sent an e-mail to verify their account information over the phone. The automated phone system instructed users to enter their credit card number on file with PayPal. The fraudulent system then attempted to verify the number; if an invalid credit card number was entered, the user was directed to enter their information again, bolstering the illusion of a legitimate operation. Although this type of multichannel attack is not limited to VoIP networks, such networks make the automated phone systems much easier to set up.

As VoIP becomes more prevalent we may begin to see Internet-based attacks previously limited to computers impact our telephone systems (Plewes, 2007). Denial of service attacks can flood the network with spurious traffic, bringing legitimate data and voice traffic to a halt. Spit (spam over Internet telephony) is the VoIP version of e-mail spam which instead clogs up a voice mailbox with unwanted advertisements (perhaps generated by text to speech systems) or vishing attacks. Vulnerabilities in the SIP protocol for VoIP may allow social engineers to intercept, reroute calls, and tamper with calls. Finally, VoIP telephones are Internet devices that may run a variety of services such as HTTP, TFTP, or telnet servers, which may be vulnerable to hacking. Since all of the VoIP phones in an organization are likely identical, a single vulnerability can compromise every phone in the organization.

SOLUTIONS AND COUNTERMEASURES TO SOCIAL ENGINEERING ATTACKS

Following the description of attacks, the chapter now turns to solutions. The first and most important level of defense against social engineering are organizational policies (Gragg, 2003). Setting up and enforcing information security policies gives clear indications to employees on what information can be communicated, under what conditions, and to whom. In a converged network, such policies need to specify appropriate information channels, appropriate means to identify the requester, and appropriate means to document the information transfer. As the attacker is ratcheting up the strong emotions that cajole or threaten the victim into cooperating, strong policies can make an employee more likely to resist threats, feelings of guilt, or a dangerous desire to help.

In addition to deploying strong policies, organizations can use the converged network to search for threats across multiple information channels in real time. In a converged environment, the strong emotions associated with social engineering could be detected over the phone or in an e-mail, and adverse actions could be tracked and stopped before an attack can succeed. In other words, convergence has the potential to help not just the social engineer, but also the staff in charge of countering such attacks.

Anti-Phishing Techniques

A number of anti-phishing techniques have been proposed to address the growing threat of phishing attacks. Most anti-phishing techniques involve hashing the password either in the user's head (Sobrado & Birget, 2005; Wiedenbeck, Waters, Sobrado, & Birget, 2006), using special browser plugins (Ross, Jackson, Miyake, Boneh, & Mitchell, 2005), using trusted hardware (for example on tokens) or using a combination of special hardware and software (e.g., a cell phone, Parno, 2006).

All the technological solutions mentioned involve a way to hash passwords so that they are not reusable if captured on a phishing site or with a network sniffer. The downfall of all of these schemes is that the user can always be tricked into giving out a password through a different, unhashed channel, allowing the attacker to use the password later on. A good social engineer would be able to just call the victim and ask for the password over the phone. Additionally, even though all these solutions are becoming increasingly user friendly and powerful, they all require additional costs.

Voice Analytics

We discussed earlier the negative implications of VoIP and its associated attacks (vishing). A positive outcome of data and voice convergence in the fight against social engineering is the ability to analyze voice on the fly, in real time as well as on stored digitized voice mail.

Voice analytics (Mohney, 2006) allows caller identification based on voice print, and can also search for keywords, can recognize emotions, and aggregate these information sources statistically with call date and time, duration, and origin. In particular, voice print can provide additional safeguards when caller ID is spoofed. At the same time, given that the social engineer has similar resources in digitally altering her voice, the voice analytics could employ more advanced techniques to thwart such attacks. For example, the caller could be asked to say a sentence in an angry voice or calm voice (to preempt attacks using recorded voice data). Attacks by people who know and avoid "hot" words can be preempted by using a thesaurus to include synonyms.

Blacklisting

Another common technological solution against social engineering is a blacklist of suspicious or unverified sites and persons. This might sound simple, especially given the ease of filtering Web sites, the ease of using voice recognition on digital phone lines, and the ease of using face recognition (for example) in video. However, maintenance of such a list can be problematic. Additionally, social engineers take precautions to disguise Web presence, as well as voice and physical appearance. Even though a converged network may allow an organization to aggregate several information sources to build a profile of an attack or an attacker, the same converged network will also help the social engineer to disperse the clues, to make detection more difficult.

Penetration Testing

Penetration testing is another very effective tool in identifying vulnerabilities, as well as a tool for motivating and educating users. As mentioned earlier, users tend to be overconfident in their ability to handle not just malware, but social engineering attacks as well. By mounting a penetration testing attack, the IT staff can test against an entire range of levels of sophistication in attack.

An exercise performed at Argonne National Labs (Argonne, 2006) involved sending 400 messages inviting employees to click on a link to view photos from an open house event. Such e-mail messages are easily spoofed and could be sent from outside the organization, yet they can be made to seem that they originate within the organization. Of the 400 recipients of the e-mail, 149 clicked on the link and were asked to enter their user name and password to access the photos, and 104 of these employees actually entered their credentials. Because this was an exercise, the employees who submitted credentials were directed to an internal Web site with information about phishing and social engineering.

A more complex and more memorable (for the victims) example of penetration testing was reported on the DarkReading site (Stasiukonis, 2006d). The attacker team used a shopping card to open the secure access door, found and used lab coats to blend in, and connected to the company network at a jack in a conference room. Several employees actually helped the attackers out by answering questions and pointing out directions. As part of the final report, the team made a presentation to the employees, which had a profound educational impact. Six months later, on a follow up penetration testing mission, the team was unable to enter the premises. An employee, who first allowed the attackers to pass through a door she had opened, realized her mistake as soon as she got to her car. She returned, alerted the security staff and confronted the attackers.

Palmer (2001) describes how an organization would locate "ethical hackers" to perform a penetration testing exercise. The penetration testing plan involves common sense questions, about what needs to be protected, against what threats, and using what level of resources (time, money, and effort). A "get out of jail free card" is the contract between the organization initiating the testing and the "ethical hackers" performing the testing. The contract specifies limits to what the testers can do and requirements for confidentiality of information gathered. An important point, often forgotten, is that even if an organization performs a penetration testing exercise and then fixes all the vulnerabilities identified, follow up exercises will be required to assess newly introduced vulnerabilities, improperly fixed vulnerabilities, or additional ones not identified during a previous test. In particular, despite the powerful message penetration testing can convey to potential victims of social engineering, there is always an additional vulnerability a social engineer may exploit, and there is always an employee who has not fully learned the lesson after the previous exercise.

Additionally, social engineering software is available to plan and mount a self-test, similar to the Argonne one reported earlier (Jackson Higgins, 2006a). Intended mainly to test phishing vulnerabilities, the core impact penetration testing tool from Core Security (www.coresecurity.com) allows the IT staff to customize e-mails and to use social engineering considerations with a few mouse clicks (Core Impact, n.d.).

Data Filtering

One application that may address social engineering concerns at the boundary of the corporate network is that proposed by Provilla, Inc. A 2007 Cisco survey identified data leaks as the main concern of IT professionals (Leyden, 2007). Of the 100 professionals polled, 38% were most concerned with theft of information, 33% were most concerned about regulatory compliance, and only 27% were most concerned about virus attacks (down from 55% in 2006). Provilla (www.provilla-inc.com) claims that their DataDNA™ technology allows organizations to prevent information leaks, including identity theft and to maintain compliance. The product scans the network looking for document fingerprints, on "every device...at every port, for all data types," according to the company. The channels listed include USB, IM, Bluetooth, HTTP, FTP, outside email accounts (Hotmail, Gmail, etc). Conceivably, the technology could be extended to include voice over IP protocols, although these are not mentioned on the company Web site at this time.

Reverse Social Engineering

Another defensive weapon is to turn the tables and use social engineering against attackers (Holz & Raynal, 2006). This technique can be used against less sophisticated attackers, for example, by embedding "call back" code in "toolz" posted on hacker sites. This can alert organizations about the use of such code and about the location of the prospective attacker. Alternatively, the embedded code could erase the hard drive of the person using it—with the understanding that only malevolent hackers would know where to find the code and would attempt to use it.

User Education

Among the tools available against social engineering, we saved arguably the most effective tool for last: educating users. Some of the technologies mentioned in this section have the potential to stop some of the social engineering attacks. Clearly, social engineers also learn about these technologies, and they either find ways to defeat the technologies or ways to circumvent them. Some experts go as far as to say that any "no holds barred" social engineering attack is bound to succeed, given the wide array of tools and the range of vulnerabilities waiting to be exploited. Still, educating users can patch many of these vulnerabilities and is likely to be one of the most cost-effective means to prevent attacks.

We cannot stress enough that user education is only effective when users understand that they can be victims of attacks, no matter how technologically aware they might be. Incidentally, penetration testing may be one of the most powerful learning mechanisms for employees, both during and after the attack. Stasiukonis (2006c) confesses that in 90% of the cases where he and his penetration testing team get caught is when a user decides to make a call to verify the identity of the attackers. The positive feelings of the person "catching the bad guys" and the impact of the news of the attack on the organization are guaranteed to make it a memorable lesson.

Educating the users at all levels is critical. The receptionist of a company is often the first target of social engineering attacks (to get an internal phone directory, to forward a fax or just to chat about who might be on vacation, Mitnick & Simon, 2002). On the other hand, the information security officers are also targeted because of their critical access privileges. An attacker posing as a client of a bank crafted a spoofed e-mail message supposedly to report a phishing attack. When the security officer opened the e-mail he launched an application that took control of the officer's computer (Jackson Higgins, 2006b). A social engineering attack may succeed by taking the path of least resistance, using the least trained user; at the same time, an attack might fail because one of the best trained users happened to notice something suspicious and alerted the IT staff.

Educational efforts often achieve only limited success and education must be an ongoing process. A series of studies by the Treasury Inspector General for Tax Administration (2007) used penetration testing to identify and assess risks, then to evaluate the effectiveness of education. The study found that IRS employees were vulnerable to social engineering even after training in social engineering had been conducted. In 2001, the penetration testers posed as computer support helpdesk representatives in a telephone call to IRS employees and asked the employees to temporarily change their password to one given over the phone. Seventy-one percent of employees complied. Due to this alarming rate, efforts were made to educate employees about the dangers of social engineering. To assess the effectiveness of the training, a similar test was conducted in 2004, and resulted in a response rate of 35%. However, another test in 2007 successfully convinced 60% of employees to change their password. One bright spot is that of the 40% of employees who were not duped by the social engineers, 50% cited awareness training and e-mail advisories as the reason for protecting their passwords, indicating that user education has the potential for success. In response to the latest study, the IRS is elevating the awareness training and is even emphasizing the need to discipline employees for security violations resulting from negligence or carelessness.

Clearly, user education is not limited to social engineering attacks that take advantage of converged networks. Any social engineering attack is less likely to succeed in an organization where employees are well informed and empowered by well-designed security policies. Education becomes more important on converged networks, to account for the heightened threat level and to allow users to take advantage of the available converged tools that may help prevent attacks.

CONCLUSION

Despite the negative press and despite the negative trends we discussed in this chapter, the good news is that the outlook is positive (Top myths, 2006a). The media is often portraying the situation as “dire” and reporting on a seemingly alarming increase in the number of attacks. For one, the number of users and the number and usage of information systems is increasing steadily. That in itself accounts for a staggering increase in the number of incidents reported. Additionally, the awareness of the general population with respect to information security issues in general and with respect to social engineering in particular is also increasing. The media is responding to this increased interest by focusing more attention on such topics. Surveys indicate that in fact the rate of occurrence of computer crime is actually steady or even decreasing, and that only the public perception and increased usage make computer crime seem to increase. A typical analogy is the seemingly daunting vulnerabilities in Microsoft operating systems, which are in fact only a perceived outcome of the increased usage base and increased attractiveness for attackers (Top myths, 2006b).

Whether the rate of computer crime is increasing or not, social engineering remains a real problem that needs to be continually addressed. Convergence in telecommunications makes it easier for users to access several information channels through a unified interface on one or a small number of productivity devices. This same trend makes it easier for attackers to deploy blended attacks using several information channels to a potential victim, and makes it easier to reach the user through the same converged interface or productivity device. By its nature, convergence means putting all one’s eggs in one basket. The only rational security response is to guard the basket really well.

If there is one point we have tried hard to make painfully clear in this chapter, education, rather than technological solutions, appears to be the best answer to the social engineering problem. Users who are aware of attack techniques, who are trained in following safe usage policies, and who are supported by adequate technological safeguards are much more likely to recognize and deflect social engineering attacks than users who rely only on technology for protection.

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This work was previously published in Social and Human Elements of Information Security: Emerging Trends and Countermeasures, edited by M. Gupta; R. Sharman, pp. 133-147, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.8

On the Effectiveness of Social Tagging for Resource Discovery

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ABSTRACT

Social tagging is the process of assigning and sharing among users freely selected terms of resources. This approach enables users to annotate/describe resources, and also allows users to locate new resources through the collective intelligence of other users. Social tagging offers a new avenue for resource discovery as compared to taxonomies and subject directories created by experts. This chapter investigates the effectiveness of tags as resource descriptors and is achieved using text categorization via support vector machines (SVM). Two text categorization experiments were done for this research, and tags and Web pages from del.icio.us were used. The first study concentrated on the use of terms as its features while the second used both terms and its tags as part of its feature set. The experiments yielded a macroaveraged precision, recall, and F-measure scores of 52.66%, 54.86%, and 52.05%, respectively. In terms of microaveraged values, the experiments obtained 64.76% for precision, 54.40% for recall, and 59.14% for F-measure.

DOI: 10.4018/978-1-59904-879-6.ch025

The results suggest that the tags were not always reliable indicators of the resource contents. At the same time, the results from the terms-only experiment were better compared to the experiment with both terms and tags. Implications of our work and opportunities for future work are also discussed.

INTRODUCTION

The increasing popularity of Web 2.0-based applications has empowered users to create, publish, and share resources on the Web. Such user-generated content may include text (e.g., blogs, wikis), multimedia (e.g., YouTube), and even organization/navigational structures providing personalized access to Web content. The latter includes social bookmarking/tagging systems such as del.icio.us and Connotea.

Social tagging systems allow users to annotate links to useful Web resources by assigning keywords (tags) and possibly other metadata, facilitating their future access (Macgregor & McCulloch, 2006). These tags may further be shared by other users of the social tagging system, in effect creating a community where users can create and share tags pointing to useful Web resources. Put differently, tags function both as content organizers and discoverers. Users create and assign tags to a useful resource they come across so that it would be easy for them to retrieve that resource at a later date. At the same time, other users can use one or more of these tags created to find the resource. The same tags may also be used to discover other related and relevant resources. In addition, through tags, a user can potentially locate like-minded users who hold interests in similarly-themed resources, leading to the creation of social networks (Marlow, Naaman, Boyd, & Davis, 2006).

Social tagging provides an alternative means of organizing resources when compared with conventional methods of categorization based on taxonomies, controlled vocabularies, faceted classification, and ontologies. Conventional methods require experts with domain knowledge and this often translates to a high cost of implementing such systems. They are also bound strictly by rules to ensure their classification schemes remain consistent (Morville, 2005). As the system becomes larger, the rules tend to be more complicated, leading to possible maintenance and accessibility issues. In contrast, the classification scheme in social tagging systems is deregulated. Instead of relying on (a few) experts, they are supported by a (possibly large) community of users. At the same time, tags are "flat," lacking a predefined taxonomic structure, and their use relies on shared, emergent social structures and behaviors, as well as a common conceptual and linguistic understanding within the community (Marlow et al., 2006). Tags are therefore also known as "folksonomies," short for "folk taxonomies," suggesting that they are created by lay users, as opposed to domain experts or information professionals such as librarians, and may in fact be more effective in describing the resource

While social tagging systems have become popular, it is not known if tags created by ordinary users (as opposed to experts) are useful for the discovery of information. A few studies have investigated the use of tags as resource descriptors. Examples include comparing the use of tags against author-assigned index terms in academic papers (Kipp, 2006; Lin, Beaudoin, Bui, & Desai, 2006), examining the ability of tags to classify blogs using text categorization methods (Sun, Suryanto, & Liu, 2007), and investigating the ability of del.icio.us tags to classify Web resources in a small scale study (Razikin, Goh, Cheong, & Ow, 2007). However, to be best of our knowledge, no large scale work has been conducted with del.icio.us, one of the earliest and more popular social tagging sites. The site has a diverse set of tags and Web resources, and its main function is to store, organize, and share bookmarks among a community of users.

The goal of this present chapter is to investigate if tags are useful in helping users to access relevant Web resources. Specifically, we obtain Web pages and their associated tags from del.icio.us and study whether the tags are good descriptors of these resources. Here, we adopt from techniques in text categorization (Sebastiani, 2002) and argue that an effective tag is one in which a classifier is able to assign documents to with high precision and recall. The rationale here is that if a classifier is able to accurately assign documents to their respective tags, then such tags are useful for organizing resources, implying that users would be able to utilize them for accessing information. The remainder of this chapter is organized as follows. In the next section, research related to this work is reviewed. A description of our experimental methodology and the results are then presented. We then provide a discussion of the implications of our findings and conclude with opportunities for future work in this area.

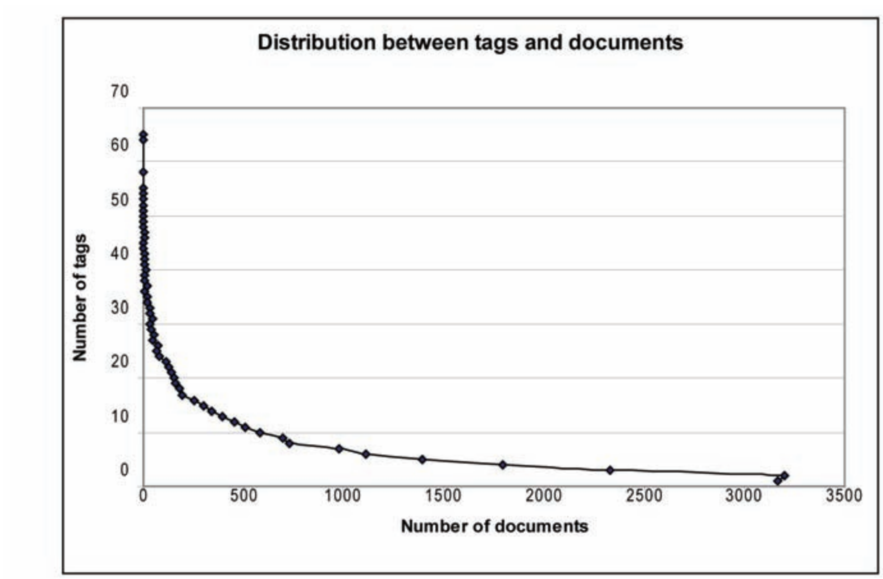
RELATED STUDIES

The use of tagging has become a popular way of organizing and accessing Web resources. Sites such as del.icio.us, Flickr, YouTube, and Last.fm offer this service for their users. Correspondingly, social tagging has also attracted much research, and work has mainly concentrated on the architecture and implementation of systems (e.g., Hammond, Hannay, Lund, & Scott, 2005; Puspitasari, Lim, Goh, Chang, Zhang, Sun, et al., 2007), usage patterns in tagging systems (e.g., Golder & Huberman, 2006; Marlow et al., 2006), user interfaces (e.g., Dubinko, Kumar, Magnani, Novak, Raghavan, & Tomkins, 2006), and the use of social tagging in search systems (e.g., Yanbe, Jatowt, Nakamura, & Tanaka, 2007) among others.

In particular, as tagging becomes an accepted practice among Web users, there is growing interest in investigating whether tags are a useful means for organizing and accessing content. For example, comparing tags with controlled vocabularies provide a basis for evaluating how tags differ from keywords assigned by experts. Lin et al. (2006) compared tags from Connotea and medical subject heading terms (MeSH terms) and found that there was only 11% similarity between MeSH terms and tags supplied by the users. The authors argued that this is because MeSH terms serve as descriptors while tags primarily focus on areas that are of interest to users. Kipp (2006) compared tags with author supplied keywords and indexing terms to determine the overlap in terms of usage. Results indicated that about 35% of the tags were related to the terms supplied by the authors and indexing terms. However, the relationship between tags and terms were not defined formally in thesauri.

An early work on automatic text categorization in social tagging systems was done by Brooks and Montanez (2006). Their study employed articles from the blogosphere. The authors used 350 popular tags from Technorati and 250 of the most recent articles of the collected tags. Using TF-IDF to cluster documents and pairwise cosine similarity to measure the similarity of all articles in each cluster, they found that tags categorize articles in the broad sense and users in a particular domain will not likely be able to find articles with a tag relating to a specific context. Sun et al. (2007) focused on classifying whole blogs with tags, and compared the classification results based on tags alone, tags together with blog descriptions (short abstract), and blog descriptions alone. It was found that tags together with descriptions had the best classification accuracy, while tags alone were more effective than blog descriptions alone for classification. Finally, in departure from the study of tags in blogs, Razikin et al. (2007) conducted a small scale study of the effectiveness of using tags to classify Web resources in del.icio.us. Using a support vector machine (SVM) classifier, relatively high precision and recall rates of 90.22% and 99.27%, respectively, were obtained.

Figure 1. The distribution of tags over the number of documents



METHODOLOGY

Tags and Web pages from del.icio.us were mined from the site from August 2007 to October 2007. During this period, we randomly collected 100 tags and 20,210 pages that were in the English language. Pages that were primarily nontextual (e.g., images and video) were discarded. Consistent with the work of Brooks and Montanez (2006), we started mining the tags from the popular tags page. As such, our tags will be biased towards the more commonly used ones. The popularity of a tag indicates that there are a significant number of documents related to it, and therefore provide a sufficient size for the training and testing of the text classifier.

In our dataset, each tag was associated with an average of 1,331 documents, and each document was associated with an average of 6.66 tags. The minimum number of tags for a document was 1 while the largest number of tags for a single document was 65. Figure 1 shows the distribution of the tags for the number of documents. It clearly demonstrates that power law distribution applies. Interestingly, the same was observed for blogs (Sun et al., 2007). In the figure, there are 3,167 documents with one tag each while there is only a single document with the largest number of tags (65).

Two text categorization experiments were conducted in the present research. The SVM was the machine learning classifier selected for our work as it is a popular machine learning classifier used in Web-based text categorization studies with good performance. Specifically, the SVM^{light} package (Joachims, 1998) was used. Being a binary classifier, we created one classifier for each tag with the examples comprising Web pages belonging (positive examples) and not belonging (negative examples) to that tag. In total, 100 classifiers were trained with the default options of the package. The performance of the tags was evaluated based on the macroaveraged and microaveraged precision, recall, and F-measure.

The first experiment, which served as a baseline, used the terms from the Web pages as the features while the second experiment included tags, in addition to terms, as part of its feature set. The pages in our dataset were processed by removing the hypertext markup language (HTML)

Table 1. Top 15 tags with the highest F-measure values

	Experiment 1				Experiment 2			Diff
Tag	**Precision**	**Recall**	**F-measure**		**Precision**	**Recall**	**F-measure**	
reference	58.38	87.23	69.95		57.80	62.83	60.21	-9.74
howto	56.02	86.21	67.92		61.93	54.83	58.16	-9.76
politics	55.25	87.91	67.85		52.81	90.04	66.57	-1.28
imported	58.57	79.50	67.45		56.40	52.99	54.64	-12.81
fun	55.01	86.83	67.35		50.05	55.94	52.84	-14.51
blogs	55.07	85.74	67.06		59.14	73.92	65.71	-1.35
web	57.37	80.24	66.90		55.76	71.92	62.82	-4.08
web2.0	55.58	82.92	66.55		55.86	75.00	64.03	-2.52
inspiration	53.51	86.29	66.06		54.10	63.04	58.23	-7.83
Internet	54.90	82.18	65.83		55.17	66.22	60.19	-5.64
california	57.14	76.40	65.38		55.17	66.22	60.19	-5.64
restaurants	55.43	79.69	65.38		49.07	88.76	63.20	-2.18
osx	54.07	82.58	65.35		48.00	56.25	51.80	-13.58
recipe	56.83	73.79	64.21		54.92	69.30	61.28	-4.07
news	**54.93**	**76.52**	**63.96**		**58.19**	**88.24**	**70.13**	**6.17**

elements, JavaScript codes, and cascading style sheets elements. This is followed by the process of stop word removal and stemming of the remaining words. TF-IDF values of the terms were then obtained and these values were used as the feature vector for the SVM classifier. For each tag, we selected all the pages that were tagged with the keyword and these were grouped as the positive samples for the particular tag. An equal amount of pages, which were tagged with a different tag, were selected as negative samples. From this set of positive and negative samples, two-thirds of the pages were used as the training sample while the rest were part of the test set.

The second experiment augmented the first with additional features added with the aim of determining if these new features to the dataset would improve the results. The setup for the experiment was similar to that done for Experiment 1. The only difference is the addition of the document's tags to the feature set. The TF-IDF values for the tags were obtained and used as the feature values. Likewise in this experiment, the default parameters of the SVM package were used.

RESULTS FOR EXPERIMENT 1 – TERMS ONLY

Table 1 shows the top 15 tags which scored the highest F-measure obtained from Experiment 1. Table 2 shows the bottom 15 tags with the lowest F-measure obtained from the same experiment. In both tables, the extreme right column shows the difference in the F-measure values obtained in both. Entries in bold indicate an increase in the F-measure value for Experiment 2. The results are ranked in ascending order according to the tag's F-measure values obtained in this experiment.

As seen in Table 1, the top 15 tags that obtained the highest F-measure values had very broad meaning in that we were not able to determine a specific context with respect to the tag. Examples include "reference," "howto," and "politics." On the whole, the top 15 tags had better recall than precision values, indicating that the classi-

Table 2. Bottom 15 tags with the lowest F-measure values

	Experiment 1				Experiment 2			Diff
Tag	**Precision**	**Recall**	**F-measure**		**Precision**	**Recall**	**F-measure**	
templates	**49.63**	**31.60**	**38.62**		**63.27**	**43.87**	**51.81**	**13.19**
animation	46.99	31.97	38.05		52.43	22.13	31.12	-7.88
xml	47.03	31.52	37.74		51.30	28.42	36.57	-1.17
ajax	52.47	29.32	37.62		39.58	9.52	15.35	-22.27
economics	44.71	30.89	36.54		49.25	26.83	34.74	-1.80
windows	54.95	26.93	36.14		40.00	9.32	15.12	-21.02
accessories	**47.37**	**28.42**	**35.53**		**52.63**	**52.08**	**52.36**	**16.83**
cms	45.28	27.80	34.45		45.59	23.85	31.31	-3.14
journal	**51.32**	**25.83**	**34.36**		**42.74**	**35.10**	**38.55**	**4.19**
ruby	**55.56**	**24.15**	**33.67**		**55.64**	**35.75**	**43.53**	**9.86**
actionscript	43.36	26.34	32.78		49.38	21.51	29.96	-2.82
parts	**50.00**	**22.50**	**31.03**		**57.89**	**27.50**	**37.29**	**6.26**
self-improvement	43.55	23.28	30.34		44.00	18.97	26.51	-3.83
icons	**45.45**	**14.93**	**22.47**		**55.84**	**32.09**	**40.76**	**18.29**
adobe	**45.10**	**13.29**	**20.54**		**42.86**	**13.87**	**20.96**	**0.42**

fier was able to correctly assign the documents which actually belong to the tag more than 75% of the time. However, the bottom 15 tags paint a different picture (see Table 2). These tags appear to have a narrower definition in contrast to the top 15 tags. For example, the term "adobe" has a more objective and precise meaning than "fun." The recall values for these tags were lower than its precision values, implying the classifier tended to predict more true negatives than true positives. In other words, the number of pages that did not belong to the category was higher than the pages belonging to it.

Table 3 presents the macroaveraged and microaveraged values for precision, recall, and F-measure. The macroaveraged precision and recall were 52.66% and 54.86%, respectively, while the standard deviation for precision was 4.21 and 19.05 for recall. In contrast with the standard deviation for precision, the standard deviation for recall varied greatly and a reason could be contributed by the classifier's tendency to misclassify a page which actually belongs to the tag. The macroaveraged F-measure was 52.05% and suggests that the classifier managed to predict at least half of the test data correctly with a 10.99 standard deviation across tags.

Microaveraged values show how the classi-

Table 3. Macroaveraged and microaveraged values for Experiments 1 and 2

	Experiment 1			Experiment 2		
	Precision	**Recall**	**F-measure**	**Precision**	**Recall**	**F-measure**
Macroaveraged	52.66 (s = 4.21)	54.86 (s = 19.05)	52.05 (s = 10.99)	50.77 (s = 6.06)	45.24 (s = 20.75)	45.77 (s = 13.21)
Microaveraged	64.76	54.40	59.14	56.47	54.93	55.69

fier performed based on each document. Here, the microaveraged precision was 64.76% while recall was 54.4%. From the F-measure value, the document had a 59.14% chance of being correctly classified. As shown in Table 3, both the macroaveraged and microaverage F-measure values were quite close. However, the F-measure value suggests that the users are not exactly good tag creators in the sense that other users would not be able to locate related resources using these tags. It was discussed previously that a large group of users would provide more reliable tags for resource description in contrast to expert individuals, yet this is not the case as indicated by our results. We surmise that the underlying reason is that tags can have multiple meanings and that there is no agreement on their usage in del.icio.us. As a result, the Web documents that are associated with a tag are not semantically related to each other, which in turn reduces the classifier's precision. The vocabulary problem (Furnas, Landauer, Gomez, & Dumais, 1987) is another reason that could contribute to our results. In other words, a tag would be associated with a diverse set of pages, and most of these pages may have been tagged only once with a particular tag.

RESULTS FOR EXPERIMENT 2 – TERMS AND TAGS

The results obtained in this Experiment 2 are shown in the right columns of Tables 1 and 2. The same tags that were selected in Experiment 1 are again shown in the table. In addition, the difference between the F-measures obtained in both experiments for the selected tags are shown, and entries in bold show an increase in values from those obtained in Experiment 1. Here, only eight of the selected tags have an increase in their F-measure values. The tag "icons" has the largest gain with 18.29. Documents belonging to this tag have an increased chance of 18.29% to be selected than before. On the other hand, the tag "ajax" suffered the largest drop in F-measure value with a decrease of 22.27%.

Table 3 shows the macroaveraged and microaveraged values for precision, recall, and F-measure obtained for this experiment. On average, all the categories had precision and recall values of 50.77% and 45.24%, respectively. The standard deviation for precision was 6.06, smaller than that for recall at 20.75. This was similar to the values obtained in the previous experiment. The F-measure score suggests that the classifier only managed to predict 45.77% of the pages correctly for each category on average, with a standard deviation of 13.21. For microaveraged values, the classifier managed to predict the relevance of each document with a precision and recall of 56.47% and 54.93%, respectively. The microaveraged value for F-measure was 55.69%.

It can be seen from Table 3 that the macroaveraged and microaveraged values obtained in Experiment 2 were lower than those obtained in Experiment 1, implying that the addition of tags as part of the feature set did not help in improving the precision, recall, and F-measure values. This is an interesting outcome, as making use of the terms only resulted in better performance than having terms together with tags. Although tags are words themselves, they may degrade the performance of the classifier because they appear in every document associated with these tags, causing them to have smaller TF-IDF weights in the document collection.

DISCUSSION AND CONCLUSION

In contrast to taxonomies and subject directories, social tagging is an alternative means of organizing Web resources. It is growing in popularity and is being used in a number of Web sites. In this chapter, we have investigated the effectiveness of tags in assisting users to discover relevant content by employing a text categorization approach. Here, we considered tags as categories, and examined the performance of an SVM classifier in assigning a dataset of Web resources from del.icio.us to their respective tags. Two experiments were conducted. The first examined the use of document terms only as features while the second added the document's tags in addition to the previous feature set. Surprisingly, results from the first experiment were better than the second. The macroaveraged F-measure obtained from Experiment 1 was 52.05% while the F-measure from Experiment 2 was 45.77%. The microaveraged values from both experiments were 59.14% and 55.69%. Put differently, the use of terms only yielded slightly better results than using terms and tags.

The relatively low values for precision, recall, and F-measure suggest that not all tags are reliable descriptors of the document's content. Our findings are similar to Sun et al.'s (2007) work. In that study, the range of macroaveraged F-measure values obtained for the description-only experiments ranged from 32% to 41%. Perhaps the much lower values were a result of using a shorter length of text as descriptions. It was reported that the description contained an average of only 14.8 terms for each blog. While the work of Razikin et al. (2007) was similar to the present work, the results obtained in that study were better. A reason for this could be the fact that the tags chosen were not from the popular list, and thus the Web pages that were associated with these tags tended to be more specifically related to the tags themselves. As the present work used the more popular tags, the likelihood of pages being incorrectly assigned to a tag could have been much higher because of greater usage by a diversity of users, thereby contributing to the poorer performance scores.

Some implications can be drawn from our present study. First, proponents of social tagging argue that the knowledge from a group of users could be much better than those provided by an expert (Suroweicki, 2004). However, our results have shown that this may not be applicable for all the tags, as some tags were found to be good descriptors and some were not. Future research could investigate the specific characteristics that make tags good descriptors for resource discovery. For example, one could examine whether tags with objective meanings might yield better performance than those with subjective meanings. Next, because not all tags are created equally for resource discovery, a social tagging system could assist users by suggesting tags in addition to supporting free keyword assignment. For example, after identifying characteristics of tags that serve as good resource descriptors, such tags could be used as recommendations to a tag creator for a given Web resource. In addition, a social tagging system might recommend different tags depending on whether the tag would be for public access, in which case, the recommendations would focus only on "good" tags, or for private use, in which case the recommendations could include tags that have meaning only to the creator.

In conclusion, our findings have shown different levels of effectiveness of tags as resource descriptors. There are however, some limitations to our study that provide opportunities for future work. The first concerns the use of terms and tags of the documents. These might not be the only features that could be used. Additional features like the document's title and the anchor text could prove useful for classification. Different weight schemes could be attempted for different features as well. Further, our corpus had an average of 1,331 documents per tag and future work could look into increasing the number of documents per tag, and utilize tags other than those that were popular.

ACKNOWLEDGMENT

This work is partly funded by A*STAR grant 062 130 0057.

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KEY TERMS

Social Tagging/Social Bookmarking: The process of sharing and associating a resource, such as Web pages and multimedia, with tags.

Support Vector Machines: A vector-based machine learning technique which makes use of the maximum distance between vector classes as a decision boundary.

Text Categorization: The process of assigning documents to predefined labels using various techniques such as statistical and vector space models.

Web 2.0: Web applications that enable the sharing or creation of resources by a group of users. Some of these applications include Weblogs, wikis, and social bookmarking sites.

This work was previously published in Handbook of Research on Digital Libraries: Design, Development, and Impact, edited by Y. Theng, S. Foo, D. Goh, J. Na, pp. 251-260, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.9
Representing and Sharing Tagging Data Using the Social Semantic Cloud of Tags

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ABSTRACT

Social tagging has become an essential element for Web 2.0 and the emerging Semantic Web applications. With the rise of Web 2.0, websites that provide content creation and sharing features have become extremely popular. These sites allow users to categorize and browse content using tags (i.e., free-text keyword topics). However, the tagging structures or folksonomies created by users and communities are often interlocked with a particular site and cannot be reused in a different system or by a different client. This chapter presents a model for expressing the structure, features, and relations among tags in different Web 2.0 sites. The model, termed the social semantic cloud of tags (SCOT), allows for the exchange of semantic tag metadata and reuse of tags in various social software applications.

DOI: 10.4018/978-1-60566-368-5.ch046

INTRODUCTION

With the rise of Web 2.0, websites which provide content creation and sharing features have become extremely popular. Many users have become actively involved in adding specific metadata in the form of *tags* and content annotations in various social software applications. While the initial purpose of tagging is to help users organize and manage their own resources, collective tagging of common resources can be used to organize information via informal distributed classification systems called *folksonomies* (Mathes, 2004; Merholz, 2004).

Studies of tagging and folksonomies can be divided into two main approaches: (a) semantic tagging concentrates on folksonomies that are inconsistent and even inaccurate because a large group of untrained users assign free-form terms to resources without guidance. Since this approach aims to resolve tag ambiguities, a wealth of ideas and efforts is emerging regarding how to use and combine ontologies with folksonomies (Weller, 2007); (b) social networking focuses on a community of users interested in a specific topic that may emerge over time because of their use of tags (Mika, 2005). The power of social tagging lies in the aggregation of information (Quintarelli, 2005). Aggregation of information involves social reinforcement by reinforcing social connections and providing social search mechanisms. Thus, a community built around tagging activities can be considered a social network with an insight into relations between topics and users.

Using freely determined vocabularies by a participant is less costly than employing an expert (Sinclair & Cardew-Hall, 2007) and a cognitive load of tagging in comparison with taxonomies or ontology is relatively low (Merholz, 2004). However, tagging the data from social media sites without a social exchange is regarded as an individual set of metadata rather than a social one. Although tagging captures individual conceptual associations, the tagging system itself does not promote a social transmission that unites both creators and consumers. To create social transmission environments for tagging, one needs a consistent way of exchanging and sharing tagging data across various applications or sources. In this sense, a formal conceptual model to represent tagging data plays a critical role in encouraging its exchange and interoperation. Semantic Web techniques and approaches help social tagging systems to eliminate tagging ambiguities.

BACKGROUND

Social Tagging

Social tagging and folksonomies have received much attention from the Semantic Web and Web 2.0 communities as a new way of information categorization and indexing. Among the most popular websites that employ folksonomies are Del.icio.us[1] (social bookmarking system) and Flickr[2] (photo-sharing network). CiteULike, using a similar approach to Del.icio.us, focuses on academic articles.[3] There are a number of multimedia sites that support tagging, such as Last.fm[4] for music and YouTube[5] for video.

Although the idea of a *tag* is not new, most people agree that a tag is no longer just a keyword. There is semantic information associated with a tag (Weller, 2007). A tag represents a type of metadata used for items such as resources, links, web pages, pictures, blog posts, and so on. Tagging can be defined as a way of representing concepts through keywords and cognitive association techniques without enforcing a categorization. The term *folksonomy* is a fusion of the two words *folk* and *taxonomy* (Vander Wal, 2004); it became especially popular with the proliferation of web-based social software applications, such as social bookmarking or annotating photographs. Building on the above definitions, folksonomy can be considered as a collaborative practice and method of creating and managing tags for the purpose of annotating and categorizing content (Mathes, 2004).

Advantages and disadvantages of social tagging present an issue for discussion. Although social tagging and folksonomies have much to offer users who utilize tags in various social media sites, there are important drawbacks inherent within the current tagging systems: for example, there is no formal conceptualization to represent tagging data in a consistent way and no interoperability support for exchanging tagging data among different applications or people (Marlow et al., 2006; Kim et al., 2007). The simplicity and accessibility of tags may lead to a lack of precision resulting in keyword ambiguity caused by misspelling certain words, as well as using synonyms, morphologies, or over-personalized tags. Since there are many different ways of using tags, it may be easy to misunderstand the meaning of a given tag.

Aside from these problems, social tagging systems do not provide a uniform way to share and reuse tagging data amongst users or communities. There is no consistent method for transferring tags between the desktop and the web or for reusing one's personal set of tags between either web-based systems or desktop applications. Although some folksonomy systems support an export functionality using their Open APIs (Application Programming Interfaces) and share their data with a closed agreement among sites, these systems do not offer a uniform and consistent way to share, exchange, and reuse tagging data for leveraging social interoperability. Therefore, it may be difficult to meaningfully search, compare, or merge similar tagging data from different applications.

With the use of tagging systems increasing daily, these limitations will become critical. The limitations come from lack of standards for tag structure and the semantics for specifying the exact meaning. To overcome the current limitations of tagging systems, it may be beneficial to take into account not only standards for representing tagging data but also develop interoperable methods to support tag sharing across heterogeneous applications.

SEMANTIC TAGGING APPROACHES

Folksonomy vs. Ontology

In general, a *taxonomy* is the organization of a set of information for a particular purpose in a hierarchical structure. An *ontology* is set of well-defined concepts describing a specific domain. It has strict and formal rules for describing relationships among concepts and for defining properties. The distinction between an ontology and a taxonomy is sometimes vague. A simple ontology without properties and constraints (i.e., concept hierarchy) could be considered a taxonomy, but a heavyweight ontology should clearly specify its capabilities.

From a classification perspective, folksonomies and ontologies can be placed at the two opposite ends of the spectrum. When compared to a traditional classification system, a folksonomy can be seen as a set of terms forming part of a flat namespace; that is, a folksonomy is a completely uncontrolled and flat system (Tonkin, 2006). To its disadvantage, folksonomy has no hierarchy and there are no directly specified parent-child relationships between the varying descriptions of the same object. Despite these limitations, the usefulness of folksonomies has been acknowledged: a folksonomy is a user-generated classification created through a bottom-up consensus.

Tag Ontology

There are certain disagreements on the merits of folksonomies and traditional classifications (see, for example, Hendler, 2007; O'Reilly, 2005; Shirky, 2004; Spivack, 2005). Shirky (2004) makes an argument that ontological classification or categorization is overrated in terms of its value. Shirky views folksonomies as emergent patterns in users' collective intelligence and claims that they can be harnessed to create a bottom-up consensus view of the world. According to Shirky, traditional classification systems have been structured using hierarchical taxonomies by experts studying a particular domain. Therefore these systems do not satisfy user-specific ways of thinking and organizing information. Meanwhile, Gruber (2005) criticizes Shirky's approach in that he fails to point out that a folksonomy has limitations to represent, share, exchange, and reuse tags and confuses "ontology-as-specified-conceptualization" with a very narrow form of specification. Hendler

(2007) also argues that Shirky misunderstood how ontologies could be built on the principles of the Semantic Web. Spivack (2005) asserts that folksonomies are just specific, highly simplistic cases of ontologies with minimal semantics.

Despite conflicting differences between folksonomies and ontologies, the Semantic Web and ontologies can be seen as a complement to folksonomies. Gruber (2005) and Spivack (2005) emphasize the importance of folksonomies and ontologies working together. In particular, Gruber (2005) proposes the "Tag Ontology." This aims at identifying and formalizing a conceptualization of the activity of tagging, and building technology that commits to the ontology at a semantic level. This approach is a good starting point to bridge Web 2.0 and the Semantic Web:

- **Gruber's Conceptual Model:** Suggests a model that defines a tagging activity including an object, a tag, a tagging, and a source.
- **Richard Newman's Tag Ontology:** Defines the three core concepts of Tagger, Tagging, Tag for representing the tagging activity (Newman, 2005) and is based on a tripartite tagging (i.e., user, resource, and tag).

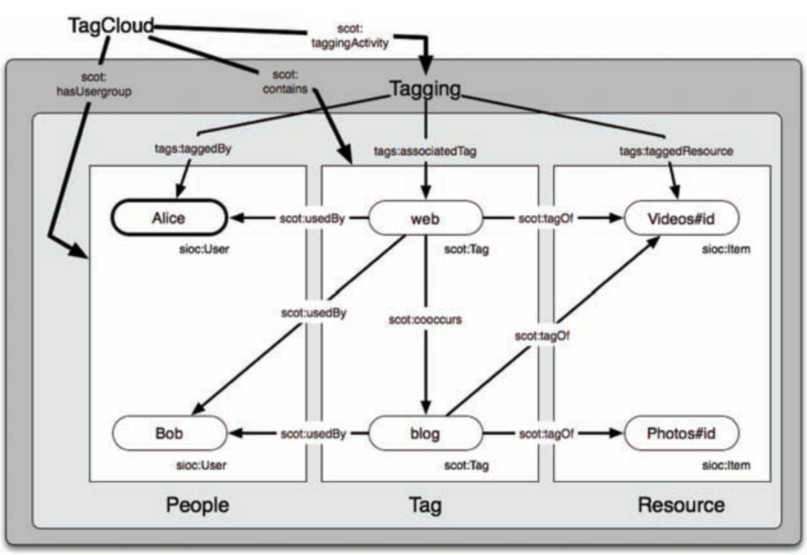
The two approaches are focused on tagging activities or events that people used to tag in resources using terms. Therefore the core concept is Tagging. The concept of tagging has a relationship, as a concept, with Tagger and Resource to describe people who participate in a tagging event and objects to where a tag is assigned. However, there are no ways to describe the frequency of tags in these ontologies.

SCOT: Social Semantic Cloud of Tags

SCOT (Social Semantic Cloud of Tags) is an ontology for sharing and reusing tag data and representing social relations among individuals. It aims to describe the structure and the semantics of tagged data as well as offer interoperability of data among different sources.

Figure 1 illustrates the relations among the elements as well as a tagging activity. The vocabularies can be used to make explicit a collection of users, tags, and resources; they are represented by

Figure 1. Terms and relations in SCOT that can be used to describe tagging activities



a set of RDF classes and properties that can be used to express the content and structure of the tagging activity as an RDF graph.

The TagCloud, which represents a conceptual model of a folksonomy, has a connection point to combine other concepts (i.e., tag, tagging, tagger, and so on.) and can be connected with other tag cloud with a unique namespace. The scot:TagCloud is a subclass of sioc:Container. All information consisting of relationships among taggers, items, and all tags is connected to this class. This class has the scot:contains and the scot:hasUsergroup properties. The former represents tags in a given domain or community while the latter describes taggers who participate in a tagging activity. A tagger may not be a single person according to contexts. For instance, if multiple taggers in a certain community generate a tag cloud, this tag cloud should contain all taggers. The scot:hasUsergroup property represents a person with a container. The scot:composedOf property describes a part of a TagCloud. In particular, if a TagCloud has more than two tag clouds, the property identifies each tag cloud. The scot:taggingActivity property present a relationship between a TagCloud and a Tagging.

The scot:Tag class, a subclass of tags:Tag (Tag class of Tag Ontology), allows users to assert that a tag is an atomic conceptual resource. A tag is a concept associated with a piece of information. The concept has many different variations according to taggers' cognitive patterns. Tag ambiguities, one of the most critical problems, result from this reason. The SCOT ontology provides several properties such as scot:spellingVariant, scot:synonym to solve this problem. It is called the "linguistic property" since these properties focus on representing the meaning of a tag and the relationships between each tag. In addition, the ontology has properties to describe occurrence of a tag (i.e., scot:frequency). A tag itself has its own frequency. The frequency is not unique, but it is an important feature to distinguish or compare with other tags. We called it a "numerical property." The properties have their own numerical values by computing. The properties in Figure 1 show high-level properties in the SCOT ontology.

In addition to representing the structure and the semantics of tags, the model allows the exchange of semantic tag metadata for reuse in social applications and interoperation amongst data sources, services, or agents in a tag space. These features are a cornerstone to being able to identify, formalize, and interoperate a common conceptualization of tagging activity at a semantic level.

SCOT aims to incorporate and reuse existing vocabularies as much as possible to avoid redundancies and to enable the use of richer metadata descriptions for specific domains. The ontology has a number of properties to represent social tagging activity and relationships among elements occurring in an online community.

- DC, or Dublin Core, provides a basic set of properties and types for annotating documents. In SCOT, we use the properties dc:title for the title of a TagCloud, dc:description to give a summary of the TagCloud, dc:publisher to define what system is generating the TagCloud, dc:creator to link to the person who created this set of tags. dcterms:created, from the Dublin Core refinements vocabulary, is used to define when a TagCloud was first created.
- FOAF (Brickley & Miller, 2004), or Friend of a Friend, specifies the most important features related to people acting in online communities. The vocabulary allows us to specify properties about people commonly appearing on personal homepages, and to describe links between people who know each other. foaf:Person is used to define the creator of a particular TagCloud. foaf:Group can be used to define a group of people who have created a group TagCloud.
- SIOC (Breslin et al., 2005), Semantically-Interlinked Online Communities, provides

the main concepts and properties required to describe information from online communities (e.g., message boards, wikis, blogs, etc.) on the Semantic Web. In the context of SCOT, sioc:Usergroup can be used to represent a set of sioc:User who have created the tags contained within a particular group TagCloud. A TagCloud is also a type of sioc:Container, in that it contains a set of Tags (subclass of sioc:Item).

- SKOS (Simple Knowledge Organization Systems) provides specifications and standards to support the use of vocabularies, such as thesauri, classification schemes, subject heading lists, taxonomies, other types of controlled vocabulary as well as terminologies and glossaries (Miles & Bechhofer, 2008). Tag is a subclass of skos:Concept, and a number of SKOS properties are used to define the relationships between Tags: broader, narrower, and so on.

Int.ere.st: Platform for Tag Sharing

Int.ere.st is a website where people can manage their tagging data from various sources, search resources based on their tags which were created and used by themselves, and leverage a sharing and exchanging of tagging data among people or various online communities.[6] The site is a platform for providing structure and semantics to previously unstructured tagging data via various mashups. The tagging data from distributed environments (such as blogs) can be stored in a repository, such as SCOT, via the Mashup Wrapper, which extracts tagging data using Open APIs from host sites. For instance, the site allows users to dump tagging data from Del.icio.us, Flickr, and YouTube; these tagging data are transformed into SCOT instances on a semantic level. Thus, all instances within Int.ere.st include different tagging contexts and connect various people and sources with the same tags. In addition, users can search people, tags, or resources and can bookmark some resources or integrate different instances. Through this iterative process, the tags reflect distributed human intelligence into the site.

Int.ere.st is the first OpenTagging Platform[7] of the Semantic Web, since users can manage a collection of tagging data in a smarter and more effective way as well as search, bookmark, and share their own as well as other's tagging data underlying the SCOT ontology. Those functionalities help users exchange and share their tagging data based on the Semantic Web standards. The site is compatible with other Semantic Web applications, and its information can be shared across applications. This means that the site enables users to create Semantic Web data, such as FOAF, SKOS, and SIOC automatically. RDF vocabularies can be interlinked with the URIs of SCOT instances that are generated in the site and shared in online communities.

FUTURE TRENDS

Social computing enables building social systems and software; it also allows for embedding social knowledge in applications rather than merely describing social information. Within social network analysis, traditional approaches have focused on static networks for small groups. As the technologies move forward, a major challenge for social network analysis is to design methods and tools for modeling and analyzing large-scale and dynamic networks. In particular, folksonomies are inherently dynamic and have different contexts among sources.

To facilitate the development of a social network for folksonomies, it is important to pay attention to social information. Although SNA allows analyzing phenomenon of social behavior at both individual and collective level, we do not have a solution that represents the relations among elements and reflects them to the objects. Tag ontologies are promising in providing the tools and formalism for representing social information including users, resources, tags, and their relationships.

Social search has become an active area in academic research as well as industry. Social search is a type of search engine that determines the relevance of search results by considering user interactions, contributions, or activities, such as bookmarking, tagging, and ranking. For instance, Del.icio.us and Spurl[8] (social bookmarking services) rely on user rankings, while Technorati[9] and Bloglines[10] (tag aggregators) analyze blogs and feed-based content. In particular, Swicki[11] and Rollyo[12] offer a community-based topic search as well as "searchles"[13] (these allow users to tag, group, and save links and create their own "SearchlesTV" channels through video mashups).

Most approaches, however, are limited to different types of resources and to show a comprehensive perspective on social relations across different applications. For instance, if users are involved in two different social spaces such as Del.icio.us and YouTube, one cannot build an integrated social network unless the two services have a mutual agreement. This issue, to some degree, is related to social information representation, since both websites have different aspects and events for building social connections. Thus, if one has a common conceptualization for social events, it is easy to build social connections among different spaces and to search them from different sources. Since tag ontologies are suitable to represent common conceptualization of social events, a social search can adopt Semantic Web technologies. We believe that a social search can benefit from a formal conceptualization of social knowledge, including tagging data based on the Semantic Web.

CONCLUSION

Tags have become an essential element for Web 2.0 and the Semantic Web applications. There is a vast collection of user-created content residing on the web. Tagging is a promising technological breakthrough offering new emerging opportunities for sharing and disseminating metadata. The critical issues discussed in this chapter offer many implications and challenges for representing tagging data semantically and exchanging them socially. With emphasis placed on tag ontologies and opportunities, these issues must be confronted without delay. Creators and consumers of folksonomies, as well as service providers, will profit from effective and efficient tagging methods that are socially and semantically enhanced.

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KEY TERMS AND DEFINITIONS

Folksonomy: A practice and method of collaboratively creating and managing tags for the purpose of annotating and categorizing content. The term *folksonomy* is a fusion of two words: *folk* and *taxonomy.* Folksonomies became popular with the introduction of web-based social software applications, for example, social bookmarking and photograph annotating.

Mashup: Involves web services or applications combining data from different websites. In general, mashup services are implemented by combining various functionalities with open APIs.

Ontology: Is set of well-defined concepts describing a specific domain.

Open API (Application Programming Interface): Is used to describe a set of methods for sharing data in Web 2.0 applications.

Semantic Web: Is an extension of the current World Wide Web that links information and services on the web through meaning and allows people and machines use web content in more intelligent and intuitive ways.

Social Computing: Is defined as any type of collaborative and social applications that offer the gathering, representation, processing, use, and dissemination of distributed social information.

Social Semantic Cloud of Tags (SCOT): Is an ontology for sharing and reusing tagged data and representing social relations among individuals. It aims to describe the structure and the semantics of data and to offer the interoperability of data among different sources.

Social Software: Can be defined as a range of web-based software programs that support group communication. Many of these programs share similar characteristics, for example, open APIs, customizable service orientation, and the capacity to upload data and media.

Social Tagging: Also known as *collaborative tagging*, refers to assigning specific keywords or *tags* to items and sharing the set of tags between communities of users.

Tag: A type of metadata used for items such as resources, links, web pages, pictures, blog posts, and so on.

Tagging: A way of representing concepts through tags and cognitive association techniques without enforcing a categorization.

Taxonomy: A method of organizing information in a hierarchical structure using a set of vocabulary terms.

ENDNOTES

1 http://del.icio.us
2 http://www.flickr.com
3 http://www.citeulike.org
4 http://www.lastfm.com
5 http://www.youtube.com
6 http://int.ere.st
7 http://opentagging.org
8 http://www.spurl.net
9 http://www.technorati.com
10 http://www.bloglines.com
11 http://www.swicki.com
12 http://rollyo.com
13 http://www.searchles.com

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 519-527, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 7.10
Anomaly Detection for Inferring Social Structure

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INTRODUCTION

In traditional data analysis, data points lie in a Cartesian space, and an analyst asks certain questions: (1) What distribution can I fit to the data? (2) Which points are outliers? (3) Are there distinct clusters or substructure? Today, data mining treats richer and richer types of data. Social networks encode information about people and their communities; relational data sets incorporate multiple types of entities and links; and temporal information describes the dynamics of these systems. With such semantically complex data sets, a greater variety of patterns can be described and views constructed of the data.

This article describes a specific social structure that may be present in such data sources and presents a framework for detecting it. The goal is to identify *tribes*, or small groups of individuals that intentionally coordinate their behavior—individuals with enough in common that they are unlikely to be acting independently.

While this task can only be conceived of in a domain of interacting entities, the solution techniques return to the traditional data analysis questions. In order to find hidden structure (3), we use an anomaly detection approach: develop a model to describe the data (1), then identify outliers (2).

DOI: 10.4018/978-1-60566-010-3.ch007

BACKGROUND

This article refers throughout to the case study by Friedland and Jensen (2007) that introduced the tribes task. The National Association of Securities Dealers (NASD) regulates the securities industry in the United States. (Since the time of the study, NASD has been renamed the Financial Industry Regulatory Authority.) NASD monitors over 5000 securities firms, overseeing their approximately 170,000 branch offices and 600,000 employees that sell securities to the public. One of NASD's primary activities is to predict and prevent fraud among these employees, called registered representatives, or *reps*. Equipped with data about the reps' past employments, education, and "disclosable events," it must focus its investigatory resources on those reps most likely to engage in risky behavior. Publications by Neville et al. (2005) and Fast et al. (2007) describe the broader fraud detection problem within this data set.

NASD investigators suspect that fraud risk depends on the social structure among reps and their employers. In particular, some cases of fraud appear to be committed by what we have termed *tribes*—groups of reps that move from job to job together over time. They hypothesized such coordinated movement among jobs could be predictive of future risk. To test this theory, we developed an algorithm to detect tribe behavior. The algorithm takes as input the employment dates of each rep at each branch office, and outputs small groups of reps who have been co-workers to a striking, or anomalous, extent.

This task draws upon several themes from data mining and machine learning:

Inferring latent structure in data. The data we observe may be a poor view of a system's underlying processes. It is often useful to reason about objects or categories we believe exist in real life, but that are not explicitly represented in the data. The hidden structures can be inferred (to the best of our ability) as a means to further analyses, or as an end in themselves. To do this, typically one assumes an underlying model of the full system. Then, a method such as the expectation-maximization algorithm recovers the best match between the observed data and the hypothesized unobserved structures. This type of approach is ubiquitous, appearing for instance in mixture models and clustering (MacKay, 2003), and applied to document and topic models (Hofmann, 1999; Steyvers, et al. 2004).

In relational domains, the latent structure most commonly searched for is clusters. Clusters (in graphs) can be described as groups of nodes densely connected by edges. Relational clustering algorithms hypothesize the existence of this underlying structure, then partition the data so as best to reflect the such groups (Newman, 2004; Kubica et al., 2002; Neville & Jensen, 2005). Such methods have analyzed community structures within, for instance, a dolphin social network (Lusseau & Newman, 2004) and within a company using its network of emails (Tyler et al., 2003). Other variations assume some alternative underlying structure. Gibson et al. (1998) use notions of hubs and authorities to reveal communities on the web, while a recent algorithm by Xu et al. (2007) segments data into three types—clusters, outliers, and hub nodes.

For datasets with links that change over time, a variety of algorithms have been developed to infer structure. Two projects are similar to tribe detection in that they search for specific scenarios of malicious activity, albeit in communication logs: Gerdes et al. (2006) look for evidence of chains of command, while Magdon-Ismail et al. (2003) look for hidden groups sending messages via a public forum.

For the tribes task, the underlying assumption is that most individuals act independently in choosing employments and transferring among jobs, but that certain small groups make their decisions jointly. These tribes consist of members who have worked together unusually much in some way. Identifying these unusual groups is an instance of anomaly detection.

Anomaly detection. Anomalies, or outliers, are examples that do not fit a model. In the literature, the term anomaly detection often refers to intrusion detection systems. Commonly, any deviations from normal computer usage patterns, patterns which are perhaps learned from the data as by Teng and Chen (1990), are viewed as signs of potential attacks or security breaches. More generally for anomaly detection, Eskin (2000) presents a mixture model framework in which, given a model (with unknown parameters) describing normal elements, a data set can be partitioned into normal versus anomalous elements. When the goal is fraud detection, anomaly detection approaches are often effective because, unlike supervised learning, they can highlight both rare patterns plus scenarios not seen in training data. Bolton and Hand (2002) review a number of applications and issues in this area.

MAIN FOCUS

As introduced above, the tribe-detection task begins with the assumption that most individuals make choices individually, but that certain small groups display anomalously coordinated behavior. Such groups leave traces that should allow us to recover them within large data sets, even though the data were not collected with them in mind.

In the problem's most general formulation, the input is a bipartite graph, understood as linking individuals to their affiliations. In place of reps working at branches, the data could take the form of students enrolled in classes, animals and the locations where they are sighted, or customers and the music albums they have rated. A tribe of individuals choosing their affiliations in coordination, in these cases, becomes a group enrolling in the same classes, a mother-child pair that travels together, or friends sharing each other's music. Not every tribe will leave a clear signature, but some groups will have sets of affiliations that are striking, either in that a large number of affiliations are shared, or in that the particular combination of affiliations is unusual.

Framework

We describe the algorithm using the concrete example of the NASD study. Each rep is employed at a series of branch offices of the industry's firms. The basic framework consists of three procedures:

1. For every pair of reps, identify which branches the reps share.
2. Assign a similarity score to each pair of reps, based on the branches they have in common.
3. Group the most similar pairs into tribes.

Step 1 is computationally expensive, but straightforward: For each branch, enumerate the pairs of reps who worked there simultaneously. Then for each pair of reps, compile the list of all branches they shared.

The similarity score of Step 2 depends on the choice of model, discussed in the following section. This is the key component determining what kind of groups the algorithm returns.

After each rep pair is assigned a similarity score, the modeler chooses a threshold, keeps only the most highly similar pairs, and creates a graph by placing an edge between the nodes of each remaining pair. The graph's connected components become the tribes. That is, a tribe begins with a similar pair of reps, and it expands by including all reps highly similar to those already in the tribe.

Models of "Normal"

The similarity score defines how close two reps are, given the set of branches they share. A pair of reps should be considered close if their set of shared jobs is unusual, i.e., shows signs of coordination. In deciding what makes a set of branches unusual, the scoring function implicitly or explicitly defines a model of normal movement.

Some options for similarity functions include:

Count the jobs. The simplest way to score the likelihood of a given set of branches is to count them: A pair of reps with three branches in common receives the score 3. This score can be seen as stemming from a naïve model of how reps choose employments: At each decision point, a rep either picks a new job, choosing among all branches with equal probability, or else stops working. Under this model, any given sequence of n jobs is equally likely and is more likely than a sequence of $n+1$ jobs.

Measure duration. Another potential scoring function is to measure how long the pair worked together. This score could arise from the following model: Each day, reps independently choose new jobs (which could be the same as their current jobs). Then, the more days a pair spends as co-workers, the larger the deviation from the model.

Evaluate likelihood according to a Markov process. Each branch can be seen as a state in a Markov process, and a rep's job trajectory can be seen as a sequence generated by this process. At each decision point, a rep either picks a new job, choosing among branches according to the transition probabilities, or else stops working.

This Markov model captures the idea that some job transitions are more common than others. For instance, employees of one firm may regularly transfer to another firm in the same city or the same market. Similarly, when a firm is acquired, the employment data records its workforce as "changing jobs" en masse to the new firm, which makes that job change appear popular. A model that accounts for common versus rare job transitions can judge, for instance, that a pair of independent colleagues in Topeka, Kansas (where the number of firms is limited) is more likely to share three jobs by chance, than a pair in New York City is (where there are more firms to choose from); and that both of these are more likely than for an independent pair to share a job in New York City, then a job in Wisconsin, then a job in Arizona.

The Markov model's parameters can be learned using the whole data set. The likelihood of a particular (ordered) sequence of jobs,P(Branch A → Branch B → Branch C → Branch D)isP(startat Branch A) • P(A → B) • P(B → C) • P(C → D)

The branch-branch transition probabilities and starting probabilities are estimated using the number of reps who worked at each branch and the number that left each branch for the next one. Details of this model, including needed modifications to allow for gaps between shared employments, can be found in the original paper (Friedland & Jensen, 2007).

Use any model that estimates a multivariate binary distribution. In the Markov model above, it is crucial that the jobs be temporally ordered: A rep works at one branch, then another. When the data comes from a domain without temporal information, such as customers owning music albums, an alternative model of "normal" is needed. If each rep's set of branch memberships is represented as a vector of 1's (memberships) and 0's (non-memberships), in a high-dimensional binary space, then the problem becomes estimation of the probability density in this space. Then, to score a particular set of branches shared by a pair of reps, the estimator computes the marginal probability of that set. A number of models, such as Markov random fields, may be suitable; determining which perform well, and which dependencies to model, remains ongoing research.

Evaluation

In the NASD data, the input consisted of the complete table of reps and their branch affiliations, both historical and current. Tribes were inferred using three of the models described above: counting jobs (JOBS), measuring duration (YEARS), and the Markov process (PROB). Because it was impossible to directly verify the tribe relationships, a number of indirect measures were used to validate the resulting groups, as summarized in Table 1.

Table 1. Desirable properties of tribes

Property	Why this is desirable
Tribes share rare combinations of jobs.	An ideal tribe should be fairly unique in its job-hopping behavior.
Tribes are more likely to traverse multiple zip codes.	Groups that travel long distances together are unlikely to be doing so by chance.
Tribes have much higher risk scores than average.	If fraud does tend to occur in tribe-like structures, then on average, reps in tribes should have worse histories.
Tribes are homogenous: reps in a tribe have similar risk scores.	Each tribe should either be innocuous or high-risk.

The first properties evaluate tribes with respect to their rarity and geographic movement (see table lines 1-2). The remaining properties confirm two joint hypotheses: that the algorithm succeeds at detecting the coordinated behavior of interest, and that this behavior is helpful in predicting fraud. Fraud was measured via a risk score, which described the severity of all reported events and infractions in a rep's work history. If tribes contain many reps known to have committed fraud, then they will be useful in predicting future fraud (line 3). And ideally, groups identified as tribes should fall into two categories. First is high-risk tribes, in which all or most of the members have known infractions. (In fact, an individual with a seemingly clean history in a tribe with several high-risk reps would be a prime candidate for future investigation.) But much more common will be the innocuous tribes, the result of harmless sets of friends recruiting each other from job to job. Within ideal tribes, reps are not necessarily high-risk, but they should match each other's risk scores (line 4).

Throughout the evaluations, the JOBS and PROB models performed well, whereas the YEARS model did not. JOBS and PROB selected different sets of tribes, but the tribes were fairly comparable under most evaluation measures: compared to random groups of reps, tribes had rare combinations of jobs, traveled geographically (particularly for PROB), had higher risk scores, and were homogenous. The tribes identified by YEARS poorly matched the desired properties: not only did these reps not commit fraud, but the tribes often consisted of large crowds of people who shared very typical job trajectories.

Informally, JOBS and PROB chose tribes that differed in ways one would expect. JOBS selected some tribes that shared six or more jobs but whose reps appeared to be caught up in a series of firm acquisitions: many other reps also had those same jobs. PROB selected some tribes that shared only three jobs, yet clearly stood out: Of thousands of colleagues at each branch, only this pair had made any of the job transitions in the series. One explanation why PROB did not perform conclusively better is its weakness at small branches. If a pair of reps works together at a two-person branch, then transfers elsewhere together, the model judges this transfer to be utterly unremarkable, because it is what 100% of their colleagues at that branch (i.e., just the two of them) did. For reasons like this, the model seems to miss potential tribes that work at multiple small branches together. Correcting for this situation, and understanding other such effects, remain as future work.

FUTURE TRENDS

One future direction is to explore the utility of the tribe structure to other domains. For instance, an online bookstore could use the tribes algorithm to infer book clubs—individuals that order the same books at the same times. More generally, customers with unusually similar tastes might want to be introduced; the similarity scores could become a basis for matchmaking on dating websites, or for connecting researchers who read or publish similar papers. In animal biology, there is a closely related problem of determining family ties, based on which animals repeatedly appear together in herds (Cairns & Schwager, 1987). These "association patterns" might benefit from being formulated as tribes, or even vice versa.

Work to evaluate other choices of scoring models, particularly those that can describe affiliation patterns in non-temporal domains, is ongoing. Additional research will expand our understanding of tribe detection by examining performance across different domains and by comparing properties of the different models, such as tractability and simplicity.

CONCLUSION

The domains discussed here (stock brokers, online customers, etc.) are rich in that they report the interactions of multiple entity types over time. They embed signatures of countless not-yet-formulated behaviors in addition to those demonstrated by tribes.

The tribes framework may serve as a guide to detecting any new behavior that a modeler describes. Key aspects of this approach include searching for occurrences of the pattern, developing a model to describe "normal" or chance occurrences, and marking outliers as entities of interest.

The compelling motivation behind identifying tribes or similar patterns is in detecting hidden, but very real, relationships. For the most part, individuals in large data sets appear to behave independently, subject to forces that affect everyone in their community. However, in certain cases, there is enough information to rule out independence and to highlight coordinated behavior.

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KEY TERMS AND DEFINITIONS

Anomaly Detection: Discovering anomalies, or outliers, in data.

Branch: In the NASD schema, a branch is the smallest organizational unit recorded: every firm has one or more branch offices.

Branch Transition: The NASD study examined patterns of job changes. If employees who work at Branch A often work at Branch B next, we say the (branch) transition between Branches A and B is common.

Latent Structure: In data, a structure or pattern that is not explicit. Recovering such structures can make data more understandable, and can be a first step in further analyses.

Markov Process: Model that stochastically chooses a sequence of states. The probability of selecting any state depends only on the previous state.

Registered Representative (rep): Term for individual in the NASD data.

Tribe: Small group of individuals acting in a coordinated manner, e.g., moving from job to job together.

This work was previously published in Encyclopedia of Data Warehousing and Mining, Second Edition, edited by J. Wang, pp. 39-44, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.11
Emerging Online Democracy:
The Dynamics of Formal and Informal Control in Digitally Mediated Social Structures

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ABSTRACT

The emergence and development of Web 2.0 has enabled new modes of social interaction that are potentially democratic, both within and across digitally mediated venues. Web-based interaction offers unlimited opportunities for organizing across geographic, demographic, and contextual boundaries, with ramifications in professional networking, political action, friendships, romances, learning, recreation, and entertainment. The authors conceptualize the democratization of Web-based social structures, defining online democracy as an imperfect balance of formal and informal modes of discursive control. The wrangling between formal and informal modes of discursive control ensures perpetual dynamism and innovation; the wrangling also offers the promise that diverse voices are not only welcome but also potentially responsive and responsible. The conclusion advocated is the importance of paying attention to these tendencies since they demonstrate that the Web's proclivities for decentralization and pluralism do not necessarily lead to relativistic and nihilistic hypertextuality but to potentially novel forms of shared social control.

INTRODUCTION

With the advent of web-based social interaction technologies, new opportunities have arisen for user control and interactivity. These opportunities range widely in their relational complexities, spanning information gathering and opinion sharing, the formation of interpersonal relationships and online communities, and the development and maintenance of sophisticated organizational and global networks. Across these varied modes of interactivity, control of the technology, the media, and the communicative

DOI: 10.4018/978-1-60566-368-5.ch036

content is becoming increasingly decentralized and populistic. It is necessary, therefore, to address what is commonly called the "democratization" of the web.

Democracy, as conceived here, is not characterized by wholly unregulated chaos, despite the relativistic potential of hypertextual communication. Whereas interactivity in digitally mediated venues may range in quality from "anything goes" anarchy to rigid authoritarianism, this chapter addresses the emergence of democratic moderation, in which online participants "concertively" regulate their communication. Here we identify some past research and thoughts on the Internet's democratic qualities;[1] describe and illustrate online contexts as potentially democratic social structures that experience interplay between formal and informal communicative forces; and anticipate future trends of theory, empirical research, and practice.

BACKGROUND

The introduction of a new generation of social interaction technologies opens a possibility of the transformation of structural and social reality (McLuhan & Fiore, 1967; Ong, 1982). Since its emergence, the Internet[1] has been approached, theoretically and empirically, as a momentous and consequential social, cultural, economic, and political force (DiMaggio, Hargittai, Neuman, & Robinson, 2001; Wilson & Peterson, 2002). Some have theorized that the Internet might drastically transform the self, interaction, and social order and serve as a catalyst for social justice, empowering individuals to find spaces within which their voices may count (Negroponte, 1995). Others have cautioned that the Internet constrains and disempowers individuals within structured routines and cultural norms. They have argued that in the new virtual world some would emerge as winners (e.g., transnational corporations and interests) and others as losers (Beniger, 1996). Castells (1996), for instance, proposed that the Internet would follow the commercial path of its media predecessors and predicted a web "populated by two essentially distinct populations, *the interacting* and *the interacted*" (p. 371): the first group exemplifying the web's fragmentation potential and, the second, its reproduction of traditional media's massification patterns; and both groups reflecting the divide between the information rich and poor.

Studies on the Internet's potential to rearrange social, cultural, economic, and political life have focused on such issues as access to open information flows across national and global systems (Bimber, 2000; Norris, 2001; Schiller, 1995), identity construction (Cutler, 1996; Morse, 1998; Turkle, 1995), community formation and mobilization (Foster, 1997; Rheingold, 1993; Zappen, Gurak, & Doheny-Farina, 1997), and civic and political participation and deliberation (Putnam, 2000). The potential of the Internet to promote civic engagement and political democracy have also gained attention (e.g., Agre, 2002), especially since the 1990s when United States' congressional, state, and presidential candidates began deploying campaign websites (Hurwiz, 1999). The increased opportunities for interactivity among citizenries through blogs, chat rooms, and Internet forums are now being investigated (e.g., Best & Krueger, 2005; Dahlgreen, 2000; Endres & Warnick, 2004) as are the perceived public risks posed by such online participation (Andrejevic, 2006; Best, Krueger, & Ladewig, 2007). While some suggest that the Internet has the potential to mobilize "netizens" in new ways and to support democratic processes (Carpini, 2000; Deuze, 2006; Min, 2007), at times lending authorial voice to marginalized constituents and concerns, there is also increased support for the polarization of the public and the unfulfilled potential of deliberative democracy (Noveck, 2000; Selnow, 1998; Streck, 1998; White, 1997; Wilhelm, 2000). Still others point out that online deliberative democracy can be actualized, but its impact is greatly diminished when positioned within a dominant commercialized and individualized culture (Dahlberg, 2001).

On a more micro-analytic level, various studies have explored language, communication practices, and social interaction and relations on the Internet (e.g., Crystal, 2001). These inquiries address the emergence and negotiation of "netiquette" rules that socialize online participants, as well as more subtle self-imposed or community-imposed levels of informal control that undermine the Internet's democratic potential. McLaughlin, Osborne, & Smith (1995) identified early misconduct on Usenet that included misuse of technology, bandwidth waste, factual errors, inappropriate violation of language guidelines, newsgroup-specific conventions, and ethical codes. The extent to which the Internet liberates or simply reproduces patterns of expression and participation, in relation to gender, race, and sexual politics, continues to interest participants, observers, and researchers (Bromseth, 2001; Dibbell, 1993; Herring, 1996; Herring & Paolillo, 2006; Kendall, 2000; Lessig, 1999; Miller, 1995; Stivale, 1997) as do the Internet's descriptive and prescriptive rules and various interactive forms, where behaviors range from disruption and hostility (e.g., flaming) to disciplinary control and normalization (Dutton, 1996; Lee, 2005; Phillips, 1996; Thompsen, 1996). Much of the research has examined online contexts such as MUDs, MOOs, and Usenet communities that are now being replaced in prominence by new Internet venues.

Janack (2006) studied how participants of *Blog for America*—a feature of the 2000 U. S. presidential candidate Howard Dean's campaign website—discursively disciplined themselves. That study echoes this chapter's focus: While new social media feature pluralistic participation, interactivity, and ungrounded hypertextuality, they operate within both formally structured and emergent frameworks of values, practices, and expectations that significantly reaffirm and rewrite authority and control. In Janack's study, for instance, blog participants behaved as gatekeepers, a role traditionally enacted by campaign staffers, to silence Dean's critics through various rhetorical strategies (e.g., ignoring or minimizing critical comments, *ad hominem* attacks). If Internet-enabled discourse may be described in Bakhtin's (1984) language as "carnivalesque," we can see how it potentially brings people together as equals to revel in liberation from exogenous constraints (legal, governmental, religious, and so on) and social stratifications. At once, though, it is necessary to recognize that the carnival, no matter how liberating, is a social order nonetheless. Its playfulness, unpredictability, populism, and multi-voicedness are inevitably bounded and regulated. This moderation is a hallmark of online democracy, and an important potential characteristic of web-based interaction.

ONLINE DEMOCRACY'S MODES OF SOCIAL CONTROL

Online communication occurs within and across diverse contexts and forms, ranging from relatively simple information posts to highly sophisticated social and political commentary. Accordingly, discursive qualities vary greatly throughout the web. Some utterances are noisily and chaotically ungrounded whereas others are kept orderly by the moderator's iron fists. Of interest is what happens somewhere between these extremes, when administrative and lay users participate together to negotiate and maintain their shared social orders.

To understand such potentially democratic qualities, it is necessary to define online democracy and to address how it may be enacted. This section begins with the general idea that all online interaction is governed by tensional interplay between formal and informal modes of control. Then we define online democracy as a particular mode of dialectical tension, and illustrate this dynamic—and the general potential for online democracy in Internet-mediated venues—by exploring some actual online interaction.

Online Social Structures and Democracy

Any social structure is continuously rebuilt through participants' communication (Giddens, 1984). This applies not only to face-to-face and other traditional social contexts but also to emerging venues that are digitally mediated, such as online forums, discussion boards, blogs, wikis, and social networking sites. These online settings may be thought of as both nouns and verbs; they are as much solid frameworks of norms as they are fluid interactions among people. In Giddens' terms, such simultaneously solid and fluid structures comprise socially made rules (implicit and explicit formulas for action) and resources (participants' commoditized abilities, knowledge, designated roles, etc.) that at once permit and limit interaction. The constant "reinscription" of rules and resources occurs not just within a given social structure as a demarcated and unitary body but also *across* overlapping structures that may mediate and contradict each other.

One way to understand this complex nature of social structures is to address how they are enabled and constrained by a dialectical interplay of social forces—what Bakhtin (1981) characterizes as "centripetal" and "centrifugal." Centripetal forces are authoritative, stabilizing, decisive, and preserving of traditions. Directives, punishments, and behaviors that concretize stratified roles are instances of centripetally leaning talk. Conversely, centrifugal forces are insurgent, destabilizing, equivocally open-ended, and change-minded. Questions, evasions, and behaviors that challenge authority are centrifugally leaning.

When examining online interaction, each discrete utterance (e.g., a blog post) manifests a quality that is roughly mappable along the *centripetal—centrifugal* continuum. Directives and pronouncements, for instance, tug the discourse centripetally whereas questions and invitations for response pull things centrifugally. In looking at a communicative context's utterances in aggregate, it is possible to recognize a particular meta-dynamic, the cumulative tugging of which defines the social structure's general character. How imbalanced are its forces? How do they tend?

If a given online setting experiences a preponderance of explicit rules, web forum moderator-enforced censorship, gate-keeping, and other centripetally-leaning discourses, the social structure tends toward autocracy or authoritarianism as an organizational form. Its social order is maintained by verbal and nonverbal talk that enforces centralized control while stifling insurgence. Leaders are typically designated and recognizable as established roles, and control mechanisms tend to be formally explicit and enforceable as codified rules. At the other end of the sliding scale—the centrifugal one—a given online venue with few (or no) explicit regulations, disciplinary procedures, and plenty of cacophonous interaction leans toward anomie or anarchy as the basis of social (dis)order. Discursive struggles occur through decentralization of authority and destabilization of public order. Leadership is emergent and fluid, and social norms—which are likely implicit—are negotiated among participants rather than imposed from atop or outside of the social structure.

Online Democracy

Whereas social forms such as anarchy and autocracy inhabit the continuum's two dialectical extremes, online democracy hovers (however imprecisely) near the middle. Online democracy may be defined as the quasi-counterbalance of normalizing and destabilizing discursive forces; a subtle and messy negotiation of control in which centripetal and centrifugal pushes and pulls more-or-less even out. The "more-or-less" characteristic of this equilibrium reflects the general idea that social structures, which are constantly remade in participants' interaction, are always dynamic and never static. For this discussion of online venues—which are potentially democratic but certainly not always—this definition is important. Given the seemingly pluralistic decentralization of discourse in web-based settings, the Internet appears to come to life as a noisy "marketplace of ideas" (Mill, 1956); a panoply of public "sphericules" (Gitlin, 1998) in which interaction is most easily described as ungrounded. The risk of these characterizations is that they may overemphasize centrifugal forces while denying or trivializing the emergence and functions of social control.

Control within and among online social structures is ubiquitous, and it comes in two generally different modes that are dialectically engaged. The first mode is what Spitzer (1982) describes as "formal," embodying centripetal qualities with their hierarchical stratification. The second, "informal" mode advances centrifugal qualities that disrupt hierarchical structures in socially emergent ways. As formal and informal modes of control interact within a democratic social system, discourses that "seem to weaken hierarchies of power may actually establish new channels through which those hierarchies can be strengthened, extended, and made more responsive to the complexities of modern social administration" (Spitzer, 1982, pp. 187-188). Accordingly, in addressing the democratization of online social spheres, it would be a mistake to highlight a presumed absence of discursive control. Instead it is important to acknowledge how control functions, both formally and informally.

Formal Control in Online Democracy

Democratic online venues are, in part, maintained by formal discursive control. There are many common instances of formal control in contemporary Internet life. Registration forms that are created and processed by centralized (usually institutional) website managers, for instance, require prospective users to provide their names, contact information, and other identifiers to gain access to the venue. Often, registrants are required to accept explicit terms and conditions. The contents of posts are filtered, either by moderators or automatically. Rules for conduct are stated, as are enforcement mechanisms, which range from message flagging to censorship to banishment. In short, formal control is usually obvious to participants, manifesting in "power-down" policies and actions that demand and enforce respect while constraining behavior.

Informal Control in Online Democracy

In roughly equal measure, informal control mechanisms also fulfill important functions in web-based democracies. Unlike formal control, which maintains social order authoritatively, informal enactments of control are essentially disruptive. They may directly undermine explicit authority, as do acts of spamming, flaming, hacking, and impersonation. They may also rewrite, reframe, or appropriate the online venue's content and norms to shift power away from the institution or privileged users. Informal control may be recognized in tagging and other XML-enabled tools that users apply to customize and order online content according to their own preferences.

But this disruption is not as chaotic, unregulated, and destructive as one might assume. If formal control is "top-down" then informal control is "bottom-up," manifesting what Foucault (1995) addresses in terms of a "panopticon"—an invisible mode of omniscience. Fostered online by the blurring of private and public identities within contexts that are rife with mutual voyeurism, panoptic omniscience compels participants to discipline not only each other, but also themselves. Barker (1999) describes the effect in organizational settings as "concertive control," through which team members in a "supervisorless culture" develop communicative patterns such as "informal hierarchies, particular power relationships, and team norms" (p. 13). In this negotiation there is both disruption and discipline—as well as the (re) construction of order. So informal control may be understood as emergent and participant-centered co-regulation.

THE DYNAMICS OF FORMAL AND INFORMAL CONTROL IN ONLINE DEMOCRACY: A CASE OF JUICYCAMPUS.COM

One specific case that offers an insightful view of how formal and informal kinds of control play out on the Internet is JuicyCampus.com, a website that aims to enable "online anonymous free speech on college campuses" (JuicyCampus.com, About Us). The website claims to provide a forum "where college students discuss the topics that interest them most, and in the manner that they deem most appropriate" (JuicyCampus.com, About Us) and promotes itself as the "world's premier college gossip site" that attracts "nearly one million unique visitors per month, while serving 500 campuses across the country" (JuicyCampus.com, Official Blog Announcements). Critics view the website as a gossip mill and compare it to "a dorm bathroom wall writ large, one that anyone with Internet access can read from and post to" (Morgan, 2008). However controversial it may occur to an outside observer, JuicyCampus.com represents a growing number of unmoderated online forums that promise anonymity to the users. The provision of general communicative guidelines coupled with the absence of gatekeeping and censorship-minded monitoring results in rich meta-discussions among participants about what kinds and styles of talk are appropriate. In the course of this site's interaction and meta-interaction, an illustration emerges of the carnival that is web-based democracy.

The Web as a Borderless System of Social Structures

JuicyCampus.com was founded in 2007 by Matt Ivester, a Duke University graduate who characterized the site as an attempt to cultivate "gossip 2.0" (cited in Morgan, 2008). The site does not require participants to register, and posts are anonymous. The site has spread to 500 college campuses in the U.S. and has been the center of a number of controversies with regard to its function and nature of participation. For the purposes of this analysis we focus on one of the most discussed JuicyCampus.com's threads, *The Yale Women's Center is Genius*, which as of March 2008 had generated 153 responses.

The Internet's borderlessness and carnivalesque qualities become apparent when one traces the emergence of this forum: a group of Yale students, members of the Zeta Psi fraternity, posed in front of the Yale Women's Center holding a sign reading, "We love Yale sluts" (Abrahamson, 2008). The photograph was uploaded on Facebook.com on January 16, 2008 and came to the attention of the Yale Women's Center members and the university community. On January 21 the Center declared an intention to pursue legal action (Abrahamson, 2008). On the same day, a blog posting appeared on IvyGateblog.com (O'Connor, 2008) that generated 216 responses from January 21 to February 28. On February 29 the forum's thread, entitled *The Yale Women's Center is Genius*, was posted on JuicyCampus.com with entries followed by the authors until March 16. The list of responses that have emerged or directed attention to this case is not meant to be exhaustive but rather an indication of the dynamic and hypertextual way in which discourse unfolds.

The discursive positions and moves of participation in all these social networks simultaneously invoke, reflect, co-opt, and control the Internet's carnivalesque potential and offer a macro-analytic glimpse of the centripetal and centrifugal forces that are generally at work in public online interaction. Participants' posts on JuicyCampus.com exemplify the range of potential discursive positions from which democratic talk can unfurl—with appeals to legal issues and ramifications, celebrations of freedom of expression and feminist ideology, references to sexual and gender politics, concerns about advertising and the economies of cyberspace, and, of course, frequent mention of netiquette rules and what constitutes appropriate discourse. It is to this exploration of the formal and informal enactments of control that we now turn.

Enactments of Formal Control

JuicyCampus.com's official policies straddle the legal and contextual. The site has an official policy outlining terms and conditions of use, an intellectual property policy, and a privacy policy. Although the site's *Privacy & Tracking Policy* page claims, "we do not track any information that can be used by us to identify you" (JuicyCampus.com, Privacy & Tracking Policy), the site managers have assisted police in identifying individuals who have made explicit threats (see, for example, Morgan, 2008). The site also has frequent announcements by the site managers that contextualize much of the more formal legal language, at times in contradictory ways. For example, the site outlines specific *Terms & Conditions* with regard to user conduct that also address defamation. However, on the *Frequently Asked Questions* page the site creators note: "Facts can be untrue. Opinions can be stupid, or ignorant, or mean-spirited, but they can't be untrue. And we believe everyone is entitled to their opinion" (JuicyCampus.com, Frequently Asked Questions). Site managers' specific announcements have tackled the issue of defamation (December 9, 2007; December 11, 2007); anonymity (December 9, 2007); use of real names of people being discussed (January 29, 2008); copyrighted material; the posting of contact information; spamming; and what constitutes "juicy," which the site founder says is *not hate* (February 29, 2008).

What is notable in reviewing these announcements is the celebration of the carnival—the recognition that online democracy's nature and form are contested and emergent. What is even more noteworthy is that it is the *institution* that enacts this celebration of carnival. As JuicyCampus.com (Official Blog Announcements, February 29, 2008) states, "Ultimately, JuicyCampus is created by our users, and we ask that you please take this responsibility seriously." So, at once the site managers are doing two things: advancing and maintaining formal control by inviting and permitting emergent and user-controlled discourse (invitation and permission being particular modes of control); and delimiting discourse in a way that protects themselves legally while defining the parameters of "juiciness."

Enactments of Informal Control

Anonymous users enact emergent and decentralized control in various ways throughout JuicyCampus.com's *The Yale Women's Center is Genius* discussion. Most basically, informal control is typified in users' ability to initiate discussion threads and reply without fear of monitoring, filtering, censorship, or expulsion. The important point about this is that, whereas users are liberated from formal oversight, they are subject to one another's responses. This cultivates a mode of discipline that emerges among participants, akin to Foucault's (1995) "panopticon" and Barker's (1999) "concertive control." Participants exercise discipline on issues ranging from who can participate, how they may appropriately do so, and why. Informal enactments of control are manifest in various strategies such as name-calling, threats, irony, caution, silencing, confrontation, and othering, among others (see Table 1):

Disciplining potentially defamatory talk (relating mostly to the Women's Center coordinator), participants argue from various positions that engender much more than just the legal perspec-

Table 1. Types of informal control

Participation issue	Strategy	Illustration of informal control
Who?	Name-calling	you a * get off the site. "impartial observer?" NEWSFLASH: everyone here is * invested. stop slowing the dialogue down. (3/4/08)
What?	Threat	the author of the other thread – "someone needs to * chase o-m till she cries" and the post on this thread of the same name - should be found, shamed, and lethally injected. how dare you speak of her? (2/29/08)
Where?	Caution	as a fan of the women's center: can we not talk about their strategies online, let alone on this site? FOR BLARINGLY OBVIOUS REASONS. (3/6/08)
When?	Irony	i just hate feminists and wrongly assumed it was safe to post at 5 a.m. because I wrongly assumed that they would be asleep. but now i see my mistake: they didn't have any sex so they couldn't fall asleep. (3/4/08)
Why?	Othering	i just wanted to express my opinion. I am not like any of you crazies. (3/4/08)

tive witnessed at the formal level of administrative control of the site (see Table 2):

Here we see the carnival's explosively disruptive potential as competing languages and perspectives struggle to frame the legitimacy of participation. We also see the attempts to control, rein in, redirect, and reframe the discussion's boundaries. The tension between formal (centripetal) and informal (centrifugal) modes of control is evident throughout the JuicyCampus.com site and the Yale Women's Center forum thread, and point to web-based democracy's inherent messiness. In these matters, there will be no "resolution." And, in these matters, as one participant observes, the carnival comes to life meta-discursively: "i love that the most discussed thread on juicycampus is about the women's center's attempt to destroy juicycampus" (3/4/08).

FUTURE TRENDS

As the Internet has emerged in popular use and evolved into Web 2.0, it has become less a medium for the sheer expression and transference of *information* and more a setting for *relationship-making*. Web-based interaction offers unlimited opportunities for organizing across geographic, demographic, and contextual boundaries, with ramifications for professional networking, po-

Table 2. Illustrations of informal control

What counts as defamation?	Illustration of informal control
Moral perspective	The * making these nasty comments about people should be thoroughly ashamed of themselves! (2/29/08)
Democratic perspective	these big anonymous sites make everybody forget that the people we are talking about are not public property, that their lives are not performed for our benefit, that the warriors are people too. * is as good a person as she is a warrior. let's make sure we remember that. (2/29/08)
Relational Perspective	WHY ARE ALL YOU PEOPLE SICKOS???? SHE IS MY * SISTER. I HAVE HELPED HER FIND TEDDY BEARS THAT SHE HAS LOST FOR YEARS. SHE IS * AWESOME. (3/2/08)
Public Domain Perspective	i am totally in awe of * and i became a feminist since arriving at yale because of two talks i went to at the women's center that she moderated... but she is a celebrity here. you shouldn't nipe at kids for talking about her because she is a public person, like a politician. we do have some right to talk about her as a person in a way that we dont have a right to talk about other people. (3/2/08)
Legal Perspective	dude, why are you mouthing off about girls on this thread? ITS LIKE SUICIDE. dumb *. everyone knows that they are planning to sue the site. EVERYONE knows that they have lawyers cuz of the frat stuff. EVERYONE knows that your * will get subpeonaed and EVERYONE will know who you are. (3/5/08)

litical action, friendships, romances, education, recreation, healthcare, and so on. One example of real but previously unforeseeable use of online interaction is *Naughtie Auties*, a resource center in the Second Life virtual venue where those with autism spectrum disorders can practice social interaction (Saidi, 2008). Theorists, researchers, and practitioners of web-based communication will increasingly have opportunities to engage these new relationship structures' discursive negotiations of control, and to recognize democracy when it occurs and assess its functions and sociologic consequences.

Internet scholars and users will also have increasing opportunities to consider how technological populism contributes to open and democratic discourse. It is noteworthy that means for producing and distributing visual, literary, musical, etc. creations are increasingly accessible. The result is that "authorship," broadly understood, is becoming less elite and more decentralized. It is now quite easy for amateurs to self-produce and distribute their art, ideas, and home videos, and to redefine "celebrity" in populistic terms via so-called "first-person media." As well, through Web 2.0-based technologies, lay people may co-opt, remix, and redistribute canonic pieces of art in ways that redefine authorship and ownership, problematizing notions of intellectual property. This wrangling between formal control mechanisms (e.g., copyright law) and insurgent, populistic inter-activities has everything to do with democracy, and will, in the future, be an important locus of concern.

Generally, the emergent democratization of online discourse is important to study and reflect upon since its social practices both influence and are influenced by life beyond "virtual" space. Democracy as a social order and even as a moral ideal is a historical phenomenon that has yet to be fully realized. It may be enacted in daily life, however imperfectly, throughout many contexts, spanning family, labor, education, entertainment, community, politics, etc. In a sense, participants in online venues that enable democratic interaction have opportunities to learn how to "do" democracy in effective and satisfying ways. There are particular procedures (e.g., deliberative decision making), responsibilities (e.g., shared leadership), and expectations of decorum (e.g., mutual respect, even in light of disagreement) that support effective democratic organizing. How democracy is practiced in online environment has great consequence for many dimensions of 21st century life, including citizenship (national, global, corporate, etc.), community building, resource management, innovation, and so on. In short, the Internet's new opportunities for experiencing and practicing democracy both reflect and contribute to the emerging democratization of broader social life.

CONCLUSION

The authors have approached online interaction as potentially democratic. The discussion's emphasis has not been upon democratic political interaction *per se*, but upon communicative practices of online democracy as they may be enacted in (and across) a wide range of online settings, such as blogs, wikis, and social networks. The definition of online democracy that we advance—a subtle and messy negotiation of control in which centripetal and centrifugal pushes and pulls more-or-less even out—is important for understanding how online contexts, potentially, are neither strictly controlled by their institutional creators/managers nor entirely disrupted by their "mobs" of users. This imperfect balance between formal and informal modes of discursive control ensures perpetual dynamism and innovation, as well as the promise that diverse voices are not only welcome but also potentially responsive and responsible.

Our intentions have been to recognize that, first, as in "real" life, so-called "virtual" interactions and relationships may take various organizational forms that range from anarchy to absolute control; and, second, that the Internet provides some new opportunities that are democratic in quality. It is important to pay attention to these opportunities since they demonstrate that the web's proclivities for decentralization and pluralism do not necessarily lead to relativistic and nihilistic hypertextuality but to potentially novel forms of shared social control. When formal and informal regulatory forces temper each other, there are consequences for the kinds of relationships and communities that interactants may forge. As participants in online venues increasingly engage in online democratic social structures, they may learn to relate on both substantive and meta-discursive levels in order to negotiate mutually recognized rules and resources. Such practice might have great consequence for broader social systems, and for the character of democracy throughout 21st century life.

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KEY TERMS AND DEFINITIONS

Carnival: A concept developed by Bakhtin (1984) that illustrates how people come together as a collective of equals and interact in a way that defies exogenous sociologic divisions. In the experience of carnival, there is an air of playfulness and multi-voicedness that invigorates participants' understandings of self and community.

Formal Discursive Control: Communicative currents within a social structure that are institutionally centralizing, and which impose and enforce regulations in a "top-down" manner that is typically explicit (e.g., codes of conduct). Formal control is manifested in what Bakhtin (1981) terms "centripetal" forces, which are authoritative, stabilizing, decisive, and preserving of traditions.

Informal Discursive Control: Communicative currents within a social structure that disrupt institutional authority and enable the negotiation of emergent norms in a "bottom-up" manner that is often implicit and subtle. Informal control is manifested in what Bakhtin (1981) terms "centrifugal" forces, which are insurgent, destabilizing, equivocally open-ended, and change-minded.

Online Democracy: The quasi-counterbalance of normalizing and destabilizing discursive forces; a subtle and messy negotiation of control in which centripetal and centrifugal pushes and pulls more-or-less even out.

Social Structure: A relational system that is both constrained and enabled by norms (beliefs, values, rules, and roles) that are made and remade in participants' interaction. Social structure is partly stable and partly dynamic; at once a thing and a process.

ENDNOTE

1 We use the Internet here to reference mostly the various examples of mediated networks including the World Wide Web and electronic mail, social and interactive spaces such as weblogs and wikis, and sharing media such as podcasts and social bookmarking tools rather than the technological infrastructure itself.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 404-416, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 7.12
Agent Cognitive Capabilities and Orders of Social Emergence

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ABSTRACT

This chapter critically examines our theoretical understanding of the dialectical relationship between emergent social structures and agent behaviors. While much has been written about emergence individually as a concept, and the use of simulation methods are being increasingly applied to the exploration of social behavior, the concept of "social emergence" remains ill defined. Furthermore, there has been little theoretical treatment or practical explorations of how both the range and type of emergent structures observed may change as agents are endowed with increasingly sophisticated cognitive abilities. While we are still a very long way from being able to build artificial agents with human-like cognitive capabilities, it would be timely to revisit the extent of the challenge and to see where recent advances in our understanding of higher order cognition leave us. This chapter provides a brief recount of the theory of emergence, considers recent contributions to thinking about orders of emergence, and unpacks these in terms of implied agent characteristics. Observations are made about the implications of alternative cognitive paradigms and the position is proposed that an enactivist view provides the most logical pathway to advancing our understanding. The chapter concludes by presenting an account of reflexive and non-reflexive modes of emergence, which incorporates this view.

DOI: 10.4018/978-1-60566-236-7.ch002

INTRODUCTION

Building and working with artificial societies using the methods of multi-agent social simulation serves us in several ways: 1) It allows us to operationalize social theories and to compare simulated behaviors with those observed in the real world; and 2) it allows us to build new theory by exploring the minimal mechanisms that might explain observed social behavior. Most importantly 3) it provides a unique ability to explore the interplay between levels of phenomena and to understand dynamic properties of systems. A great deal can and has been achieved in both these areas with even the simple methods we currently have available. However, Keith Sawyer (2003) has recently reminded us that, to date, we have worked with agents with very limited cognitive capability and that this necessarily limits the range and type of behavior which can be explored. This echoes a sentiment made a decade ago by Christiano Castelfranchi (1998a) that social simulation is not really *social* until it can provide an adequate account of the implication of feedback between macro and micro which becomes possible with higher cognitive functioning of social agents.

In many respects, developments in our capacity to simulate artificial societies have led us to confront anew a long-standing issue within social theory. This is a problem that social science conducted within traditional disciplinary boundaries has become quite adept at avoiding. Indeed it can be argued that the particular form disciplinary fragmentation takes in social science is a primary strategy for avoiding it. The problem is referred to in a number of ways depending on the disciplinary tradition. This chapter begins by revisiting this most important of problems. In terms of the challenge it poses to artificial societies it can be expressed in the following three questions:

1. What are the fundamental cognitive characteristics which distinguish human agents from animal or automaton?
2. How do these characteristics influence the range and type of behaviors agents may generate and the emergent structures which they may give rise to?
3. How can we theorize about the relationship between cognitive capability and categories of emergent form?

These questions form the focus for this chapter. We begin to address them by revisiting the contribution of alternative schools of thought to our understanding of the nature and origins of emergent structure and alternative concepts of orders of emergence. We then discuss the implications of the two competing cognitive paradigms within AI—that of cognitivism and the enactive view. Finally we turn to current research on the development of human cognition and examine its implications for anticipating different orders of emergent structure—proposing what we call reflexive and non-reflexive classes of emergence. Finally a research program for the advancement of understanding in this area is proposed.

This work has its origins in two strands of research with which the authors are currently involved. The first addresses the relationship between micro and macro levels of social behavior and organization directly. Over the past decade we have explored the characteristics of the micro-macro problem (see Chris Goldspink & Kay, 2003, 2004) in pursuit of a coherent and consistent account of the interpenetration (circular causality) between micro and macro phenomena. Our aim is to develop a theory which can provide a substantive account of fundamental social generative mechanisms. To date no such social theory exists that satisfactorily explains this dynamic.

The other strand is one author's involvement with the Centre for Research in Social Simulation and though it the European Union funded project titled Emergence in the Loop (EMIL). The aim of EMIL is to: a) provide a theoretical account of the mechanisms of normative self-regulation in a number of computer mediated communities b) specify the minimum cognitive processes agents require to behave in normative ways c) develop a simulator which can replicate the range and type of normative behavior identified by the empirical research so as to further deepen our understanding of how and under what conditions normative self-regulation is possible and the range and type of environmental factors which influence it.

A BRIEF RECOUNT OF THE THEORY OF EMERGENCE

The notion of emergence has a long history, having been invoked in a number of disciplines with varying degrees of centrality to the theoretical and methodological development of associated fields. Unfortunately the concept has largely remained opaque and ambiguous in its conceptualization, leading to the criticism that it stands as little more than a covering concept – used when no adequate account or explanation exists for some unexpected phenomena. Clayton has argued that the concept covers:

…a wide spectrum of ontological commitments. According to some the emergents are no more than patterns, with no causal powers of their own; for others they are substances in their own right… (Clayton, 2006: 14).

The origin of the concept has been attributed to George Henry Lewes who coined the term in 1875 (Ablowitz, 1939). It subsequently found wide adoption within the philosophy of science but more recently has been advanced within three distinct streams: *philosophy*, particularly of science and mind; *systems theory*, in particular complex systems; and *social science* where it has largely been referred to under the heading of the micro-macro link and/or the problem of structure and agency. Interestingly there has been relatively little cross fertilization of thinking between these streams.

The Contribution from Philosophy of Science

The philosophy of science and philosophy of mind stream is arguably the oldest – some date it back to Plato (Peterson, 2006) but the debate is widely seen as having come to focus with the British Emergentists (Eronen, 2004; Shrader, 2005; Stanford Encyclopaedia of Philosophy, 2006). This school sought to deal with the apparent qualitatively distinct properties associated with different phenomena (physical, chemical, biological, mental) in the context of the debate between mechanism and vitalism: the former being committed to Laplacian causal determinism and hence reductionism and the latter invoking 'non-physical' elements in order to explain the qualitative difference between organic and inorganic matter. This stream remains focused on explaining different properties of classes of natural phenomena and with the relationship between brains and minds (See Clayton & Davies, 2006 for a recent summary of the positions). As a consequence this has been the dominant stream within artificial intelligence. Peterson (2006: 695) summarizes the widely agreed characteristics of emergent phenomena within this stream as follows. Emergent entities:

1. Are characterized by higher-order descriptions (i.e. form a *hierarchy*).
2. Obey higher order *laws*.
3. Are characterized by *unpredictable novelty*.
4. Are *composed of* lower level entities, but lower level entities are *insufficient* to fully account for emergent entities (*irreducibility*).
5. May be capable of *top-down causation*.
6. Are characterized by *multiple realization or wild disjunction* (Fodor, 1974) (alternative micro-states may generate the same macro states).

A key concept within these discussions is that of *supervenience*: a specification of the 'loose' determinisms held to apply between levels such that *'…an entity cannot change at a higher level without also changing at a lower level'* (Sawyer, 2001: 556). Within this stream prominence of place is given to both downward and upward causation. Clayton and Davies (2006) specify downward causation as involving macro structures placing *constraint* on lower level processes hence *'Emergent entities provide the context in which local, bottom up causation takes place and is made possible'* (Peterson, 2006: 697). Davies (2006) argues that the mechanism of downward causation can usefully be considered in terms of boundaries. Novelty, he argues, may have its origin in a system being 'open'. If novel order emerges it must do so within the constraints of physics. He concludes:

…top-down talk refers not to vitalistic augmentation of known forces, but rather to the system harnessing existing forces for its own ends. The problem is to understand how this harnessing happens, not at the level of individual intermolecular interactions, but overall – as a coherent project. It appears that once a system is sufficiently complex, then new top down rules of causation emerge. (Davies 2006: 48).

For Davies then, top-down causation is associated with self-organization and may undergo qualitative transitions in form with increasing system complexity. For Davies also it is the 'openness' of some systems that 'provides room' for self-organizing process to arise, but he concludes, *'openness to the environment merely explains why there may be room for top-down causation; it tells us nothing about how that causation works.'* The devil then, is in the detail of the mechanisms specific to particular processes in particular contexts and particular phenomenal domains. Perhaps then a part of the problem with the concept is that it has been approached at too abstract a level.

The Contribution from Social Science

The micro-macro problem—the relationship between the actions of individuals and resulting social structures and the reciprocal constraint those structures place on individual agency—has long standing in social science as well as in philosophy. The problem is central to many social theories developed throughout the 19th and 20th century. Examples include: Marxian dialectical materialism (Engels, 1934) built upon by, among others, Vygotsky (1962) and Lyont'ev (1978); the social constructionism of Berger and Luckmann (1972); Gidden's structuration theory (1984); and the recent work of critical realists (Archer, 1998; Archer, Bhaskar, Ciollier, Lawson, & Norrie, 1998; Bhaskar, 1997, 1998). These alternative theories are frequently founded on differing assumptions, extending from the essentially objectivist/rationalist theory of Coleman (1994), through the critical theories of Habermas and to the radical constructivism of Luhmann (1990; 1995).

Fuchs & Hofkirchner (2005: 33) have recently suggested a four category schema for classifying social theory according to the ontological position adopted with respect to the micro-macro relationship. The majority of existing social theories, they argue, fall into one or other of two categories which they label *individualism* and *sociologism*. Neither of these 'paradigms' provides a theoretical foundation which supports exploration let alone the possibility of advancing understanding of the interplay between agency and structure, rather the problem is avoided by restricting analysis to one level or the other. A third category, *dualism*, while considering both aspects, insists on the adoption of a dichotomous stance and as a consequence does not support any understanding of the interplay between levels. Only those theories categorized as *dialectical* therefore have relevance. Even here, it is reasonable to conclude that little practical advance has been achieved, as most positions result in a straddling of bottom up and top-down arguments and/or suffer from excessively vague conceptualization. These theories also quickly break down into a dichotomy the moment an attempt is made to make them operational.

What has been largely agreed, despite the very different theoretical and often inadequate handling of this problem, is that structure and agency come together in *activity* or in *body-hood* – the specific psycho-motor state at the instant of enaction. Both Vygotsky and Giddens, for example, focus on action as the point of intersection between human agency and social structures and it is implicit in Bourdieu's *habitus* also.

The Contribution from Systems Theory

Systems language was clearly evident in the work of the early Emergentists and in a great deal of sociology and anthropology which took seriously the structure/agency problem – notably that of Margaret Mead and Gregory Bateson. However, 'systems' as a focus of systematic research arguably took form with von Bertalanffy's attempt to establish a General Systems Theory in 1950 (Bertalanffy, 1950; Bertalanffy_von, 1968). As the science of 'wholes' systems theory stands in contrast to reductionism's concern with parts. Systems theory was put forward as a counter to what was perceived as excessive reductionism dominating scientific discourse during much of the 20th century.

In the early stages of development of the theory systems tended to be modeled as 'black boxes' effectively masking the relationship between micro and macro elements. The application of the concept to social science, in particular through the development by Ernst von Glasersfeld and Heinz von Foerster (Keeney, 1987) of social cybernetics along with soft systems approaches (Checkland, 1988) provided a theoretical lens and methods useful for describing the systemic behavior of social systems. So while the aspiration of GSM to establish a general science of systems is generally regarded to have failed (Jackson, 2000), systems approaches have contributed valuable methods for the study of the interplay between levels in a social system. The Systems view of emergence was founded on:

- Holism; the whole is greater than the sum of its parts.
- A concern with *feedback both positive and negative*.
- A concern with boundaries and boundary conditions.

More recently the development of complex systems theory and its application to natural, social and cognitive phenomena has provided additional concepts upon which much current debate about emergence draws. Many of these concepts and methods have become widely used within the multi-agent modeling community (Castelfranchi, 1998b; Conte, Hegselmann, & Terna, 1997; Gilbert, 1995; Holland, 1998).

Within contemporary debate, and in contrast to the position taken by the British Emergentists who argued that irreducibility was the *exception* (Eronen, 2004), most real world systems are now argued to be non-linear (S. Kauffman, 2000; S. A. Kauffman, 1993, 1996; Stewart, 1990) and hence irreducible. It is non-linearity which contributes to these system's capacity for novelty and unpredictability through the presence of deterministic Chaos (Lorenz, 2001; Williams, 1997) and/or equifinality. Equifinality as it is known within systems theory, or the principle of 'wild disjunction' as it is known in philosophy, refers to a system where a single high level property may be realized by more than one set of micro-states which have no lawful relationship between them (Richardson, 2002a, 2002b; Sawyer, 2001). As there is no a-priori basis by which the likely micro state can be determined, such systems are irreducible and unpredictable in principle.

Observations

The concept of emergence has led to the establishment of a number of general principles which describe the relationship between micro and macro phenomena, as well as some methods and techniques for identifying and exploring it. Specifically, we can conclude that there are systems which are:

- Inherently analytically reducible (to which the concept of emergence does not apply);
- Analytically reducible in principle but difficult to reduce in practice and/or where an advance in science/knowledge is needed for reduction to be possible because the results were 'unexpected' (Chalmers, 2006) (to which the concept of 'weak' emergence can be applied);
- Not reducible in principle (to which the principle of 'strong' emergence is relevant).

We argue that all living systems and all social systems belong to the latter class. Accordingly we agree with McKelvey (1997) that a great deal of social order may be attributable to complex organization involving non-liner relations between elements. It is for this reason that simulation methods are regarded as important but only to the extent that we can construct artificial societies which are reasonable analogues of the social systems we want to understand and this implies agent architectures which are capable of generating the range of social behaviors/structures of interest. The problem here is that we still have a very rudimentary understanding of what cognitive capabilities support or are necessary for what range and types of social structures.

In the following section we draw on the limited prior attention given to this problem and attempt to clarify what is currently known. Throughout the discussion, pointers are provided to where the mechanisms being outlined have, at least in part, been incorporated into computer simulations of artificial intelligence or artificial societies.

ORDERS OF EMERGENCE

A number of authors have identified what they refer to as orders of emergence. Gilbert, for example distinguishes between first and second order emergence. First order emergence includes macro structures which arise from local interactions between agents of limited cognitive range (particles, fluids, reflex action). By contrast, second order emergence is argued to arise *'where agents recognise emergent phenomena, such as societies, clubs, formal organizations, institutions, localities and so on where the fact that you are a member or a non-member, changes the rules of interaction between you and other agents.'* (Gilbert, 2002). This reflects high order cognition on the part of the agent. In particular it reflects a range of capabilities including but not limited to the ability to distinguish class characteristics; assess 'self' for conformity with class characteristics and/or signals from other agents which suggest acceptance or belonging; the ability to change rule associations and behavior as a function of these changes. First and second order emergence then each imply qualitatively distinct mechanisms and suggest a continuum of orders of emergence linked, in biological entities at least, to cognitive capability.

In a similar vein, Castelfranchi (1998a: 27) has distinguished what he refers to as cognitive emergence. *'Cognitive emergence occurs where agents become aware, through a given 'conceptualization' of a certain 'objective' pre-cognitive (unknown and non deliberated) phenomenon that is influencing their results and outcomes, and then, indirectly, their actions.'* This approach is based on a first generation AI (Franklin, 1998) approach to conceptualizing agents: agent cognition is assumed to involve acting on beliefs desires and intentions (BDI). Thus Castelfranchi conceives of a feedback path from macro pattern to micro behavior in much the same way as Gilbert, except that here a cognitive mechanism is specified. Castelfranchi argues that this mechanism has a significant effect on emergence and indeed *'characterises the theory of social dynamics'* – that is, it gives rise to a distinct class of emergent phenomena. In this account, the representations agents have about the beliefs, desires and intentions of other agents plays a causal role in their subsequent behavior and therefore shapes the structures they participate in generating. In this same chapter Castelfranchi argues that understanding this process is fundamental to social simulation: it is where social simulation can make its greatest contribution.

These ideas are more comprehensively reflected in the five orders of emergence suggested by Ellis (2006:99-101). These are:

1. Bottom up leading to higher level generic properties (examples include the properties of gases, liquids and solids)
2. Bottom up action plus boundary conditions leading to higher level structures (e.g. convection cells, sand piles, cellular automata)
3. Bottom up action leading to feedback and control at various levels leading to meaningful top down action - teleonomy (e.g. living cells, multi-cellular organisms with 'instinctive' – phylogenetically determined reactive capability)
4. as per 3 but with the addition of explicit goals related to memory, influence by specific events in the individuals history (i.e. learning)
5. In addition to 4 some goals are explicitly expressed in language (humans).

Ellis's framework makes clear that the range and type of emergence possible in a system depends fundamentally on the range and class of behavior agents are able to generate and that this varies depending on the properties of the agent.

If we consider Ellis' category one emergence, it is apparent that particles have fixed properties and are able to enter into a limited range of interactions (specified by physical laws) based on those properties. Swarms of particles can nevertheless demonstrate some rudimentary self-organization and hence emergence (Kennedy & Eberhart, 2001). Physics has furnished good accounts of many specific examples (Gell-Mann, 1995) but they have limited implication for our understanding of social behavior.

Category two has also recently been well explored as it is the focus of complexity theorists. Examples include the work of Per Bak (1996) on sand piles and earthquakes, Lorenz (2001) on weather systems and Prigogine (1997; 1985) on far from equilibrium systems. Many so called social simulations also belonging here– specifically those which incorporate agents which have fixed behaviors and no capacity for learning (individual or social). These include classic simulations based on swarms (Boids) and/or involving fixed decision criteria or rules such Schelling's segregation model, the cooperation models of Axelrod (1984) or the Sugarscape models of Epstein and Axtell (1996). Some may argue that these models involve agents with goals and therefore represent examples of fourth order emergence. The transition between 3rd order and fourth, as will be argued below, involves a move to agent autonomy that is missing in these models: their goals are designed in and not a result of their own operation it is for this reason that we argue they belong to order two.

It is significant that Ellis provides primarily biological examples for his category three order of emergence. The paradigmatic biological entity which illustrates the processes of reciprocal micro-macro causality and for which we have an excellent description which has been made operational both in vitro and in silico (see for example McMullin & Grob, 2001; F. Varela, Maturana, & Uribe, 1974) is the cell. While the mechanisms of autocatalysis and the metabolic pathways of cell self-production are well known, well documented and closely studied, the most concise articulation of the fundamental processes involved come with the theory of autopoiesis developed by the theoretical biologists Humberto Maturana and Francisco Varela (H. Maturana & Varela, 1980; H. R. Maturana & Varela, 1992; F. Varela, 1979; F. Varela et al., 1974). Unfortunately this account is not widely appreciated even within biology itself[1]. Varela (1997: 78) states:

Autopoiesis is a prime example of a …dialectics between the local component levels and the global whole, linked together in reciprocal relation through the requirement of constitution of an entity that self-separates from its background.

The theory of autopoiesis provides a foundation for understanding other emergent processes, particularly those associated with biological entities. The originating authors themselves extended it to cover multi-cellular entities and to provide a more general theory of cognition. Others have gone so far as to argue that it furnishes a theory of society and/or organization (Niklas Luhmann, 1995; von_Krogh & Roos, 1995; Zeleny, 1991) although this remains controversial (Bednarz, 1988; Mingers, 2002, 2004) and we specifically reject it as incompatible with the original concept and as unnecessary (Goldspink, 2000; Kay, 1999).

Unlike the self-organizing processes which characterize the second order, the defining characteristic of biological self-organization is the attainment of 'strong autonomy' (Rocha, 1998). While Ellis does not say so directly, it would appear that it is the advent of a self-referential operational closure which demarcates third and higher orders of emergence from the lower orders.

Maturana and Varela argue that cognition is associated with this operational closure or autonomy. Autonomy is used here to refer to a *constitutive* process rather than as a *categorical* distinction and cognition is defined as the range of behaviors the agents can generate to remain *viable* or *to retain its identity* as a self-constituting agent (Froesea, Virgo, & Izquierdo, 2007; Thompson & Varela, 2001). For those immersed in symbolic AI it may come as a surprise that a biological cell may thus be described as a cognitive entity. This theme will be developed further in a following section as it is central to the idea of enactive cognition finding increasing uptake within second generation AI, artificial life and robotics (Barandiaran, 2005; Di Paolo & Lizuka, 2007; Di Paolo, Rohde, & De Jaegher, 2007; Moreno & Etxeberria, 1995; Moreno, Umerez, & Ibanes, 1997).

In his third order category Ellis includes a range of capabilities of biological entities up to and including 'instinctive' action. These suggest that this category would pertain to single and multicellular organisms including those with a central nervous system. It may be that this order is too broadly cast. Multi-cellularity is arguably another threshold point as differentiated aggregates of cells display greater capacity to respond to their environment, even where they do not possess a central nervous system, than do individual cells. Furthermore those with a central nervous system enjoy even greater behavioral flexibility. As a consequence each probably originates a distinct macro phenomenology different from that of the cells that constitute them (H. R. Maturana & Varela, 1992).

The primary point of distinction between order three and order four would appear to be between (phylogenetically) fixed individual characteristics and a capacity for an individual agent to have goals and to learn. The mechanisms by which these characteristics are acquired and fixed at the level of individuals (sexual transmission and natural selection) are ignored by Ellis or seen as unimportant from the perspective of emergence. This is reasonable if our concern is with social behavior which manifests over relatively short time cycles in geological terms. When does a capacity to adjust structure in response to an environment as implied by the characteristics of Ellis' third order become the learning ability associated with the forth order?

Ellis explicitly demarcates the goal directedness of the fourth order from apparent goals implied in the teleonomic operation of living things implicit in the third. We must therefore assume he means active goal-setting: the exercise of what we commonly refer to as agency or free will. Agency results from the vastly expanded behavioral plasticity available when an organism develops an advanced nervous system. Also, to learn an agent must have some form of memory. Memory too is generally associated with the existence of a central nervous system and is often seen as involving stored representations. But the idea of 'representations' is highly problematic from a biological point of view. What is it that is represented and how? We consider this problem in the next section.

Ellis would seem to be pointing to a category here which deals with non-human animals but the transition points are not well defined from the perspective of mechanisms of emergence. Learning in animals can stretch from simple operant conditioning to complex evaluative processes involving logical reflexion. Different stages along this continuum would appear to support significantly different forms of emergent structure. Ellis makes no distinction, for example, between individual and social learning.

Ellis marks his final transition from category four to category five by moving from simple learning capability to the capacity for language. Animals such as apes have rudimentary language ability – are they included in here or is this category the human catch-all category? Unfortunately the more closely we look at the jump between fourth and fifth order the more it resembles an abyss.

There has been a considerable research effort directed at understanding the origins and developmental phases associated with the attainment of the distinctive human cognitive capabilities. These are the capabilities which seem to relate to the transition between Ellis' category four and five orders of emergence. Much of this has drawn on comparative neurology, and sociological and psychological study of non-human animals, in particular apes. Insights are available also from developmental psychology and neurology directed at understanding human ontogeny: the phases of development from infant to adult. Note that these may overlap as phylogenetically determined capabilities characteristic of some animals may correspond to early stages of human ontogenetic development. This corpus offers those of us involved with AI two opportunities a) a capacity to aim to better stage the development of agent specifications - aiming to provide a reasonable model for simple intelligence before the more complex and b) a capacity, even before we can effectively model or simulate more advanced intelligence, to theorize about the implications it may have for emergence of social structure.

Some work has already been undertaken in this area, most notably in the area of robotics rather than computer simulation of social phenomena (although robots can be regarded as physical simulations and multi-agent software simulations as simulated robotics). Of particular note here is the work of Dautenhahn (2001; 2002), Bryson (2007; n.d) and Steels (1997; 2005; 1999) in the area of language.

Gardenfors (2006) identifies the following as needing to be explained (presented in order of their apparent evolution).

- Sensations
- Attention
- Emotions
- Memory
- Thought and imagination
- Planning
- Self-consciousness/theory of mind
- Free-will
- Language

These are present to varying degrees in different organisms and develop at different stages in humans as they develop from infancy to adulthood. The degree of interrelatedness is not, however, straight forward. Apes for example demonstrate self-awareness and theory of mind but do both without language whereas in humans language appears to play a significant role in both. For the time being then too little is known about these transitions.

It is perhaps in understanding these transitions that we find the greatest challenges for advancing artificial societies and it is here that we find philosophy may have dealt us an unhelpful turn. The advent of the central nervous system and the observation that cognitive function is correlated with brain size has contributed to a distinctive account of the function of brain and its relationship to mind (Johnson, 1990; Lakoff & Johnson, 1999). In this convention, mind and hence cognition has been argued to originate in brains and to involve symbol manipulation. As we consider the literature on what makes human cognition distinctive, we need to be mindful of the effect of this and alternative paradigms. What are these alternatives and what difference do they make to our understanding of orders of emergence in general and social emergence in particular?

TWO PARADIGMS: TWO POSSIBLE APPROACHES

Within AI there are two alternative and some argue antithetical paradigms of cognition – symbolic and connectionist. Symbolic AI assumes that it is possible to model every general intelligence using a suitable symbol system and that intelligence involves symbol manipulation (Franklin, 1998).

In their book *The Embodied Mind*, Varela & Rosch (1992) state:

The central intuition … is that intelligence—human intelligence included—so resembles computation in its essential characteristics that cognition can actually be defined as computations of symbolic representations (F. Varela, Thompson, & Rosch, 1992: 40).

The symbolic approach inevitably constructs a duality. The environment is experienced as a facticity and acted upon directly, but is also conceived and symbolically represented in the mind. Mind and behaviour are linked as hypothesis and experiment. The mind looks for patterns in representations and tests the degree to which these accord with the outside world.

More recently, this tradition has been challenged. The advent of complexity theory has given greater impetus to connectionist models of mind such as neural networks. Here emergent structure or pattern arises from massively interconnected webs of active agents. Applied to the brain, Varela et al state:

The brain is thus a highly cooperative system: the dense interconnections amongst its components entail that eventually everything going on will be a function of what all the other components are doing (1992: 94).

It is important to note that no symbols are invoked or required by this model. Meaning is embodied in fine-grained structure and pattern throughout the network. Unlike symbolic systems, connectionist approaches can derive pattern and meaning by mapping a referent situation in many different (and context dependent) ways. Meaning in connectionist models is embodied by the overall state of the system in its context. It is implicit in the overall 'performance in some domainre'. Herein lays its major problem from the perspective of multi-agent simulation. In connectionist models the micro-states which support a given macro state is opaque – relatively inaccessible to an observer and difficult to interpret – indeed, there will often be several or many micro configurations compatible with a given macro-state (Richardson, 2002b). Several attempts have been made to address this problem. The first was to consider hybrid systems in an attempt to gain the advantage of each (Khosla & Dillon, 1998). The second has been to find a middle ground. This is apparent for example in Gardenfors' theory of conceptual spaces (Gardenfors, 2004). At the same time the practical value of connectionist systems – their capacity to categorize contexts or situations in a non-brittle way– has been seen as a significant advantage in robotics (Brooks, 1991).

Back in 1992 Varela et al noted that:

…an important and pervasive shift is beginning to take place in cognitive science under the very influence of its own research. This shift requires that we move away from the idea of the world as independent and extrinsic to the idea of a world as inseparable from the structure of [mental] processes of self modification. This change in stance does not express a mere philosophical preference; it reflects the necessity of understanding cognitive systems not on the basis of their input and output relationships but by their operational closure (1992: 139).

They go on to argue that connectionist approaches, while an advance on cognitivism are not consistent with an approach which views biological agents as operationally closed in that *'…the results of its processes are those processes themselves'* (1992, p. 139). They assert:

Such systems do not operate by representation. Instead of representing an independent world, they enact a world as a domain of distinctions that is inseparable from the structure embodied by the cognitive system (1992: 140).

These authors argue for an approach of cognition as 'enaction', an intertwining of experience and conceptualization which results from the structural coupling of an autonomous organism and its environment. Autopoietic theory provided a concrete and operationalizable account of the intertwining of micro and macro at the level of the cell. The enactive theory of cognition goes some way towards providing a basis for understanding this process in multi-cellular animals. Enactive cognition is currently enjoying significant attention and hence conceptual extension as well as experimental grounding in the field of robotics (see for example De Jaegher & Di Paolo, 2007; Di Paolo et al., 2007; Metta, Vernon, & Sandini, 2005). The attraction here is pragmatic – it helps to address longstanding problems within robotics, in particular the problem of symbol grounding (Harnad, 1990). To date it has seen little uptake within social simulation. The implications of enaction go well beyond pragmatics however.

The enactive turn in AI has as an explicit target a resolution of the micro-macro problem. While symbolic AI assumes the existence of an objective independent world and a mental model with some correspondence to the real world, enaction dispenses with this dichotomy. As an autonomous entity, the cognizing agent is concerned only to maintain its viability in an environment. It adjusts its structure to accommodate perturbation from the environment (which includes other cognitive agents) in order to do so. Advanced nervous systems and capabilities such as language simply extend the requisite variety available to the agent extending the range and type of environmental perturbations it can survive. As agents and environments structurally couple they co-determine one another to 'satisfice' the conditions for mutual viability. From this perspective, the importance of environment recedes from determinant to constraint. Intelligence moves from problem solving capacity to flexibility to enter into and engage with a shared world. However, McGee (2005a; 2005b) has recently argued that despite its promise, enactive cognition is not yet sufficiently well articulated to 'speak of hypothetical mechanisms'. The limiting factor here would appear to be as much one of insufficient application as theoretical difficulty. In the final section we attempt a definition of two classes of emergence which we call reflexive and non-reflexive. These draw on the enactive paradigm and attempt to provide a concrete specification of the mechanisms which underlay each.

TOWARDS AN ENACTIVE SPECIFICATION OF ASPECTS OF COGNITION AND THEIR ASSOCIATED ORDERS OF EMERGENCE

How then do we advance our understanding of the effect of different cognitive capability on orders of emergence? A useful strategy may be to simplify the problem. By way of a mental exercise we will take simple extremes and recast the problem in terms of an enactive view. From an enactive position the critical phases of cognitive development appear to be as follows:

- Autonomy (operational closure)
- Structural Coupling
- Reflexivity/self consciousness
- Language/consensual domains

All living beings (from amoeba to humans) are distinguished by autonomy and as autonomous entities they necessarily enter into structural coupling with their environment. We take this as one pole of the continuum and identify the class of emergence which it can support as non-reflexive. This is the enactive equivalent to social order which is a product of emergence *without* the feedback loop from macro to micro which Castelfranchi (1998a) refers to as immergence. The mechanisms are, however, more sophisticated than are currently modeled in Artificial Societies as they involve autonomous agents – these are essentially what Ellis refers to in his category four – i.e. biological agents which can change their structure (learn) in response to environmental perturbation. It should be feasible to simulate this type of agent with current technology or at least to achieve a close proxy although we have not yet managed to do so beyond the most basic chemical system analogues of cell autopoiesis. If we were to achieve it how might we describe the system operation?

Non-Reflexive Social Emergence

Non-reflexive emergence arises from the mechanism of structural coupling between operationally closed (autonomous) agents. Structural coupling will arise between such agents which have sufficient cognitive range (behavioral repertoire) when they are located in a common environment. Assuming that their phylogeny and ontogeny is such that they can co-exist, through the process of recurrent mutual perturbation, each will adjust its structure so as to accommodate the other – their structures will become mutually aligned or structurally coupled. This process has been approximated in a simulation by Stoica-Kluver and Kluver (2006).

An observer may notice regularities in the resulting patterns of interaction and these may be labeled as 'norms' for example although Castelfranchi would refer to them as social functions as they 'work without being understood'. These patterns represent mutual accommodations, and an observer might attribute to those accommodations some social 'function'. The accommodations an agent makes to remain viable in one domain of interaction will need to be reconciled (within its body-hood) against accommodations being made (simultaneously) as it also participates with different agents in other domain/s in which it is simultaneously participating – agency and structure converge and are both instantiated at the point of enaction. The accommodations made will be those that allow the agent to remain viable and to maintain its organization (i.e. which 'satisfice' the constraints and allow conservation of identity) based on its unique ontogeny (structure resulting from its history of interactions in a variety of domains including the current one).

Here the emergent structure can be seen to be 'in' (i.e. internalized within its own cognitive structure) each agent to the extent that each has had to make structural adjustments to operate in the shared domain. The structural adjustment each needs to make in order to persist will, however, be unique. In other words the structural accommodations each has made in order to contribute to the patterns, will *not* be the same. The structure, then, can also be regarded as 'in' the network, as it is the intersection of these disparate agent structures which gives it its particular form at a particular time. As any agent could leave the domain and have minimal effect on the resulting pattern, each agent's 'contribution' will be relatively small. The pattern can be thought about as like a hologram. The whole is in every part (agent) such that removal of parts (agents) reduces the resolution (coherence) but does not constitute loss of overall pattern. However, the loss of too many components may reduce the coupling to the point that the existing pattern de-coheres and transforms into something different. Each agent contributes to the pattern formation, so it is conceivable that the pattern will only be realized with some critical minimal number of agents present which have had a sufficient mutual history to have aligned their structures.

In natural systems, the local level interactions between agents are constrained by the existing structures of the agents and the state of their environment. With biological agents the system is open in that any emergent structure is possible as long as it remains consistent with the biological viability of the agents as living (autopoietic) entities. This biological constraint includes limits to environmental conditions conducive to life (i.e. not too hot or too cold, the need for energy, limitations to sensory channels, channel bandwidths and affective/psychomotor response capabilities etc). These are primarily a product of phylogeny (the evolutionary history of the organism at the level of the species) rather than ontogeny (the history of development at the level of the individual), and are therefore slow to change and not under the control of the emergent social system. As a consequence the basic dimensionality of the phase space of the social system does not change over the time frame of interest for understanding social systems. The dimensionality of the phase space is determined by the dimensions of variability possible by individuals – i.e. the plasticity of their nervous systems and by higher order dimensions which emerge from their interaction.

Reflexive Social Emergence

What changes if we now jump to the opposite pole on our hypothetical continuum? Here we attempt to outline the difference made by agents which are self aware and which can interact in language.

Biological agent's sensory surfaces are selected to be sensitive to difference in dimension of their world relevant to their survival and their cognitive apparatus is thus geared to make distinctions relevant to maintaining their viability in past environments. Once cognitive complexity exceeds a critical threshold (Gardenfors, 2006) these distinctions can be represented in language. Maturana and Varela (1980) describe language as involving the co-ordination of the co-ordination of actions – i.e. language provides a meta process by which agents orientate themselves within a world. Structural coupling can arise purely through behavioral coordination of action (as discussed above), but it can also take place in and through linguistic exchange – the mutual co-ordination of co-ordination of behaviors. This gives rise to a consensual linguistic domain characterized by a more or less shared lexicon. This process has been simulated using both shared referents and simple structural coupling in the absence of objective referents (Gong, Ke, Minett, & Wang, 2004; Hutchins & Hazlehurst, 1995; Steels, 1997, 1998; Steels, 2005; Steels & Kaplan, 1998; Steels & Kaplan, 1999), as has the emergence of a rudimentary grammar (Howell & Becker, n.d; Vogt, n.d).

The advent of language radically increases the behavioral plasticity of agents and has significant implications for the dimensionality of the phase space and of the resulting higher order structures it can generate and support. This is because language makes possible the emergence of domains of interaction which can themselves become the target for further linguistic distinction and hence new domains. In other words, language allows the agent to make distinctions on prior distinctions (to language about its prior language or to build further abstractions on prior abstractions). This supports the possibility of infinite recursion and infinite branching (there are no doubt biological constraints on this in humans). This is an intrinsically social process. Furthermore, a capacity to distinguish (label or categorize) processes supports reification and this simplifies the cognitive handling of processual phenomena and allows the resulting reifications to be treated by the agent in the same manner as material objects.

These capabilities greatly expand the structural flexibility of the agents: they can now invent shared epistemic worlds. The phase space of agent cognition is now based primarily on constraints of ontogeny rather than phylogeny and is hence under the influence of the agent/s.

Language makes possible a further major qualitative difference in natural and human social emergence. Humans (and possibly some other primates, cetaceans and elephants)[2] have developed sufficient cognitive capacity to become self-aware and as such exhibit reflexive behavior. This occurs when the agent is capable of distinguishing 'self' and 'other' i.e. the agent can entertain the notion of 'I' as a concept and treat that concept as an object. The advent of this capacity for reflexive identity also supposes the existence of a range of conceptual operators that act on identity – identity construction and maintenance becomes a part of the agent's world creation. Exploration of this process is proceeding under the title of Neurophenomenology (Rudrauf, Lutz, Cosmelli, Lachaux, & Le Van Quyen, 2003; Thompson & Varela, 2001).

In other words, agents can now notice the patterns that arise as they interact with others and distinguish those patterns in language. Such a mechanism would be the enactive equivalent to Castelfranchi's (1998a) Cognitive Emergence. Here a reflexive agent can notice an emergent pattern of social behavior and explicitly denote it as a 'norm' for example. While this denotation may be idiosyncratic (i.e. based on the necessarily limited perception of the individual agent), the agent can nonetheless act on the basis of this denotation. Once distinguished and reified within a domain, agents can decide (on the basis of rational as well as value based or emotional criteria) how to respond – they can choose to ignore the norm or to behave in ways they believe will limit the reoccurrence of the behaviors that are outside the agreed/shared patterns of the group. Once a pattern has been distinguished in language it can make the transition to a rule: a formally stated, linguistically explicit requirement with stated conditionals and possible resources to maintain it. This suggests that an agent can form hypotheses about the relationship between a macro structural aspect of the social system in which it is a participant and then act on that hypothesis, potentially changing the structure which it participates in generating. This gives rise to a feedback path between macro and micro phenomena that is not present in any other natural phenomena.

Consistent with Castelfranchi's claim, agents possessing this cognitive complexity form the components of a social system which would exhibit a distinct class of emergence. From the emergent perspective this is argued on the basis that reflexive agents will display qualitatively different behaviors from non-reflexive through the ability to modify their own sets of behavioral change triggers. For agents which have linguistic capability, the two processes (linguistic and non-linguistic) intertwine or even become one and would not be able to be empirically disentangled. Their respective influences will only be able to be examined through simulations or by comparing agents with different (phylogenetic) capabilities (i.e. different species) and this sets some interesting methodological challenges.

The Role of the Observer

Another significant implication of the relationships described above is the observer dependant nature of emergence in social systems. In human social systems every agent is an observer and it is the process of observation and the associated distinction-making which is the reflexive engine of emergence. In natural systems, the agents of the system are unable to observe and distinguish linguistically or to distinguish external structures as separate from themselves hence the process of observation has no impact on the dynamics of the system or the way in which emergence takes place. To some extent we can see an acknowledgement of this effect in methodological discussions within ethnography, action research (Carr & Kemmis, 1986) and grounded theory (Corbin & Strauss, 1990). In each of these methodologies the impact of the researcher on the social system under study is acknowledged and seen as part of the process. The view being proposed here is that any agent that becomes a part of the system being observed has the potential to influence that system. An agent can become a part of the system simply by being itself observed or conceived as observing by those who constitute the system. In other words, the effect of the entry of a new observing agent is to change the system boundary so as to include that agent. The boundary is itself an entity of ambiguous status – it is an epistemic distinction albeit one based on potentially ontological markers. In most social theory, positing the observer as a necessary part of the system removes any ontological privilege and threatens either infinite recursion or paradox. Based on the position advocated here, a degree of both may well be fundamental to the type of system being described (Hofstadter, 2007).

Implications for Emergence

Complex systems of all kinds demonstrate a capacity to give rise to complex macro patterns as a result of local interactions between agents in highly connected webs. This local interaction can often be characterized as involving some signaling between agents. As we have seen above, in human social systems, this signaling behavior takes on a qualitatively different form. This has three key implications for our understanding of emergence that to date have largely been ignored by the literature.

1. **Social systems will display an increased range of emergent possibilities:** The reflexive nature of social systems implies that a greater range of emergent structures should be expected and they will be subject to more rapid change.
2. **Dimensions of phase space are non-constant:** As the agents in the social system define and redefine the phase space as a function of their reflexive distinctions they will create and change the dimensions of that phase space, in order to support their own viability in that space.
3. **Phase space comes under control of the system and is dynamic:** The dimensionality of the phase space associated with ontogenetic parameters is derived through the self-distinguishing characteristics of the agents and can be influenced by their situated behavior. Significantly the feedback path between macro and micro would add significant non-linearity to the system and it becomes important to identify and explain order producing mechanisms within the network.

CONCLUSION AND FUTURE DIRECTIONS

In this chapter we have attempted to provide an operational specification of the gap implicit in Ellis' fourth and fifth order emergence. In a sense we have demarcated the extremes using the lens of enactive cognition. Enactive cognition was selected as it provides a theoretical underpinning which avoids the dualism inherent in symbolic systems and the confusion of fundamental processes which results from this. It has been argued to be both theoretically better capable of capturing the essential mechanisms and of providing a practical way of avoiding the now well documented pitfalls of symbolic AI. From this perspective the first challenge that must be addressed to advance social simulation is to achieve some form or proxy of constitutive autonomy in our multi-agent models. Significant work is currently underway on this problem in robotics but there have been few systematic attempts within social simulation.

Once this has been achieved we then need to model autonomous closure in linguistic systems. We would seem to be a very long way from this at present. It may be possible however to achieve this first in some abstract domain – simulating perhaps Luhmann's self-referential systems of communicative acts. This is probably unlikely however.

In our sketching out the extremes many questions remain about what might lay in the middle. This middle includes very significant phases of human cognitive development – including theory of mind and narrative intelligence. There can be no doubt that these will support qualitatively distinct classes of emergent social phenomena. There is evidence from the study of apes that forms of these cognitive capabilities do not require language. These may be much more accessible to our still limited capacity to simulate than the human equivalents which appear to intertwine with linguistic capability. We probably have much to learn then from the study of primate communities and from research into cognition in species other than humans. At present these attract considerably less attention within the social simulation community and perhaps this is a mistake. We have learned a lot from ants – how much more from apes? Robotics also appears well equipped to incorporate the insights coming from situated, embodied and enactive cognition. It s more difficult to see how embodied proxies may be incorporated into multi-agent simulations but no doubt there are ways. Such systems will doubtless need to be able to bootstrap some level of operational closure and it will be behavior within the self-determining boundary that – free from the inevitable teleological hand of the designer can reveal insights into how we humans do what we seem to do so effortlessly – construct social worlds in which we can live viable and interesting lives.

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ENDNOTES

[1] Quite why this should be the case is not clear. It does challenge the dominant paradigm within molecular biology and may have been displaced by the apparent potential offered by genomics (Oyama, 2000). It may also be that its implications are most significant outside of the biology discipline.

[2] It is important to note that we can infer the existence of threshold effects here but cannot precisely specify the critical points of complexity at which self-awareness and language becomes possible. The ability for language is of course evident in species other than humans, but the degree to which their linguistic plasticity involves or enables reflexivity in the system is a subject for further research.

This work was previously published in Handbook of Research on Agent-Based Societies: Social and Cultural Interactions, edited by G. Trajkovski; S. Collins, pp. 17-34, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.13
Social and Distributed Cognition in Collaborative Learning Contexts

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ABSTRACT

Technological artifacts such as computers and mobile electronic devices have dramatically increased our learning interactions with machines. Coupled with the increasingly different forms of collaborative learning situations, our contemporary learning environments have become more complex and interconnected in today's information age. How do we understand the learning and collaborative processes in such environments? How do members receive, analyze, synthesize, and propagate information in crowded systems? How do we investigate the collaborative processes in an increasingly sophisticated learning environment? What is collaboration in the current technological age? This chapter, using the conceptual framework of distributed and social cognition, will seek to answer these questions. It will describe the current perspectives on social and distributed cognition in the context of learning, and examine how these theories can inform the processes of collaborative learning with computers. The chapter will conclude with implications to our learning environments today.

DOI: 10.4018/978-1-60566-106-3.ch020

INTRODUCTION

At the heart of educational psychology, is the search for a deeper and broader understanding on how learners acquire knowledge that is realistic and ecologically valid. The pervasiveness of, and increasing reliance on, electronic devices is challenging and transforming the way learners obtain, store and share information. Collaborative learning has also taken new levels of meaning and practice with these ubiquitous digital devices. Snapshots of typical learning situations see a learner accessing a personal digital assistant while listening to a lecture; another sees a learner sending text messages or surfing the Internet while talking to a peer. Collaborative learning is no longer content with just face-to-face group discussion confined within four walls or supported by the computer only. Contemporary collaborative learning environments are becoming more complex.

Evidently, today's collaborative learning environments are vastly different from the past and there is a need to understand them for classroom design, as well as to enrich educational psychology. How do we understand the learning processes and cognitive activity in such environments? How do learners collaborate in an ever crowded cognitive system? Is there a theoretical framework where we can begin to appreciate and study this increasingly sophisticated learning environment? How do the current perspectives on social cognition and educational psychology inform us in our understanding of this phenomenon? This chapter will attempt to answer these questions by discussing the current perspectives on social cognition, describing distributed cognition as a framework and drawing some implications for studying today's learning environments.

WHAT ARE LEARNING ENVIRONMENTS LIKE TODAY?

The continuing emergence of more sophisticated technology is radically challenging and changing the way students think and learn. The reliance on increasingly powerful computational artifacts has made technology ubiquitous in most classrooms and student life. This sophistication has also been taken to higher levels with the increasing availability of all types of digital information and the myriad of networked and integrated infrastructures. Our Internet and information age has given us tools and resources for engaging in learning that we never had before.

Take any typical learning situation in developed countries. In classrooms or outside schools, you will invariably see students using handheld electronic devices to enter data or check information. They can text message, surf the Internet and "google" what the teacher is saying in class. In study rooms, cafeteria, or homes, students engaging in learning will be seen using cell phones, laptops and other electronic devices. An example of today's (and tomorrow's) learning environments is the Technology Enabled Active Learning (TEAL) project at MIT (Dori, Belcher, Bessette, Danziger, McKinney, & Hult, 2003), where a studio-based learning session takes place with students engaging in and solving projects. The classroom scene is full of students discussing in groups, consulting their computer laptops, running tests with electronic equipment and communicating through electronic devices. The teacher roves from table to table, offering feedback and asking questions. Increasingly integral to these learning environments are collaborative activities involving synchronous (occurring at the same time) and asynchronous (not occurring at the same time) communication to mediate learning and knowledge building. We see students consulting each other in class groups, through e-mails, forums, and blog discussions. Learning projects and papers are written with feedback and proofreading from others. More sophisticated learning environments such as online learning, virtual learning and learning with artificial intelligence (AI) are enabling different forms of collaboration. The Internet and digital age have made our generation characteristic of sharing and learning from one another. Solo learning is increasingly difficult to accomplish in today's commonplace tasks.

WHAT ARE THE EDUCATIONAL ISSUES FACING OUR DIGITAL AGE?

Several issues confront our current understanding of learning environments. First, the multiple interactions of human and electronic devices are posing challenges to the traditional scientific method of investigation. These interactions are raising questions about the reductionist approach and ecological validity. They are also questioning how we analyze, identify and exclude variables in this complex learning process. Most empirical studies deal with the unit of analysis comprising of a single discrete task analysis without external aids

(Williamson, 2004). This reductionist approach to experiments may illuminate the single cause cognitive relationships, but in reality, contemporary settings are more complex. Perret-Clermont, Perret, and Bell (1991) are right to say that "the causality of social and cognitive processes (in a system) is, at the very least, circular and is perhaps even more complex" (p. 50). For any single effect, there are multiple causes and influences.

Second, the advent of social cognition into cognitive psychology has introduced many other considerations such as social aspect (Vygotsky, 1981), culture (Bruner, 2005), and emotions (Hatano, Okada, & Tanabe, 2001) in the study of affect and cognition. However, most of them are studied as a singular influence, rather than in a holistic or interdisciplinary manner. Rarely do we see a consideration of two or more influences at the same time in a study. While there are attempts, such as Newell (1994), to study cognition as a unified whole, Newell still regards the mind as a unit, in spite of "enlarging" it to a whole in seeking explanations for experiences and multiple influences to cognition. Is there a larger perspective of cognition or a bigger paradigm to study multiple influences to cognition?

Third, the increased complexity of collaborative activity serves as a basis from which to question the preoccupation with the individual as the unit of analysis. Also, where are the boundaries and what is included in the collaborative activity? In the study of collaborative workplaces, Kling (1991) is concerned with the problem created by the loaded concept of "collaboration" in computer supported collaborative work (CSCW). The complexity and associated issues of conflict and interpersonal dynamics was proving too much of a minefield to study. The crux of collaboration is the joint activity of "coordination, cooperation and communication" (Engelstrom, 1992, p. 64). The joint activities and interplay of the coordinating (organizing), cooperation (sharing), and communication (discourse) of knowledge, present challenging mental representations which have yet to be accounted. Members not only share the objects in the cognitive system, but cocreate a shared script of joint activities. This knowledge building (Stahl, 2002) in terms of integrating, synthesizing and creating of knowledge needs accountability. Englestrom (1992) sees communication as the higher form of collaboration and the mediated activity as the key. Do we also include this mediation in our study of cognition in a social setting? Is there a theory on cognition to help educators understand these interactive and mediated joint activities in a seemingly difficult study of a collaborative setting?

Fourth, this digital phenomenon requires a framework to provide a coherent and comprehensive paradigm to make sense of the complexity. The emergence in the 1990s of CSCW and subsequently computer supported collaborative learning (CSCL) as paradigms addressing the emergence of computer use in the workplace and classroom served the needs of that time. The interest in collaborative activity began in workplaces (CSCW) and extended into educational settings (CSCL). Where CSCW is concerned with how groups collaborate in performing tasks, CSCL looks at how groups learn in educational settings. However, as Lipponen (2002) questioned the state of CSCL in 2002 as a paradigm, this chapter is asking the same question in the light of proliferation of other electronic devices, besides computers, that aid learning. While collaborative learning in CSCL recognizes the interdisciplinary approach to such studies and several frameworks have been proposed to provide a comprehensive account of the learning contexts, none exists to incorporate the pervasive use of digital devices. Designs on not only the technology in support of learning, but the learning environment and the artifacts in the cognitive system, would yield more in terms of our understanding of learning in today's classrooms.

WHAT DO CURRENT PERSPECTIVES TELL US?

Cognitive science has kept strictly focused on the brain and its law of singular causes (Popper, 1999) while ignoring other social and cultural factors (Gardner, 1985). At the turn of the 20th century, the challenge and confluence of ideas in the epistemology of cognitive science and cognitive psychology changed the functionalist view of cognitive scientists towards cognition. The notion of "causation" was even challenged, and replaced by "relation" (Mach, 1976), which in turn led to qualitative causally interpreted Bayesian nets (Williamson, 2004) and the introduction of the notion of "probability" (Popper, 1959). The positivistic reductionism of the sciences was also challenged as the only means to understand the world (Putnam, 1981). In the 1970s, the introduction of "deterministic chaos" (Goodwin, 2003) into scientific studies began to acknowledge the recognition of the indeterminateness of scientific and objectivity of values.

At the same time, there was a movement to view cognition beyond the confines of the skull (Clark, 2002; Salomon, 1993). The analogous comparison of the brain to the computer, led to studies into the computational representations of how the mind works (Turing, 1950). This computational approach recognized that mental phenomena arose from the operation of multiple distinct processes rather than a single undifferentiated one. Connectionists, who are also concerned about learning, such as Rumelhart and McClelland (1986), used the "Parallel Distributed Processing" model to study cognition that is distributed in a network of computers, believing it to be similar to the neural networks of the brain. This was one important early work that explored the distribution of cognition. Connectionists focus on learning from environmental stimuli and storing this information in a form of connections between computers (neurons). This was an early attempt to see cognition as occurring outside the skull.

In cognitive psychology, the influences of human and social sciences, in particular, anthropology and sociology have been instrumental in the emergence of social cognition in the late 1960s. This is now the dominant model and approach in mainstream social psychology. While the cognitive aspect of learning focuses on the effects of external stimuli on individual cognition, the social aspect of learning looks at social relationships that influence human cognition. The external stimuli included interactions with other humans but it was the effects of the influences that were being studied rather than the relationships. Social cognition, on the other hand, considers the social aspects and roles of the individuals: how people process social information, the encoding, storage, retrieval, and application. The advent of social cognition and its related movements has challenged and freed cognitive studies, shifting it from outcome-oriented to process-oriented (Fiske & Taylor, 1991), recognizing cognition and learning as socially influenced. An antithesis to cognitive processes, social cognition advocates continue the debate till this day about how learning is to be studied. This resulted in most researchers' focus on either the cognitive or social processes in studying learning and cognition, such as systems supported by computers (Kreijns, Kirschner, & Jochems, 2003). It would appear that Perret-Clermont et al. (1991) are right to allude that research paradigms stressing on what is social and what is cognitive will fail because "the causality of social and cognitive processes is […] perhaps even more complex" (p. 50).

Social cognition began influencing educational psychology and ushered in the current constructivist learning theory. The rise of social constructivism via Vygotsky's social development theory and the emerging social and cultural theory of language and thought forced reconsideration about how people learn in educational psychology (Wood, 1998, p. 39). Within a sociocultural constructivist framework, the notion of learning is seen as a coconstruction of knowledge between individuals.

Seen as dialogical interaction of a community, the social cognition in education can range from a simple joint learning activity between two individuals to an extended and complex network of multiparty interaction of knowledge building. Through collaboration, learning now extends to participation in a community of learners (Brown & Campione, 1990) and community of practices (Wenger, 1999).

Thus, the dissatisfaction with the reductionist thought, singular cause method, and the belief that cognition resides only in the head, led to the developments in social cognition spawning several popular movements: situated cognition (also known as situated learning) (Lave & Wenger, 1991), activity theory (Leont'ev, 1978), embodied cognition (Varela, Thompson, & Rosch, 1992), distributed cognition (Hutchins, 1995), and the recent enactivism (Cowart, 2004). While each of the movements attend to the concerns peculiar to their areas, there appears to be none that offer a comprehensive framework, embracing both the cognitive and social processes, such as the theory of distributed cognition that we shall now turn to.

WHAT IS DISTRIBUTED COGNITION?

Consensus and acceptance of distributed cognition is still inconclusive (Salomon, 1993). However, as evident in the growing literature, distributed cognition is becoming a recognized theory. The definition of distributed cognition varies from the radical view to a loose position. Hutchins' (1995) distributed cognition theory is a study of cognition distributed across individuals and artifacts in a social-cultural and technical system as defined by the members and artifacts in a context. He challenged cognitive science's traditional preoccupation with the individual and the brain as the boundary of the unit of analysis. As such, he also challenges the "range of mechanisms" (Hutchins, 1995, p. 373) that participates in the cognitive process. For Hutchins, the study of cognition erred in confining the study within the skull of the individual and ignoring the context and the individual's interaction with others and artifacts. External elements should not be only treated as stimuli or aids to cognition but rather as equal partners in exhibiting, distributing and creating cognition. Any study into cognition should include all the elements that are directly, and even indirectly, working towards the accomplishment of a cognitive activity instead of the singularity approach. An individual's memory by itself is insufficient to understand how a memory system works (Hollan, Hutchins, & Kirsh, 2000), citing the rich and complex cognitive interactions in a cockpit or a ship's bridge involving the manipulation of artifacts. Pea (1993, p. 69) refers this as "off-loading"—when humans rely on artifacts to help them remember or compute cognitive tasks. The classic description of how a person requires an external representation by writing the multiplication on a piece of paper when called upon to solve a mathematical problem, is evidential to the use of the artifact (pen and paper) to facilitate the multiplication process which was mentally difficult to do.

Engeström (1992) also argues that computer supported collaborative work (CSCW) suffered from the Cartesian focus on the mind as the unit of analysis while relegating the collaboration to efforts to harmonize with the individual. Sociocultural aspects should be included in the study of CSCL (Kling, 1991; Reason, 1990). Reason (1990) differentiates latent human error from active error, attributing the former to the collective and suggests studying the group's interrelationships to help understand thinking better. Similarly, Cole (1991) sees cognition as a jointly and socially mediated activity. Perkins' (1993, pp. 93–95) views knowledge as "represented," "retrieved," and "constructed" jointly by the "person plus." This is a radical departure from the traditional view of cognition. Currently, there is a growing consensus that the concept of intelligence should not be confined as a property of the mind (Pea, 1993).

The unit of analysis consists of human agents and nonhuman artifacts in the environment and the unit varies with each different context (Hutchins, 1995). This focuses on whole environments as a unit of analysis. So, instead of "keeping" cognition inside the skull, cognition is now seen as external and being distributed in order to accomplish the cognitive task at hand. Lave (1988) and Saxe (1988) observe behavior and cognition in a social (or/and technological) context in their work. Hollan et al. (2000) opine that cognition can be effectively observed as occurring in a distributed manner. Some may argue that cognition is nonsymbolic (Dreyfus & Dreyfus, 1986) and therefore cannot be studied. While others like Glaser and Chi (1988) believe that thinking is represented and can be studied.

DISTRIBUTED OR NOT?

Distribution is the spreading or circulating of things over an area as opposed to a single locus. Distribution considers the sharing, transformation and propagation of any form of information processing in the system. Hutchins (1995) postulates that the cognition process is distributed across members and artifacts of a social group involving coordination between internal and external structures. The locus of cognition is no longer centered on *one* individual. Rather, there are several loci of cognition in a system, each one contributing to the distribution as well as processing the cognitive activity. Cognition is also distributed across time with the earlier events affecting later ones. This means that the manner of distribution is time sensitive. The timing and aging of the cognition affects the cognitive process and system. The cognitive system is also seen as a whole rather than its discrete parts and the boundaries of the unit of analysis are now extended. Halverson (2002) sees distributed cognition focusing on the organization and operation of the cognitive system where its mechanisms make up the cognitive process and seek cognitive accomplishment. Pea regards intelligence as distributed (Pea, 1993, p. 50) to the artifacts alleviating the tedious and burdensome cognitive tasks that humans have to undertake. For him, computer tools and programs are the natural artifacts enabling distributed intelligence to occur and it is preferable for humans to partner them than go solo in any given cognitive task.

As a cognitive science anthropologist, Hutchins (1995) sees all cognition as being distributed to both individuals and artifacts. Salomon (1993), a psychologist and an educator, is more guarded and acknowledged that cognition was distributed but keeps the individual cognition as separate while operating together with others in the system. Fearing that distributed cognition may be seen as the only explanation that ignores the other aspects, Salomon (1993) is careful not to attribute cognitive powers to nonhuman artifacts. Because of the overemphasis on "what's outside" the brain, he feels the extreme position was truncated conceptually. While espousing the overall concept of distributed cognition, he points out that not all cognition is distributed and suggested the middle road: recognizing some distribution of cognition while affirming the individual plays a significant cognitive role in the system. Salomon (1993) maintains that in any given distributed system, there are "sources" of cognition (p. 111) which he attributes to human minds. So, for Salomon (1993), he also sees the interconnectedness between what was distributed versus the internal solo cognition (p. 113) of the individuals.

However, following Vygotsky's notion of internalization, "any higher mental function necessarily goes through an external stage in its development because it is initially a social function" (1981, p. 162), cognition can be viewed as distributed because of its social origins. Individual cognition is even argued to be socially mediated where the individual thought (and action) is shaped by the social context of social relationships, self identities and group associations (Clancey, 1997). For cognition to be functionally meaningful, it has to be socially mediated whether by the individual or by others. The classic example of using a pen and paper to externally represent the cognition process during solving a complex math problem clearly suggests solo cognition is distributed between the mind and external representations. In a more complicated cognitive context like negotiating a ship into a harbor, there are some subsystems of cognitive activity where solo cognition exists, which may seem to be not distributed, such as an in-situ reflection. However, even personal reflection or any other forms of solo cognition are a result, and also a consequence, of a social interaction. Subsequently, the cognition is manifested later in the distribution; even though it was not distributed initially.

Cognition can be categorized from a range of lower-order to higher-order: from comprehension, recall to analysis, synthesis and problem solving. Pea (1993) argues that higher-order thinking belongs to solo thinking and cannot be distributed. Perkins (1993), like Pea, feels too that higher-order knowledge cannot be distributed. They argue that such complex activity occurs in the head and what is distributed is knowledge resulting from that activity. However, if the system is considered as a *whole* unit of analysis, consisting of the different sources of cognition (humans, artifacts and environment), then the cognitive system as a whole is capable of higher order cognition and can be considered as such. The distribution of cognition is within this whole system and any higher-order thinking would occur *within* the system. In reality, higher-order thinking begins with lower-order thinking and as the organizing, integrating and synthesizing (higher-order thinking) of knowledge begins, the social and mental representations are distributed. This organized knowledge may be observed as visually presented or verbally described. Although this may sound like a technical justification for higher-order cognition to be seen as distributed, the fact remains that cognition, whether it is higher or lower-order is distributed.

One of the foreseeable difficulties (but a liberating aspect) in studying distributed cognition is the indeterminateness of the system boundaries. Unlike the traditional cognitive studies where the constructs are clearly stated, ethnographic studies into cognitive behavior and patterns allow undetermined influences to be considered during the study, including new and emerging influences that interact with previous ones in the cognitive system. These recursive and emerging influences on cognition can be very exciting. While this is the nature of the study and characteristic of the analysis, the questions of limit and termination of the cognitive activity are left open. Theoretically, the cognitive system and process is limited by the cognitive task and time taken to accomplish the task, but the extended boundaries that contributed to the task and duration may be difficult to ascertain, due to the dynamic nature of the distribution. Giere (2002) went, as far as to consider the coalmines in Montana as the boundary of the distribution of his science laboratory task. But certainly, any objective researcher will not risk such an irrational stretching of the theory to its limits.

COLLABORATING ALL THE TIME?

Collaborative learning is a process of interaction of knowledge and the joint working of two or more people in an intellectual undertaking of a task or goal. Forms of collaboration range from common task completion, joint decision making to complex problem solving. Implicit in its understanding is the interaction of human members. However, collaboration can also include other intelligent entities. These other intelligent entities may come in the form of computers or highly sophisticated AI machines like robots. If the focus of collaboration is in the "joint working" aspect, then would it not be too preposterous to say that humans might collaborate with a robot or even a computer? To stretch this further, we may even be working jointly with less intelligent (but nonetheless intelligent) artifacts such as a personal digital assistant or a cell phone. Take an intellectual endeavor, for example, writing a paper. To write a paper in today's context, I will have to use a computer writing software program. The program is "intelligent" as it picks out my spelling and grammatical errors. And if I need to refer to types of format and style, it offers an array of choices. It has indeed "worked jointly" with me on my paper, although not exactly in the conceptual domain. Certainly, if I used the computer to surf the Internet for ideas and discussions on the topic I am writing, it would certainly have contributed, as a conduit, to my intellectual endeavor. Clearly, I am not equating a computer to a human, but increasingly, technology is advancing at a rate that in the near future, we may consult fairly intelligent devices for original thoughts.

COGNITIVE ARTIFACTS ARE SOURCES OF COGNITION?

In the framework of distributed cognition, artifacts are considered cognitive. This may be a radical idea to some but it may not be a far fetched notion. Take the common practice of using a personal digital assistant (PDA) to aid our memory by storing the information into its database. Did the PDA help our memory? Did it amplify our recall ability such that we are able to remember it the next time? Although it did not really change our memory, it organized the information we entered in the system so that we can retrieve it at an incredible speed, which humans are cognitively incapable of. The artifact was involved in the cognitive function of organizing the information in a way that we can search for it easily and quickly. So, the artifact performed a cognitive task: "organizing" the input data, and "searching and gathering" the required data. Technological devices that aid our memory and computation are known as cognitive artifacts (Norman, 1993).

A distinction needs to be made between cognition and semantics. Searle (1980), using the classic Chinese room experiment where a non-Chinese speaker had to use a rule book to construct a response to a question in Chinese, argues that the machine does not have the semantics of symbols it is manipulating compared to the human mind. So, the machine may act as if it is "thinking," but in reality, it had no clue to the semantic meaning even though it is able to successfully construct a "meaningful" answer to the response. The argument is that the system therefore does not understand the meaning attached to the symbols but merely processes it due to its programming. Searle (1980), therefore, argues that semantic cognition is not distributed between artifacts and humans. So the issue is, does the system really learn as compared to the human mind? In considering distributed cognition, should it include semantics in cognition?

Nardi (1996) argues that the theory of distributed cognition devalues or restricts the meaning of cognition when there is no distinction made between people and things as cognitive agents. Her contention is that for an artifact to exhibit cognition, it must possess the quality of having the "act of or process of knowing, including awareness and judgment." On this definition of cognition, she feels that artifacts are incapable of consciousness and therefore, should not be put on the same level of consideration in a cognitive system. Technically, cognition is any activity that involves the act of recall, comprehension, critical thinking (organizing, sorting, sequencing, comparing and contrasting, etc.) or creative thinking (brainstorming, predicting, synthesizing, etc.), that involves information processing. As such, any artifact that is capable of this action is performing some form of cognition. Recalling and generating knowledge is not the sole prerogative of consciousness. With huge strides in AI, we are seeing robotic machines that are capable of initiating interaction and performing complex cognitive activities but devoid of consciousness. The issue of awareness, consciousness and emotions may yet be elusive to the most advanced or powerful machine at present but in the future, who can tell?

SOCIAL, CULTURAL, HISTORICAL, AND EMOTIONAL INFLUENCES

Halverson (2002) points out that distributed cognition explores the broader sociocultural-technical system of the cognitive system. Clark (1998, p. 258) submits that the mind is best understood as the activity of "an essentially situated brain" in its bodily, cultural and environment context. Hatch and Gardner (1993) feel that the reason why cognitive scientists stayed away from the sociocultural elements is because of their unquantifiable nature and they first needed to understand the brain on its own before considering other aspects. Epistemologically, when a learner engages new learning materials, he does not interact with the material solely on a linear basis, detached from his or her surroundings. The people in the zone of proximity, the artifacts that the learner uses, the physical surroundings and context contribute to the learning process. Socially, the social role of a learner with peers affects learning. If he is held in high esteem by the peers or considered by the teacher to be a favorite student, the learning experience will be different from one who is not. Culturally, those from bigger families and are more outspoken at home, will find group activity more familiar and learning easier than those from a single child family. Learners with different histories with the teacher and classroom environments will differ in the processing of information. Personal histories with each other, with the artifacts, and with the environment will affect the learning. Learning with an unfamiliar face, machine or place compared with the familiar will yield different cognitive results. The emotional state of the learners also provides different learning experiences even when going through the same program and in the same context. Evidence has shown that emotions (Hatano et al., 2001) affect cognition and as a result, affects both individual as well as group performances too.

All these influences: social (Vygotsky, 1981), cultural (Bruner, 2005), personal histories, and emotions (Hatano et al., 2001), should be considered in the cognitive system, at the beginning, during and ending in distributed cognition. This description of learning challenges the idea that knowledge can be transmitted in an absolute and linear relationship. It also challenges the assumption that objective knowledge can be acquired in individuals. Whatever it is, the consideration of all possible influences in a cognitive system clearly seeks to give a holistic and comprehensive picture on how learning and cognition happens.

HIGHLY CONTEXTUAL AND MULTILAYERED COGNITIVE ACTIVITY

In distributed cognition, a system is observed to re-configure itself with subsystems enjoining in the interactions in the system while accomplishing the cognitive functions and task. The cognitive process is bordered by the functional relationships among elements that are participating in the process and not by the spatial distance relationship (Hollan et al., 2000). This suggests an emerging character of the cognitive processes in the system. Hutchins (2005) uses the term, "conceptual blending" (p. 1556), which involves the interactions between the mental spaces of the people, artifacts and environment. These include the body language, coordinating mechanisms, various forms of communication and how tacit knowledge is shared and accessed. Salomon (1993, p. 112) also points to the "joint nature" of the distribution rather to one agent. These layers of cognition and interplay of mental spaces clearly present a multilayered cognitive activity to behold.

Contextually, Bruner (2005) clearly believes that any social cognition is highly situated in its local context and culture. This places the cognitive system as highly contextualized in its own setting: the human members and artifacts situated in the environment. The interplay and interconnection of each member's histories and culture clearly make the study immensely rich with many layers of relationships.

Zhang and Patel (2006) consider affordances as "allowable actions" offered by the environment coupled by the properties of the agent. Affordances are the functions that can be carried out (afforded) by the properties in the environment (Gibson, 1977), including the human agents. Simply put, art studios afford drawing, computer rooms afford computer work. Affordances are another key element in considering the environment as part of the cognitive system. This means that anything that affords an executive function that contributes to the accomplishment of the cognitive task are considered in the study of the cognition distributed in the system.

While all these may paint a rather complex and seemingly incomprehensible picture of what and how learning takes place, the consideration of these factors will not only open a wider and perhaps deeper understanding of learning but in doing so, offers a more holistic and authentic picture of what learning really is.

OLD WINE IN NEW WINE BOTTLES

Cole and Engestrom (1993) cite Wilhelm Wundt and Hugo Munsterberg as the early psychologists who were the forerunners in recognizing a different form of psychology that regards cognition as requiring interaction outside the brain. Unfortunately, their writings were not picked up and developed to any recognizable cognitive psychological strands. Subsequently, Leont'ev, Luria, and Vygotsky, the progenitors of cultural-historical psychology, sought to mediate basic cognitive tasks to more complex ones with cultural tools, including the use of language (Cole & Engestrom, 1993). This means that in order to perform higher cognitive tasks, more than just the brain alone is involved, and the mediation of other cultural artifacts is also required. Hutchins (1995) alludes to Vygotsky's "Mind in Society" (1978) where his notions of treating the society as having mind like properties. By this, he is using language of the mind to describe the activities of the group. Also, for Vygotsky, every high level cognitive function appears as an interpsychological process first before the intrapsychological process occurs. Conversely, Hutchins draws on Minsky's (1986) work, "Society of the Mind" where the language of the group can describe what is inside the mind. Minsky (1986) regards the higher level of cognition as composed of several lower level agencies and are interconnected.

However, this was not the case in the Soviet Union in the early 1900's where Lev Vygotsky's social-historical school, now known as activity theory, began (Rogoff & Wertsch, 1984, pp. 1–6). Vygotsky (1978) postulates that mental functioning occurs first between people in social interaction and later within the child's mind. Similar schools of thought also arose in Scandinavia and Germany, under the banner of activity theory, action theory, and situated action.

In educational psychology, Dewey (1963) warns against treating experience (learning and development) as something going on inside one's head. He recognizes that there are "sources outside an individual which give rise to experience" (Dewey, 1963, p. 39). Evidently, distributed cognition was not entirely new in its concept.

IMPLICATIONS OF USING DISTRIBUTED COGNITION IN COLLABORATIVE LEARNING ENVIRONMENTS

The first implication in using distributed cognition in the study of collaborative learning environments is that it is an authentic and naturalistic study, rather than a de-contextualized one where the results are not tenable when put to real life situations. In terms of research validity, using the holistic approach to study cognition and learning will ensure ecological validity. Using distributed cognition as a theory presupposes a qualitative case study approach, and mixed method to understand the various influences and relationships within the cognitive system. This snapshot of the cognitive activity legitimatizes the findings while respecting the sensitivity of time. Such a naturalistic study too, when trustworthiness is ensured, has translatability value.

Second, distributed cognition demands that any cognitive system be studied as a whole environment. This holistic approach means that every human and nonhuman artifact, their embedded cultural symbolism, historical data, emotional state and social relationships are considered. At the same time, the source, transformation, propagation and emerging of cognition through time, including the subsystems of cognitive relationships are duly considered. On top of this, together with the single and multiple relationships involved within the cognitive system, the system is, as a whole, also looked at. Collaboration is thus seen as a whole, together with its subcollaborations (subsystems) and the relationship between the whole and its parts. This three-tiered matrix relational study seeks to capture as much data as possible in order to holistically and comprehensively understand the collaborative and cognitive system. This will give a more accurate picture of the learning environment.

Third, the recognition of cognition as a whole unit, allows a holistic understanding of learning in a given context: seeing the cognitive actions as a whole culminating in the aggregate performance and allowing the researcher to see how each cognitive action and relationship contribute to the performance. This bigger picture of cognition will also better inform our studies into collective intelligence (Levy, 1997) or groupthink (Janis, 1997). Salomon, Perkins, and Globerson (1991), on ways of evaluating intelligence between people and technology partnerships, cite both "systemic" and "analytic" when considering both aggregate performance and specific contribution by each member.

Fourth, this whole-environment approach radically regards the individual as a member rather than central to the study, allowing an unbiased treatment of each member and artifact in the system. This means that no one member is prejudicially seen to contribute more or less to the process and performance. This will lead to greater integration of both technological and nontechnological artifacts, human actions and the environment. At the same time, this may reveal hitherto unconsidered elements that may surprise the research with potentially significant impact, due to the impartial treatment of all members and artifacts as equal partners in the cognitive system. Educational goals would then, shift from individual mastery to jointly accomplished performance (Salomon, 1993).

Fifth, the inclusive nature of this framework, in considering all observable representations of cognition in a cognitive system allows an unbridled approach to the study of cognition. This opens up a wider sphere of possible influences that affect the performance of the cognitive tasks. In effect, we can apply these theoretical constructs to a much wider range of considerations in the study of cognitive phenomenon.

With these macro implications delineated, clearly this perspective will render learning with a larger holistic feel: no longer restricted to the linearity of cognitive relationships, but the ability to see the whole. This includes the specific contributions of each element, unbiased analysis for all members, and a broader understanding of the cognitive system.

At the micro level, the equal treatment of human and nonhuman artifacts as cognitive agents is significant in the collection and analysis of data. First, the distribution pattern and learning process will allow insights to what and how information is gathered, analyzed, synthesized, transformed, stored and created. This will help us see the flow of information, identifying both convergence and divergence points. Second, it also involves the study of the coordination between the internal and external structures in and outside the cognitive system, i.e. looking at sub systems. This will identify critical points of influences and effects to the relationships and the cognitive system as a whole. Third, scrutinizing the effects of time that each mental representation has on the cognitive processes in the system will reveal the dynamics and time sensitive nature of the human, artifacts and environment. This is central to the distributed cognition theory, the interplay and emergent qualities among the three entities: human agents, artifacts and environment. This will inform not only the design of future learning environments and its members within, but also reveal how humans actually think and learn. Critical learning incidents can be identified and enhancements be made. Fourth, the notion of cognitive artifacts opens up the perspective that intelligent artifacts are capable of cognitive abilities and of joint activity. The PDA example highlighted earlier is just one of the million ways an electronic device can contribute and collaborate in the cognitive systems to accomplish higher and more complex cognitive tasks. AI or cybernetic systems are examples of higher intelligent artifacts that may one day play a major role in learning. Fifth, the notion of affordances by artifacts and the environment gives us a dimension to consider in our studies. This study into affordances will greatly inform the future designs of learning environments.

Finally, the holistic approach stemming from distributed cognition will yield insights into the characteristics and influences of the coherent and emergent wholes (Goodwin, 2003) that make up much of the naturalistic learning environments. The inclusion of culture of the members in the analysis allows examination of the symbols and meaning attached to each visual, audio, feeling and verbal expression found in the cognitive system, and will give us insights into the reasons for human actions and behavior. Cultural considerations will force the researcher to consider the cultural perceptions of the human members towards each other, as well as the artifacts. The inclusion of the historical aspect of the members and artifacts in the unit of analysis allows the researcher to see why certain actions are taken and behavior is manifested. The historical aspect will mean looking into the histories of the cognitive systems as well as personal histories of both human and nonhuman artifacts. The technological experience or academic history of the learner will affect the interactions with other humans (with different histories) and artifacts (again with different histories). The inclusion of social structure informs the analysis of the hierarchical structure of human relationships. The inclusion of emotions into the study of cognition will let us see the behavioral and attitudinal dispositions of the interactions. The further inclusion of discourse analysis will allow researchers to examine the language used and communication that affects the distribution of the cognition. Potentially, with insights into how culture, history, emotions, communication and social structures affect cognition and its distribution, these will greatly inform the design learning environments, artifacts and learning strategies. It is believed that this framework will help to advance the studies of "effects with technology" (Salomon et al., 1991, p. 3), the partnerships with machines, which will lead to redefinition and enhancement of learners' performance with technology.

CONCLUSION

With the general dissatisfaction of reductionism and restrictive "within the skull" cognition, together with the prevalent exploratory social learning theories and social cognition movements, the emergence of distributed cognition is timely, especially since learning environments are constantly changing. The theory that cognition can be studied as distributed across human members and artifacts is fascinating as it offers a holistic view involving not just the social, historical and cultural aspects of a cognitive system but also the very idea that the cognitive system has an entity of its own is very intriguing. The theory also liberates the idea that artifacts can "do" cognition which opens up a world of possibilities in dealing with artifacts of the future, where they will certainly be more capable and more powerful as cognitive entities in their own right. Thus, distributed cognition sees cognition as one unit of analysis of the cognitive system, which was traditionally bounded by the skull, but is now extended to the elements outside the skull and bounded by whatever artifact and human agents that play a part in the cognitive system situated in a learning environment.

This chapter began with the nature of today's complex collaborative learning environments confronting our educational studies. Learning is currently seen as social, as well as situated in a context: involving other human agents as well as intelligent electronic devices. Understanding learning via distributed cognition as an extended cognitive system addresses the challenges highlighted by being nonreductionist, inclusive of various influences, and allowing reconciliation of multiple and emergent joint mediated activities. With increasing sophisticated cognitive tasks being introduced into our world today, the learning environment has become not only more crowded but filled with more sources and artifacts for cognition to be distributed. Distributed cognition can open up a new vista in understanding how cognition and learning can take place. This vista will allow us to examine the layers of cognitive processes and interplay of the internal and external structures resulting in insights that will assist us in human learning and cognition as never before. Crucially, because of its whole environment approach, influences can be identified from a broader and even deeper perspective and this will help inform technological design issues as well and human learning strategies.

As we advance in our thinking and research on learning *with* technology, distributed cognition gives us that breadth and depth to study, in detail as well as holistically, today's complex learning environments. And if learning is to be an enculturation of the practice of life-long learning and personal and professional development, then, the sooner we begin to understand the influences from as many disciplinary aspects as possible, the better we will be able to design and facilitate learning environments for our students of tomorrow.

Perhaps a more fundamental question and issue to address is how do our modern young learn. How do they learn and what makes them want to learn? What gives them meaning in learning? Answering these questions will begin to help us design learning environments that are suited for them and address the challenges of today's emerging technology. And we need a framework that can adequately address these questions in a comprehensive, holistic and ecologically valid manner.

This chapter may be in part, advancing what Kuhn (1970) advocates in his book, *The Structure of Scientific Revolutions*: the notion that science has become overly specialized with each succeeding paradigm, thus losing sight of the forest for the trees in investigating cognitive phenomenon. Nonetheless, this chapter is mindful that this paradigm of distributed cognition will not take that route.

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KEY TERMS AND DEFINITIONS

Artifact: An object or document created by humans.

Cognition: An act of information processing pertaining to memory, attention, perception, action, problem solving and mental imagery.

Cognitive System: An area or space where interconnected items of knowledge and representations of human cognitive processes are studied.

Collaborative Learning Environment: A situated area or space, networked or otherwise where there is sharing, coordinating, and cocreating of knowledge between two or more persons aided by artifacts to achieve outcomes they could not accomplish independently.

Computer-Supported Collaborative Learning: A process of increasing in knowledge through joint intellectual effort with the help of computers.

Distributed Cognition: A framework of understanding how information processing is circulated across individuals and artifacts in an environment.

Human and Computer Interaction: A study on interaction between people and computers.

Reductionist: An idea that all complex systems can be completely understood in terms of their components.

Social Cognition: A study on how people process information socially in encoding, storage, retrieval, and application to social situations.

Socially Mediated: How information and knowledge are exchanged and negotiated between humans.

This work was previously published in Handbook of Research on Electronic Collaboration and Organizational Synergy, edited by J. Salmons; L. Wilson, pp. 295-311, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.14
Social Networking Sites (SNS) and the 'Narcissistic Turn': The Politics of Self-Exposure

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ABSTRACT

The advent of the Internet hailed the ability of users to transform their identity and expression and articulation of the 'self' through their digital interactions. The Internet in its early days enabled the user to re-define identity through the text-based environment of the internet without declaring their offline persona or identity. In comparison new social software like *Facebook* have brought about a narcissistic turn where private details are placed on a global arena for public spectacle creating new ways of connecting and gazing into the lives of the others. It raises new social issues for societies including the rise of identity fraud, infringement of privacy, the seeking of private pleasures through public spectacle as well as the validation of one's identity through peer recognition and consumption.

DOI: 10.4018/978-1-60566-727-0.ch006

INTRODUCTION

The Internet in its early days signified the re-birthing of the individual and most prominently the 'self' as technology enabled the user to re-mediate identity through a text-based environment. Anonymity and virtuality constituted a form of 'avatarism' where individuals could re-invent their presence online without declaring their offline persona or identity (See Donath 1998; Froomkin 1995). In comparison, new social networking sites (SNS), such as Facebook, signify a 'narcissistic turn' where offline identities are publicized online and constructed through a multimedia platform to create new forms of self-expression, gaze, spectacle, and sociabilities. Equally, social networking is embedded within a new economy of sharing and exchanging personal information between friends and strangers. The sharing and communication of personal details have reached unprecedented levels with the proliferation of e-commerce and social networking sites in recent years (See Szomsor et al. 2008; Geyer et al. 2008; Strater & Richter 2007; Stefanone 2008; Lampe et al. 2006; Joinson 2008).

This marks a shift from the earlier 'virtuality' discourses of the Internet which perceived anonymity and the ability to transform identities online as a form of empowerment whilst raising the tenuous issues of trust, intimacy and deception. The increasing popularity of social networking sites, on the other hand, emphasizes the narcissistic tendency in the human condition manifested through an exhibition of the self through photos and other multimedia content. The publicizing of personal details on a global arena for public spectacle creates new ways of connecting and gazing into the lives of others. It raises new social issues for societies, including the rise of identity fraud, infringement of privacy, the seeking of private pleasures through public spectacle, as well as the validation of one's identity through peer recognition, connection and consumption online. The ability to connect with offline networks through online self-profiles and content and additionally the possibility of inviting audiences to be part of the 'friends' list celebrates the declaration of offline identities.

The politics of self-revelation on the Internet creates the need to understand new forms of computer-mediated behavior which are emerging and may have implications for the ways in which users construct and express their identities. The creation of profiles and the ability to make connections through these constructs indicate how these become a form of social capital in forming connections and communion with a wider imagined community offline and online. This chapter examines the phenomenon of self-exposure through social networking sites on the Internet and discusses how the emergence and popularity of these sites reflects a shift in debates about identity discourses on the Internet on a theoretical and societal level. The chapter also delves into the social and legal implications of self-revelation and, more specifically, how social networking sites create risk communities where an awareness of risks exists along with the urge to reveal in order to make contact and connections with others. Social networking sites function through complicit risk communities which highlights both the narcissistic strand as well as the postmodern hazards that lurk in the online environment.

THE EARLY DISCOURSES OF THE INTERNET

The term *cyberspace* was coined by science fiction writer William Gibson in 1982 to capture the nature of a space both real and illusory. This duality is one of the fundamental reasons why investigations of online spaces are complex and multi-dimensional. Early writings on the Internet portrayed the new medium as constituting a virtual space which was divorced from offline existence (Miller and Slater, 2000: 4). Miller and Slater (2000) define *virtuality* as the capacity of communicative technologies to constitute, rather than mediate, realities and to form relatively bounded spheres of interaction. These discourses often portrayed the emergence of new forms of society and identity (Rheingold, 2000) in which the 'virtual was often disembodied from the real' (Miller and Slater, 2000: 4). This disembodiment represented a form of escapism from real society where individuals could invent, deconstruct, and re-invent their identities. As such, cyberspace created fluidity in terms of identity as well as a form of release from the confines of the real world.

From this perspective Computer Mediated Communication (CMC) represents an unusual form of communication, as it does not fit into the conventional distinctions between public and private, and direct and mediated communication. (Diani, 2000: 386). CMC stands in a somewhat ambiguous relationship to other forms of communication. Its private and public nature is unclear. In line with the nature of communications on the Internet, there is also the question of how people establish identities in cyberspace. Because of the fact that we are not physically present on the Internet and because we can present many different personas there, the individual voices that make up a cyber community are often referred to as 'avatars' (Jordan, 1999: 59, 67). The irrelevance of geographical location with regard to CMC contributes to the phenomenon known as *disembedding*: that is, enabling users to transcend their immediate surroundings and communicate on a global platform (Giddens, 1990). Besides this feature of 'disembedding', the online environment prior to Web 2.0 was defined by the use of discursive form (textuality) and the ability to communicate anonymously. These features are seen as empowering since users are not constrained by both time and space and are at liberty to recreate and deconstruct their identities online.

The 'avatar' culture may offer people a degree of freedom to conceal identity and to approach taboo topics without the constraints of the real world. It can help forge new identities as well as new relationships. As the 'virtual' world is mediated through technology, the user may be bound by a new set of rules to negotiate the virtual world. Nevertheless, this hybrid form of communication does not exist in a vacuum. Discourses in the Internet can interact with happenings in other media and reflect one's physical context of existence. As such various online interactions can be embedded in disparate ways into larger social structures, such as professions and social movements. The dynamics of online interactions may be difficult to comprehend except through this physical embedding (Friedland, 1996; Miller and Slater, 2000; Slevin, 2000; Wynn & Katz, 1997; Slater, 2002). In this sense, the culture of the physical world can invariably transcend into cyberspace, thus further altering the pattern of mediated communications.

Early discourses of the Internet and present debates about the Web indicate that identity is a contentious and fragmented construct in view of the absence of physical cues in a discursive and subsequently a multimedia environment (Stefanone et al. 2008:107). Compared to the earlier Internet environment which leveraged on experimentation with identity, today's computer-mediated communication aligns the users closer to their offline selves. The increasing emphasis on existing offline identities and relationships as well as physical and non-verbal communication cues and manipulation defines the nature of computer-mediated communication today (Stefanone et al. 2008).

THE PROLIFERATION OF NETWORKING SITES

The shift in the discourses of empowerment and increasing need to declare and share identities may also be attributed to the technological advancements inherent in the new social Web. Web 2.0 encapsulates a plethora of tools - including wikis, blogs, and folksonomies - which promote creativity, collaboration, and sharing between users (Szomszor et al. 2008:33). The multimedia experience and social communication platforms thus equally characterise the Web 2.0 user culture. From a technical and social perspective, Web 2.0, in comparison to its earlier manifestation, refers to improved applications, increased utilization of applications by users, and the incorporation of content generative technologies into everyday life by those who can afford and access such technologies. Anderson (2007) identifies the Web 2.0 environment as a new and improved second version and particularly a user-generated Web which is characterised by blogs, video sharing, social networking, and podcasting - delineating both the production and consumption of the Web environment where both activities can be seamless. Beyond its technical capacities, the term is a convenient social construct to analyze new forms of processes, activities, and behaviors - both individual and collective as well as public and commercial - that have emerged from the Internet environment.

Unlike earlier Websites which thrived on the notion of anonymity and virtuality, these new platforms for social communion emphasise the declaration of real offline identities to participate in the networking phenomenon. While the forerunners of social networking sites in the 1990s included sites (such as Classmates.com), the advent of the new millennium heralded a new generation of Websites which celebrated the creation of self-profiles with the launch of Friendster in 2002 which attracted over 5 million registered users in a span of a few months (See Rosen, 2007; Mika 2004; Mislove et al. 2007; DiMicco & Millen 2007). Friendster was soon followed by MySpace, Livejournal.com, and Facebook; these sites convened around existing offline communities such as college students. In the case of MySpace the site was originally launched by musicians to upload and share videos while Facebook initially catered to college students but is presently open to anyone who wants to network socially online. Some of these sites have witnessed phenomenal growth since their inception. MySpace, for example, has grown from 1 million accounts to 250 million in 2008 (Caverlee et al. 2008: 1163).

Additionally, several of the top ten most visited sites on the Web are social networking sites (cf. Golbeck & Wasser 2007: 2381).The creation and exhibition of self-profiles can be historically located and is not unique to the new media environment. Christine Rosen (2007) points out that historically the rich and powerful documented their existence and their status through painted portraits. In contemporary culture, using a social networking site is akin to having one's portrait painted, although the comparative costs make social networking sites much more egalitarian. She contends that these digital 'self-portraits' signify both the need to re-create identity through the online platform as well as to form social connections. Invariably images play a role in the representation of self and in fostering communication (See Froehlich et al.2002; Schiano et al. 2004Bentley et al. 2006). For Rosen (2007: 15), the resonant strand that emerges is the 'timeless human desire for attention'.

Undoubtedly, users join such sites with their friends and use the various messaging tools to socialize, share cultural artefacts and ideas, and communicate with one another (Boyd, 2007). As such, these sites thrive on a sense of immediacy and community (Barnes, 2006). With social networking sites there is a shift in the re-making of identity. While social connective sites in the 1990s illuminated the sense of place with home pages, global villages, and cities, with social networking sites there has been an emphasis on the creation of the 'self' through hobbies, interests, interactions, and a display of users' contacts through multimedia formats (Rosen, 2007). According to Boyd and Heer (2006: 2), 'the performance of social identity and relationships through profiles has shifted these from being a static representation of self to a communicative body in conversation with other represented bodies. The emphasis of self-expression, through the creation of profiles, anchors publicity, play, and performance at the core of identity formation and communication. As such, identity is mutable online and not embodied by the body, and often the need to disclose real-life identities is intimately tied to this community's code of authenticity in making identity claims where friends and peers can verify claims made in the profiles (Donath & Boyd, 2004).

Social networking sites can support a variety of shared multimedia content beyond photos to include video and music, can be constitutive of self-identity and representation, and become a playground for the creativity of millions (Geyer et al. 2008:1545). Geyer et al. (2008) point out that while such sites connect people with each other through content and profile sharing, some sites focus on a single content type as in the case of Flickr and YouTube when communities form through the sharing of photos or videos. Other sites may entail sharing of many types of content.

In assessing SNS's, Boyd and Ellison (2007) highlight three distinctive features: the user's ability to construct a public profile, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system. According to Ralph Gross and Alessandro Acquisti (2005), such sites, through the emphasis on personal profiles, offer a representation of users for others to peruse with the intention of contacting or being contacted by others to meet new friends or dates, find new jobs, receive or provide recommendations, and much more.

Dana Boyd (2006) postulates that while the meanings of practices and features can differ across sites and individuals the notion of sharing is intrinsic to these sites. Personal information and private comments on a public platform then become a form of social capital which people trade and exchange to build new ties and to invite different types of gaze and spectatorship. Chapman and Lahav (2008) point out that while there is a novelty surrounding social networking behavior from the perspective of researchers, this behavior will become increasingly integrated with other forms of communication as social networking becomes increasingly incorporated into one's everyday routines. This means that social networking behavior will function in conjunction with other communication options including email, instant messaging, and mobile devices.

The need to attract public attention in some way through daily interactions and to seek familiar and unknown audiences characterizes social networking sites. Stefanone et al. (2008) maintain that this behavior is linked to the 'celebrity culture' that is evident in mainstream media and particularly in television genres such as reality TV (See Stefanone et al 2008). With user-generated content and the ability to host profiles on interactive sites, the Web 2.0 environment enables users to participate in celebrity culture by constructing themselves as active personas online. Stefanone et al. (2008: 107) contend that new multimedia technologies erode 'the behavioural and normative distinctions between the celebrity world and the mundane everyday lives of the users.' They argue that the dissolution of this boundary is discernible in two resonant strands: the popularization of the reality television genre and the proliferation of social networking sites which hinge on the revelation of offline identities. They identify these two trends as reconfiguring the media environment where audiences are more than the recipients of media messages. Audiences as users and consumers can become 'protagonists of media narratives and can integrate themselves into a complex media ecosystem' (Stefanone et al. 2008: 107). They argue that platforms, such as social networking sites, emphasize aspects of human interaction that have been traditionally associated with celebrities, including the primacy of image and appearance in social interaction. This may have social implications, such as 'promiscuous friending,' where the network is both a collection of known relationships as well as people with whom users may have never met. Beyond enabling social connections, this could lead to fame seeking or the desire to be 'popular' through the social imaginary of the multimedia environment.

The popularity of such sites may also be explained by the need of some people to look into other peoples' lives or to increase awareness of others within their physical and virtual communities (Strater & Richter 2007: 157). Inherent to such landscape is the ability to track other members of the community where the 'surveillance' functions allow an individual to track the actions and beliefs of the larger groups to which they belong (Lampe et al. 2006: 167). Lampe et al. (2006) define this as social searching or social browsing where it enables users to investigate specific people with whom they share an offline connection. Lampe et al. (2006:167) take the relationship between social networking and social browsing further by asserting that 'users largely use social networking to learn more about people they meet offline and are less likely to use the site to initiate new connections.'

IDENTITY AND SOCIAL NETWORKS

The identities established in social networking sites function to enable offline and online networks. Often, the identity that is constructed online reflects the complex entwining of computer-mediated communications on the one hand and offline social networks on the other. Jon Kleinberg (2006: 5) contends that 'distributed computing systems have incessantly been entwined with social networks that fuse user populations' in the online and offline environments. The growth of activities, such as blogging, social network services, and other forms of social media on the Internet has made large-scale networks more evident and visible to the general public. As Adam Joinson (2008: 1027) points out, Websites, such as Facebook, were originally built around existing geographical networks of student communities. This meant that offline communities were reflected in the online environment; such communities function in a number of ways: for example, as a means of sustaining relationships by providing social and emotional support; as an information repository; and, as offering the potential to expand one's offline and online networks. In view of this, on-line settings beyond being rich data on the construction of identity by users have also become rich sources of data for large-scale studies of social networks (See Backstorm et al. 2007; Caverlee et al. 2008; Mislove 2007; Mori 2005; Goussevskaia 2007; Joinson 2007).

Wellman (cf. Lange, 2007: 2) defines *social networks* as 'relations among people who deem other network members to be important or relevant to them in some way, with media often used to maintain such networks.' Another essential component of such sites is that user profile information involves some element of 'publicness' (Preibusch et al,. 2007) and it is the consumption of private details which sustains the culture of gaze and the curiosity of the invisible audience. Communication technologies, such as the Internet with its global platform where data can be endlessly circulated and anyone can leave electronic footprints, 'erode the boundaries between 'publicity' and 'privacy'(Weintraub & Kumar, 1997). Lange (2007), explains that social network sites are Websites that allow users to create a public or semi-public profile within the system and one that explicitly displays their relationship to other users in a way that is visible to anyone who can access their profile. Consequently, Boyd (2007) considers SNS's as the latest generation of 'mediated publics' where people can gather publicly through mediated technology. She points out that features (such as, persistence - i.e. the permanence of a profile and its circulation in cyberspace, searchability, replicability, and invisible audiences) constitute the key elements of this environment. Users' behavior may be mediated by these features without necessarily integrating the underlying immediate and future consequences or risks embedded in these technologies or their actions.

The ability to tag photos to profiles and the presence of photo recognition software means that there is a loss of visual anonymity which can be complemented by new forms of gaze (Montgomery, 2007). Equally, the semantic nature of the Web can simplify or reduce 'Web-based communications to the descriptive and may unconsciously ascribe social values by describing these relationships as 'friends' or 'acquaintances.' According to a study done by Sheffield Hallam University, while the number of friends people can have on such sites is massive, the actual number of close friends is approximately the same in the face-to-face real world (Randerson, 2007). Mori et al. (2005: 82) point out that Semantic Web-based ontologies deliberately simplify such relationships. Danah Boyd (2004:1280), in her enthnographic study of the Friendster site, found 'people are indicated as friends even though the user does not particularly know or trust the person.' In this sense, the Semantic Web flattens the complexity of relationships and falsely assumes that publicly visible or articulated social networks and relationships can be conflated with private relationships.

As such, publicity (and public labels such as 'friends'), exchange, and sharing are integral and definitive parts of the SNS culture where the emphasis is not entirely on the authenticity of the information but the elements of connection and connectivity it can create (Nardi, 2005). Social networking sites can also capture the shift in identities of users when they transition from one life phase into another. Such transitions can include progress from school to work place where the social connections and identity of the user can shift. In tandem with this, DiMicco and Millen (2007: 383) argue that these platforms are complex as such sites can reflect the fact that users have 'transitioned between life stages and expanded their number of social connections, and these sites can assist users in maintaining social networks and diverse social relations.' This then entails a degree of managing self-identity on such spaces and perhaps the creation of multiple identities through multiple profiles to delineate a distinction between corporate and non-coporate identites, for example, or between formal and professional relationships compared to long-term friendships. DiMicco and Millen's (2007: 386) research reveals that multiple identities can nevertheless be burdensome where users may require more technical knowledge to navigate access control mechanisms which may deny access to one set of users while allowing a target audience to view selected profiles.

Gross & Acquisti (2005), point out that the most common model of the SNS is the presentation of the participant's profile and the visualization of his or her network of relations to others. Such sites can encourage the presentation of a member's profile (including their hobbies and interests and the publication of personal and identifiable photos) to the rest of the community through technical specifications, while visibility of information can be highly variable amongst such sites. Most networking sites make it easy for third parties, from hackers to government agencies, to access participants' data without the site's direct collaboration, thereby exposing users to risks ranging from identity theft to online and physical stalking and blackmailing (Gross & Acquisti, 2005).

Additionally users browse neighbouring regions of their social network as they are likely to find content that is of interest to them. Thus search engines may use social networks to rank Internet search results relative to the interests of users' neighbourhoods in the social network.

RISKS

The casualness with which people reveal personal details online is related to the different norms people apply to online and offline situations where these variant norms have implications for notions of privacy, authenticity, community, and identity. Research conducted by Mislove et al. (2007:41) on sites (such as Flickr, LiveJournal, Orkut and YouTube) reveals that these sites are the portals of entry into the Internet for millions of users. Equally, they invite advertisements as well as the pursuit of commercial interest; this means users in these networks tend to trust each other having been brought together through common interests. *Trust* has been defined in various ways in sociological literature. Golbeck et al. (2003) define it as credibility or reliability in human interaction where it can entail the according of a degree of credence to a person through interpersonal communication. With specific reference to information sharing, Mori et al. (2005:83) infer that trust could relate to reliability with regard to how a person handles information that has been shared or reciprocated. Gips et al. 2005 argue that the 'social' aspect of these networks is self-reinforcing; this means to be trusted one must make many 'friends' and create many links that will slowly pull the user into the core of activities.

Barnes (2006), in citing Benniger, postulates that electronic forms of communication are gradually replacing traditional modes of interpersonal communication as a socializing force, mediating and at times displacing social norms in different contexts. In the interactive spaces of the Internet, there may be a disconnect between the way users say they feel about the privacy settings of their blogs and how they react once they have experienced the unanticipated consequences of a breach of privacy (cf. Barnes, 2006; Gibson 2007; Mannan & Oorschot 2008). The issue of privacy setting can be problematic on social networking sites for users since a default privacy setting can constrain a user's need to meet and network with more people beyond their offline network (Joinson 2008: 1035). Mannan & Oorschot (2008: 487) concur that there is a tendency to overlook privacy implications in the current rush to join others in 'lifecasting' and users may work on the false impression that only friends and family are consuming the personal content.

Gross & Acquisti's (2005) anecdotal evidence suggests that participants are happy to disclose as much information as possible to as many people as possible, thus highlighting the design and architecture of sites which hinge on the ease with which personal information is volunteered and the willingness of users to disclose such information. The perceived benefits of selectively revealing data to strangers may appear larger than the perceived costs of possible privacy invasions. Other factors (such as, peer pressure and herding behavior, relaxed attitudes towards or lack of interest in, personal privacy, incomplete information about the possible privacy implications of information revelation, faith in the networking service or trust in its members, and the myopic evaluation of privacy risks of the service's own user interface) may drive the unchallenged acceptance by users of compromises to their safety (Gross & Acquisti 2005; Strater & Richter 2007; Gibson 2007), thus sealing the role of SNS's as complicit risk communities.[this sentence was long enough to confuse and the puncuation added to the confusion; I hope these changes clarify the author's meaning.] Strater & Richter (2007) point out that large-scale analyses of Facebook have revealed that a majority (87% on average) of students have default or permissive settings. While a significant majority have an awareness of privacy options, less than half ever alter their default setting. This means that while users do not underestimate the privacy threats of online disclosure, they can nevertheless misjudge the 'extent, activity and accessibility of their social networks' (Strater & Richter 2007: 158).

According to a 2008 study by Ofcom, over one-fifth of UK adults have at least one online community profile (cf. Szomszor et al. 2008). Caverlee at al (2008: 1163) nevertheless point out that the growth of social networking sites has come with a huge cost as these sites have been subject to threats: such as, specialised phishing attacks, the impersonation of profiles, spam, and targeted malware dissemination. Unanticipated new threats, they state, are also bound to emerge. They identify three resonant vulnerabilities which plague social network users: malicious infiltration, nearby threats, and limited network view. Malicious infiltration covers the illusion of such networks being secure through the provision of requiring a valid email address or a registration form when in effect malicious participants can still gain access. Similarly, nearby threats allude to the nearness of malicious users who can be a 'few hops away' despite users believing they have a tight control over their direct friends. Lastly, a limited network view describes the fact that users have a myopic perspective on the entire network as they may not be privy to information about the vast majority of participants in the entire network. The Facebook site for example maintains over 18 million user profiles with 80% to 90% of college undergraduates as users where users are allowed to disclose more varied information fields on the site (cf. Strater & Richter 2007: 157). Strater and Richter's (2007) research on Facebook also reveals that users were unaware of the ability of others to remove, delete, and in other ways control tagged photographs and wall posts from their profiles, thereby consigning such personal images and information to a life of permanent circulation and consumption on the Web.

Barnes (2006), in citing Katz and Rice (2000), describes the Internet as a 'Panopticon where surveillance is part of the architecture'. There are a myriad of risks lurking in the trails of data people leave in SNS sites and in the ways it is mined for commercial, legal, and criminal purposes. SNS's (such as, LiveJournal.com, Facebook, Myspace, Friendster, and Google's Orkut.com) have been a source of concern in the US, initiating federal laws that require most schools and libraries to render such Web spaces inaccessible to minors in order to protect them from harm (McCullagh, 2006). Similarly, in the UK, the House of Lords Science and Technology select committee has suggested that both private and public sectors need more effective ways to deal with the rise of online fraud and hacking and have recommended the formation of a new national police squad charged with reducing online crime (Johnson, 2007). The Information Commissioner's Office (IOC) in the UK has also drawn up official guidelines for the millions of people who use such sites, offering warnings such as 'a blog is for life' and 'reputation is everything'. People are also advised that entries can leave an 'electronic footprint' and that the lives of people can be put at risk by the reckless disclosure of information (Hough, 2007). The notion of data and profiles having a permanence and circulation in unexpected ways is something the ICO wants to impress on people in terms of potential harm and transgression of privacy.

Early discourses of the Internet celebrated not only the ability to re-invent identity online but also the concept of 'avatarism' where a user can have multiple identities. But although this can certainly be empowering, it can also enable new forms of deception. New forms of narcissism enabled by SNS's, however, celebrate the notion of constructing one's offline profile online and inviting others to start friendships through such representations of self. Users may not then think beyond the cultural ethos of these spaces. Additionally, in tandem with the declaration of real identities online, deception and faking are also part of the terrain. Dana Boyd (2004), in observing the Fakesters in Friendsters Website, notes that users' appropriation of well-known celebrity and media profiles, or the invention of their own, 'exercises a certain creativity and introduces playful expression' which draws an audience that wishes to engage with these users. She asserts that 'fakesters' were means of 'hacking the system to introduce missing social texture'. Boyd's argument is that the phenomenon of the Fakesters reflects the fundamental weakness of trust in the network (in this particular instance the reference was to Friendsters) where there is an ambiguity between the real and the parody.

Beyond the personal information posted by social networkers, there are also worries about privacy after Facebook's secret operational code was published on the Internet. The Facebook site in the UK has 3.5 million users and about 30 million users worldwide. The company blamed the leaked code on a 'bug' which meant that it was published accidentally (Johnson, 2007). While such glitches may not necessarily allow hackers to access private information directly, they could nevertheless help criminals close in on personal data. While some personal information listed on the site is semi-private, government and quasi-government agencies, such as Get Safe Online in the UK, are worried that criminals who become friends with other users have the potential to find out much more information about them (Johnson, 2007). Research by Websense supports the idea that criminals 'work as an underground community, sharing information on what tools and methods work when it comes to tricking consumers on SNS and hackers have realized that they need to become discreet when it comes to social networking since they need to blend in with the crowd where links can be added to sites, such as Wikipedia, to lure users onto corrupt sites' (Vassou, 2006; Newman

2006). There have also been numerous incidents of spyware and spamming being employed by such sites (Rosen, 2007).

The constant demand to make these sites attractive to advertisers means that privacy of users can be compromised in other ways. Wendlandt (2007) notes that online advertising is the fastest growing segment of the advertising industry, currently accounting for more than 25% of advertising growth per year, translating to more than five times the recent average annual growth of other types of media with about 6-7% spent on Internet advertising globally. Recently, 13,000 Facebook users signed a petition protesting against the networking site's new advertising system which alerts members of friends' purchases online. Some Facebook members have even threatened to leave due to the fact that the new system allowed their friends to find out what they were planning to give them for Christmas (Wendlandt, 2007). Preibusch et al. (2007) point out that popular SNS sites, such as MySpace.com, collect data for e-commerce purposes. User profiles are important for data mining in such Websites. Data that accrues on the Web is not only used for communicating but also for secondary purposes that may be covered in the SNS's terms of use. Such data can be acquired by marketing agencies for targeted marketing or by law enforcement agencies and secret services, etc (Preibusch et al, 2007).

FUTURE TRENDS

With the increasing popularity of social networking sites, the incorporation of various multimedia formats and functions in these platforms, the supplanting of actual offline networks through social networks on the internet construct social networking sites as viable spaces for the movement of new forms of both social and financial capital (i.e. advertising, e-commerce and data mining). Here the act of connecting with larger user communities present challenges and risks for users, social software designers, commercial organizations and government bodies. The increasing appropriation of social networking sites into our everyday lives (through mobile technologies) and everyday engagements mean that visibility and non-visibility of social and personal networks will construct online identities as a vital part of a data economy. The need to reveal and to limit information flows and to enact a secure environment for users whilst enforcing users to comply with data management protocols on such sites will enact these as a contested space of new forms of sociability and social deviance. The users' notion of security, privacy and the human need for communion will continue to temper the social networks as complex and complicit risk communities.

CONCLUSION

The narcissistic streak in social networking sites that is evident through the creation of self- profiles hinges on the disclosure of offline identities where public spectacle and gaze repoliticize the construction of self. The notion of self in social networking sites is both imagined through self-description and crafted through textual and multimedia environments but equally through its articulation and display of contacts and its ability to invite or deny communion with other users. In this sense, the concept of self is anchored through both individual agency and imagination as well as other users' gaze and consumption of these profiles. This explicit ethos of exposure, display, and spectacle define the cultural ethos of social networking sites. This phenomenon again ignites debates about the issues of identity formation on the Internet where identity can be created and defined in multiple ways and is amenable to deception and inauthenticity. In the process, it highlights the complex nature of the Internet environment which can demand different cultural responses from different online spaces and communities of users. Self-exposure and narcissism gives a platform for re-definition of offline identities and new sociabilities which can in turn reconfigure and redefine the notion of friendship and community in these spaces. SNS's also herald the emergence of complicit risk communities where personal information becomes social capital which is traded and exchanged and where the concept of public or private can be defined through the nature of users' access, gaze, and the transactions and interactions they permit.

The culture of social networking sites thrives on the narcissistic and the performative, on one hand, and reciprocity and exchange, on the other. Hence the potential dangers and risks of willingly disclosing and displaying personal details become part of the architecture or code of these sites. The appropriation of new technologies by individuals in order to communicate, form new communities, and maintain existing relationships signifies new ways in which risk becomes embedded and encoded into our social practices, posing new ethical and legal challenges which inadvertently expand the landscape of risk.

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This work was previously published in Collaborative Technologies and Applications for Interactive Information Design: Emerging Trends in User Experiences, edited by S. Rummler & K.B. Ng, pp. 82-95, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 7.15
Audience Replies to Character Blogs as Parasocial Relationships

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ABSTRACT

News anchors, talk show hosts, and soap opera characters often become objects of parasocial affection because of the nature of these program genres. This chapter explores the concept of parasocial interaction by focusing on audience replies to blog posts made on behalf of a TV character, Jessica Buchanan of ABC Television Network's *One Life to Live* show. The authors employ communication accommodation theory to illuminate the concept and to identify specific communicative behaviors that occur during parasocial interaction. The chapter presents evidence of parasocial interaction within the blog replies and audience accommodation to the blog posts. Analysis suggests that parasocial interaction is the mediated manifestation of the relationship dimension inherent in television messages and used by audience members in much the same way it is used during face-to-face interaction.

DOI: 10.4018/978-1-60566-368-5.ch027

INTRODUCTION

It is estimated that in the U. S. 12 million adults "blog" or keep online journals and 57 million adults or 39% of all adult Internet users report reading blogs (Lenhart & Fox, 2006). A worldwide total of 175,000 new blogs are created every day, and the web search engine Technorati (2008) reports tracking 112.8 million blogs worldwide. Blogs are used as a vehicle for providing commentary to the public. The critical differences in blogs and diaries are the opportunities for reaching a mass audience and the opportunity for that mass audience to respond to the commentary found within the blog. Because of the interactive nature of the blogs and blogging software, readers are able to add comments, links, pictures, video, or any other media format to the blog for the edification and entertainment of other denizens of the Internet.

Popular television characters - such as, Dwight Schrute (*The Office*), Joe the Bartender (*Grey's Anatomy*), and Jessica Buchanan (*One Life to Live*) - have blogs that allow audience members' additional insight into the character's identity and additional information about the story or plotline. These blogs are different from the blogs maintained by actors since they are written from the perspective of a fictional character. More importantly these character blogs allow audience members the perception that they can interact with the character – even though this interaction is parasocial. While audience members have always had some opportunity to interact, or more often, parasocially interact with characters through fan mail, the messages they send have not been readily available to scholars for study. Blog messages are more plentiful and easier to access, and provide communication scholars an invitation for studying parasocial interaction in depth.

In this chapter we first address what is known about parasocial relationships between the audience and TV characters. We then introduce communication accommodation theory as a framework for identifying specific communicative behaviors that are likely to occur during parasocial interaction. An analysis of a TV character blog determines whether parasocial behaviors occur in blog replies and whether there is evidence of audiences accommodating the communicative behavior of the character. Finally we offer some suggestions for future research and future trends in this line of research.

BACKGROUND

Parasocial Interaction

The term *parasocial interaction* was used by Horton and Wohl (1956) to explain feelings of closeness audience members feel toward television characters. This closeness is believed to arise when TV characters behave in ways that resemble face-to-face interaction. This feeling of intimacy can be enhanced by production characteristics, such as the selection of shots and the format of the program. Bell (1991) suggests audience members may also feel as if they are engaged in an interaction when the characters seem to be adapting their behavior to the anticipated reaction of the audience. An example may help illustrate this notion. Imagine a scene where a talk show host is performing a monologue. On a small scale, a pseudo-interaction sequence might look something like this:

TV Host: Tells a bad joke.

Audience: Groans, boos, or merely does not laugh.

TV Host: Does a double take and makes a face.

In this example the audience members may feel as if the character told them the joke and then responded to their reaction. (Note that this is not a real interaction and the audience is aware of that.) Such interaction may seem more dynamic than a simple monologue because the character appears to be reacting to the audience.

Audience members are limited in their ability to reply or interact with their favorite TV characters. The audience member may "reply" by making commentary or talking back to the TV, laughing, or nodding their heads in agreement. Rather than sending fan mail, viewers may imitate face-to-face interaction. Again it is critical to acknowledge that the audience members understand that they are not actually interacting with the character. In a sense, the audience member is also acting like he or she is interacting with the character. More often, however, the audience member will do nothing more than think about the character's message and generate a reply. These parasocial interactions only occur in the minds of audience members but are nonetheless similar in some ways to actual interactions.

Since these faux interactions occur largely in the mind of the audience member, their responses to the character's messages can be viewed as cognitive. Greenwald (1968) recognized that people are often influenced more by their thoughts or cognitive responses to a message than by the message itself. More importantly audience members often recall their cognitive responses more accurately than they can remember the actual messages. These cognitive responses, then, may be considered as the cognitive enactment of parasocial interaction.

Audience replies to the blog posts of a TV character can be viewed as cognitive responses. In the cognitive response literature, the thought listing procedure is used by researchers to ascertain the thoughts of study participants. Applying this procedure researchers ask respondents to write down each individual thought that they go through while they are listening to a message (see Cacioppo, von Hippel, & Ernst, 1997 for an excellent overview of the technique). Audience replies to character blogs are similar to the thought listing procedure in that the replies identify the thoughts or issues of importance to them in response to the program and/or the character's blog postings. It is not unreasonable to expect that audience members in a close parasocial relationship will respond differently from an audience member who is less involved with the character.

Research investigating factors that increase the likelihood of parasocial interaction suggests audience members are more likely to report that they are in a parasocial relationship with a character when:

- A program presents a character in ways that resemble face-to-face interaction (Meyrowitz, 1986; Nordlund, 1978; Rubin, Perse, & Powell, 1985);
- The character engages in a conversational style of speaking and provides the audience an opportunity to respond (Rubin, Perse, & Powell, 1985); and
- Viewer involvement in a program is high (Rubin & Perse, 1987). Parasocial interaction is also more likely to occur with media personae that appear frequently on television (Levy, 1979).

Audience members are more likely to initiate face-to-face contact with characters when they report high levels of parasocial interaction (Gans, 1977; Horton & Wohl, 1956; McGuire & LeRoy, 1977). Talk show hosts, soap opera and TV shows characters, and news anchors have been most often examined as objects of parasocial affection because of the nature of those program genres.

Meyrowitz (1994) investigated the impact of losing parasocial relationships on audience members by examining audience reactions to the deaths of celebrities, such as John Lennon and Elvis Presley. He found that such a loss is not unlike the loss of a close friend and characterized these relationships as being very warm and caring. Cohen (2004) and others have examined the impact of characters being lost to show cancellations or cast restructuring and found a correlation between levels of parasocial interaction and expected breakup distress. This is consistent with Koenig and Lessan (1985) who found that viewers reported feeling closer to a favorite TV personality than to mere acquaintances (but not as close as a good friend). Audience members report feeling sorry for characters, missing characters, looking forward to seeing characters, seeking out information about the characters, and desiring to meet them in person (Rubin, Perse, & Powell, 1985).

While researchers have long suggested parasocial relationships can serve as a substitute for interpersonal relationships, the research has generally not supported this claim (Finn & Gorr, 1988; Rubin Perse, & Powell, 1985). Rather, there is little reason to believe that parasocial interaction can be predicted by social deficits, such as chronic loneliness (Ashe & McCutcheon, 2001; Perse & Rubin, 1989; Rubin, Perse, & Powell, 1985), neuroticism (Tsao, 1996), and low self-esteem (Tsao, 1996; Turner, 1993). In fact, people who have difficulty developing interpersonal relationships also often have trouble developing parasocial relationships (Cohen, 2004). These scholars have begun to suggest that parasocial relationships provide company for audience members (Isotalus, 1995) and are complementary to interpersonal relationships (Kanazawa, 2002, Perse & Rubin, 1990; Taso, 1996).

Given the increasing acceptance among researchers that parasocial relationships should be examined in much the same way that interpersonal relationships are studied, it may behoove scholars to employ communication accommodation theory in their efforts. Horton and Wohl (1956) suggest as much: "The more a performer seems to adjust his performance to the supposed response of the audience, the more the audience tends to make the response anticipated." Furthermore, the "simulacrum of conversational give and take may be called para-social interaction" (p. 215). Bell (1991) concurs and identifies accommodation theory as an excellent candidate for navigating the nexus between mass and interpersonal communication. They argue that audience perceptions of character accommodation – as manifest by the appearance of characters' adjusting their communicative performance to expected audience responses – should increase the likelihood of parasocial interaction.

Communication Accommodation Theory

Communication accommodation theory (Giles, 1973; Giles, Coupland, & Coupland, 1991) is an explanation of why people modify their communicative behavior to match the communicative behavior of others during face-to-face interaction. The theory is an extension of social identity theory (Tajfel & Turner, 1979; Tajfel, 1982) and suggests people behave in ways that will result in being seen as socially desirable. Proponents of social identity theory believe our conceptions of self are based on the social status ascribed to our membership groups. So from the perspective of social identity theory, an individual's social status is determined by social status attributed by themselves and others to their social groups. Similarly, when an individual is evaluating the social status of someone else, the social status of their group memberships plays a large role in determining that social calculus. Who we are is determined, in part, by the social groups that include and exclude us as members.

Accommodation theory suggests that when we interact with socially desirable others we adapt our communicative behavior to more closely approximate their behavior. Through this process of imitation or convergence, we are trying to ingratiate ourselves to be socially desirable and be viewed by others as being a member of that socially desirable group. We hope that through accommodation, the high status individual will like us and invite us into his or her social group. Strategically speaking we adopt the behavior of the socially desirable individual to reduce the communicative differences between us. On the most basic level, this adaptation of communicative style and content may be little more than imitating the behavior and language of the individual we are trying to accommodate so that we are accepted and liked. Of course, more skilled social interlocutors are able to converge using far less obvious and far more sophisticated techniques. Borrowing a phrase, adopting the cadence or speech patterns of the other, employing similar literary references, or even adopting the same metaphorical world view are all ways of converging with a conversational partner.

When we find ourselves interacting with someone less socially desirable, we maintain or increase communicative differences between us. In fact we behave in ways that signal to all that we are not like the person we are currently interacting. Behaving in ways that maintain our differences is called *divergence*; it is a strategy we use to maintain or increase the social distance between us.

Giles, Coupland, and Coupland (1991) suggest that sometimes people accommodate or adjust their linguistic and their nonverbal behavior in face-to-face conversations as a conscious strategy to gain approval from or to influence the other communicant. At other times we accommodate without being consciously aware of our behavior change. Whether the convergence is mindful or not, a growing body of research suggests people are influenced by people who accommodate or imitate their language (Giles, Coupland, & Coupland, 1991; van Baaren, Holland, Steenaert, & van Knippenberg, 2003) or their gestures (Chartrand & Baragh, 1999; Mauer & Tindall, 1983).

Research into the accommodation process has identified a number of behaviors including: being attentive (Ng, Liu, Weatherall, & Loong, 1997), offering compliments (Williams & Giles, 1996), head nodding, facial affect and smiling (Hale & Burgoon, 1984), pause lengths (Giles et al., 1987), posture (Condon & Ogston, 1967), self disclosure (Ehrlich & Graeven, 1971; Henwood, Giles, Coupland, & Coupland, 1993; Giles & Harwood, 1997), speech rate (Street, 1983), speech volume (Ryan, Hummert, & Boich, 1995), being supportive, (Ng et al., 1997), utterance length (Matarazzo et al., 1968; Giles et al., 1987), vocabulary (Giles, Mulac, Bradac, & Johnson, 1987), and vocal intensity (Natale, 1975; Welkowitz, Feldstein, Finkelstein, & Aylesworth, 1972).

While it could be argued that all audience members' responses to character blogs are parasocial interactions, other motivations, uses, or gratifications may also account for this behavior. If parasocial interaction is indeed motivated identification with or affinity toward the character, it is reasonable to expect audience replies to blog posts to prominently feature accommodation behavior. Accepting the premise that parasocial interaction should be studied in much the same way that interpersonal interaction should be studied, audience members should enact convergence behaviors when they reply to character blogs.

In an effort to test these ideas, character blogs and the replies to those blog posts were examined. Since the previous research suggests daytime serials have been one of the most widely researched program genres within the parasocial interaction literature and because the nature of "soap operas" encourage the development of parasocial relationships, the subsequent analyses focus on audience replies to the blog posts of Jessica Buchanan. Jessica Buchanan has been a character on the daytime program *One Life to Live* since its beginning. Taking place in Llanview – a fictitious suburb of Philadelphia, *One Life to Live* was created by Agnes Nixon and premiered on ABC in July 1968. Jessica Buchanan suffers a multiple personality disorder. Jess's second and quite distinct personality is Tess.

AN ANALYSIS OF AUDIENCE BLOG REPLIES

All of the blog posts penned by the character Jessica Buchanan between October 15, 2007 and January 11, 2008 were analyzed. Jessica made 20 entries to her blog during that time and a total of 56 audience members responded by sending 117 replies. A content analysis of the blog posts and the audience replies yields several interesting findings. None of the blogging was done by Jessica's other personality Tess. In two instances an audience member asked Jessica about the reappearance of Tess – most often in response to problems that Tess would remedy through violence. The typical blog post by Jessica was 75 words long – not including a heading and a date. These posts focus on her feelings about what has been happening within the plotline of the program. Jessica makes no mention of subplots or other characters unless they directly affect her somehow. In a sense, Jessica writes in her blog as if it were a journal or a diary that is being shared with the audience. There is no acknowledgement of the audience in her blog posts nor are there ever replies to questions or comments made by audience members.

Examination of audience replies to the blog posts indicates great disparity in their communicative behavior. Of the 56 individuals posting replies, only 9 wrote more than one time to Jessica. That is to say 83.9% of the replies were written by people who only wrote one message to Jessica over the three month period. Four of those 9 audience members wrote between 2 and 4 messages to Jessica and the remaining five audience members replied to blog posts 9 or more times during the period. This disparity is both statistically significant and theoretically significant since it provides evidence that even among fans of the show motivated enough to reply to a blog post, there is a great deal of variation in the amount of character contact audience members desire. In fact only one of the 117 blog replies contains a request for actual interaction. The fan wrote: "email me – it's the address above." That same fan also wrote the only blog replies indicating they had actually seen the character on the street. On these two different occasions the audience member wrote: "I saw you on Friday and you looked great – cool shirt," "I saw you today and you looked pretty cool," and "I just wanted to tell you that. Ok?" This particular fan replied to blog posts on 9 different occasions and repeatedly tells Jessica, "I'm your biggest fan." This last comment still brings to mind John Hinkley's last words to John Lennon even 28 years after the fact.

Audience members desiring contact are clearly interested in contact with Jessica and not the other audience members. Only three blog replies ask other audience members for information about a character or situation occurring on the soap. All three of these messages oriented toward other fans were written by individuals who only replied to one blog post during the entire period. Additionally, these requests for information from other fans only yielded one reply during the entire three month period. This seems to reduce the viability of the interactional starvation explanation for audience behavior.

The audience comments suggest clear evidence of parasocial interaction. Those audience members replying frequently tend to reply in much the same way they would reply to a friend via e-mail or a letter. In addition, the audience members making multiple posts to the blog often offer sympathy (e.g., "I hope you…" "I think you're better off…," and "Good for you Jess …") or advice (e.g., "you should …," "you're better off if you …," and "I think you can …"). It is also quite common for audience members to ask questions of Jessica – as though they were literally interacting (e.g., "Is Tess gone for good?" "What is the matter with Sarah lately?" "Why don't you just tell the family the truth?" "Is Vicki gonna be found in Paris, Texas?"). Audience members also use the "xoxo" convention to extend hugs and kisses to the character in their e-mail. Thus there does appear to be some evidence that some, if not many, audience members are behaving in ways that are consistent with parasocial interaction.

From the perspective of accommodation theory, fans should enact convergence behaviors or adopt behaviors consistent with Jessica's behavior if they perceive a character to be highly socially desirable. Analysis of the blog replies provides evidence of characters engaging in accommodation behaviors in their replies to Jessica's blog posts. For example, there is evidence that offering compliments constitutes convergence behavior (Williams & Giles, 1996) and can be found in the audience replies (e.g., "You pretending to be Jess is a great idea …," "I love you guys …," "Dressing her up as Jared was a stroke of genius…," "Of course you're fiercely protective of your twin and everyone else you love. That's one of your best qualities…," "You go girl …," "Applauds Jessica...," "You are a neat family …").

Self disclosure is another communicative behavior that has been associated with convergence and again can be found, although much less frequently, in the audience replies (Ehrlich & Graeven, 1971; Henwood, Giles, Coupland, & Coupland, 1993; Giles & Harwood, 1997). Responses that illustrate this say: for example, "Get a dog, I have two dogs…," "I would miss him too …," "I was heartbroken when you chose to be with Nash – I actually cried," and "I seen a lot of snakes since I been (Sic) dating…."

Other more common convergence behaviors found in audience replies include being attentive (Ng et al., 1997) and supportive (Ng et al., 1997). In nearly every blog reply, there is clearly some evidence of audience members expressing support for Jessica. This support includes informational support, such as telling Jessica things that are going on in the program as well as being empathetic and providing her emotional support. Examples of informational support include: "You might want to get that dizziness checked out …," "There might be a slight chance you are pregnant…," "I see romance between Antonio and the lady cop anyway …," and "Please don't let Dorian get Charlie, Vicki found him first and she deserves him a lot more than you know."

Examples of empathy and the provision of emotional social support are also very common in audience replies to Jessica: "You are right. You've been through hell & back. I can understand why you would be afraid to marry again. But Nash is not Antonio or Tico…," "If I was in your shoes, I would miss him too," "Jessica you're doing the right thing for you, Bree and Nash …," "Don't feel guilty for hurting Antonio. Eventually he will understand that things are better this way. It wasn't fair to you or Antonio living the lie of your marriage when you were in love with Nash. You were dying and you had to tell Antonio the truth once and for all. Eventually, he will move on and he can be happy with Jamie and whoever comes into his love life next…. Enjoy your new life and take it easy. Just because you've been released from the hospital doesn't mean you're invincible."

Other examples of convergence, including the borrowing of vocabulary from another person in conversation, can be found in the language used by audience members. For example, in one blog entry, Jessica refers to Jared Banks as a "snake." In two of the nine replies to that post, the fans described Jared as being a snake and a third reply suggested Jessica throw Jared out on his "reptilian ass." Obviously this type of language convergence is quite difficult to code unless the vocabulary is idiosyncratic, but it is clear from going through all of the blog replies that there is a great deal of mirroring of language and style in blog replies.

We suggest parasocial interaction can be studied by examining the audience replies to character blogs. Certainly the analysis of blog posts is not the only way to study parasocial interaction, but it represents a relatively unobtrusive way for researchers to gain insight. In addition, communication accommodation theory appears to be useful for identifying specific behaviors that demonstrate convergence and divergence. Examining parasocial relationships in much the same way interpersonal relationships are studied should yield important insights into the potential uses and effects of the mass media. Perhaps more importantly, the use of accommodation theory may also help us better understand the differences and similarities between interpersonal and mass communication.

FUTURE TRENDS

In the future, researchers will examine more closely convergence and divergence behaviors that occur in parasocial relationships. A growing body of research on the notion of parasocial breakups (e.g., the consequences of shows being taken off the air or characters being written out of shows) will undoubtedly help in this endeavor (Cohen, 2004). New studies that use attachment theory (Bowlby, 1973) may also shed some light on the ways audience members become involved in parasocial relationships. Borrowing from attachment theory, once again, points to the increased use of research on interpersonal communication and interpersonal relationships to understand parasocial interaction. It makes sense that the reasons children form attachments to their parents and that adults form attachments to other adults should also apply to the reasons they form attachments to mediated characters.

Future researchers will undoubtedly begin focusing their efforts on explaining the communicative processes that occur during parasocial interaction. We suggest the interactional view

(Watzlawick, Beavin & Jackson, 1967) as a starting point for such efforts. This theoretical structure may identify the underlying mechanism for parasocial relationships as well as a mechanism for explaining how individuals can use the same media content and characters to fulfill their needs.

The key axiom applicable here is that messages have both a content and relationship dimension. The content component is the message or the words within a message while the relationship component tells communicants how the content/message should be interpreted. How the message should be interpreted is based on a number of factors – the most important being the nature of the relationship between the communicants. The relationship between communicants is believed to be the single most important contextual factor and can obviously alter the meaning of message content.

If the interactional perspective is adapted to mediated communication, audience members establish relationships with all TV characters so that they can contextualize the messages they receive from television. Certainly not all relationships are particularly close – just as most of our interpersonal contact is not particularly intimate. Thus parasocial relationships are an example of close relationships between audience members and characters. These relationships are interesting because close relationships have idiosyncratic relational rules or rules that are specific to a particular relationship. That audience members' can develop relationships – albeit parasocial relationships – with characters allows audience members to shape a message to better use the media for gratification.

Future research also needs to compare the communicative behavior of fans writing to TV characters with those replying to blogs written actors. The teen actress Kristen Aldersen who plays Starr Manning on *One Life to Live* also has a blog. Kristen writes her blog not in character but instead as herself (a high school aged actress). Audience members behave quite differently when replying to her blog, just as they behave differently to other TV characters (e.g., Kendall Hart-Slater of *All My Children* and Dr. Robin Scorpio of *General Hospital*).

The ultimate value of such research may be the explication and clarification of the parasocial interaction concept. It seems less useful if it is a loss of touch with reality as it has been written about in the past. If parasocial interaction is more akin to being highly involved and a key determinant in the way audiences contextualize mediated messages, then this should become clear under careful scrutiny.

CONCLUSION

A life-long fan of General Hospital, Mary Ann Gayonski (personal communication, September 13, 2008) summed up audience perceptions of parasocial interaction accurately when she said, "I feel like I know them." "If I saw a character on the street I would want to talk with them about what is happening on the show." "I don't know that much about the actor, but I do know the character." "It really is like knowing someone – it's not the same as knowing someone – but it is like knowing someone." "Lots of time I know what a character is going to do before they do it." "They are not really friends but they do seem like friends sometimes." This testimony reveals that audience members would treat characters as if they were friends or acquaintances – even though they recognize them for what they are in most cases – characters on a fictional program.

As friends and acquaintances, audience members are likely to accommodate or converge given the affect they feel toward the character when given a chance to interact. If audience members feel that characters are "like friends," they are likely to treat them as if they are friends – just as dog owners may treat their pets as if they have language skills they do not possess. Like using heuristics in the evaluation of information, these behavioral heuristics occur because it is easier to behave toward characters as if they were actually people.

With the addition of an audience of other fans able to view character blog posts and replies to blog posts, it is again reasonable to expect some effort at accommodation to demonstrate their similarity with the character as well as some divergence behaviors to indicate to others that they indeed recognize the characters are not real. If audience members are behaving toward the other audience members, we would expect more divergence and less convergence to occur. This preliminary research certainly does not support that hypothesis. Very little audience-to-audience interaction can be observed within these blog posts and replies. Audience members appear to be writing to the characters with little regard for others "eavesdropping" into their conversation.

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KEY TERMS AND DEFINITIONS

Accommodation: The modifications in communicative behavior made by individuals during interaction. Accommodation may include changes to verbal, vocal and non-verbal behaviors. The process of accommodation may occur as an intentional communicative strategy or may occur without the conscious awareness of the individual; it is motivated by the desire to be liked. Accommodation can be manifest as convergence (adopting the communicative behavior of another) or divergence (behaving stylistically different from another to maintain our differences).

Cognitive Response: Thoughts that occur while we are listening to someone talk are called *cognitive responses*. Cognitive response is not a synonym for decoding a message. "Decoding" refers to a completely separate process. In decoding, sound or visual stimuli are translated back into language. Once we have decoded the message, our idiosyncratic responses or thoughts to those messages are described as our cognitive responses. If we are very interested in the topic, our cognitive responses may be message relevant. Message relevant responses focus on counter-arguments or additional evidence supporting a particular position. If we are not interested in the topic, our cognitive responses may not be particularly message relevant (e.g., "I "I need to get gas on my way home"). In short, our cognitive responses are the things we think of while listening to the messages of others. Cognitive responses occur while reading, watching television, listening to the radio, or surfing the Internet.

Communication Accommodation Theory: Proposed by Howard Giles, professor of communication at the University of California, Santa Barbara, to explain the adaptations people make in their communicative behavior during conversation. The theory assumes people adapt their communicative behaviors and message content in an effort to be perceived favorably by high social status individuals. When interacting with individuals of low social status, we are motivated to maintain our distance or be perceived as being different from the low status individuals. This theory is based on many of the same tenets as social identity theory.

Convergence: When an individual imitates or adopts the communicative behaviors of another in conversation, we say they are converging or becoming more like the other communicatively. For example a person may accommodate the communicative behavior of another by talking louder or adopting an accent (vocal accommodation), by appropriating the language of another in conversation (verbal accommodation), or by imitating kinesic or facial behaviors (nonverbal accommodation). These adaptations are efforts by a communicant to be viewed favorably by the high social status other during conversation.

Divergence: When we communicate with someone we perceive to be socially unattractive, we diverge or behave in such a way that we will be viewed as being different from that person. Motivated by the desire to be seen as socially desirable, in the presence of an undesirable communicative partner, we fail to accommodate and actually behave in ways that will distance us from another. For example, if someone uses coarse language or slang, we might diverge by employing formal or more precise language. If they talk in a loud voice, we might talk in a quiet voice; and, if they wave their hands, we might maintain a more still communicative style.

Parasocial Interaction: The term *parasocial interaction* is often used as a synonym for parasocial relationship. When the two terms are differentiated, parasocial interaction is used to describe the specific audience and/or character behaviors. One character winking at an audience and another giving a soliloquy are examples of parasocial interaction. Similarly audience members talking to their TV or generating verbal replies that go unexpressed are examples of parasocial action too. It is generally believed that the way a show is designed and shot contributes to the likelihood of audience members engaging in parasocial interaction and/or establishing parasocial relationships.

Parasocial Relationship: The term *parasocial relationship* was first coined by Horton & Wohl (1956) to describe the pseudo-friendships that occur between audience members and TV characters and other media personae. The notion of relationship is used here to describe faux interpersonal relationships that typically share some commonalities with actual interpersonal relationships. For example, an audience member can feel affect toward a character, "know" or understand the character, or relate to a character as if the character was an actual acquaintance. These relationships can represent little more than the liking of a character; they can also extend into the realm of delusion. In such extreme cases, audience members may actually believe they have a relationship with the character. The term is often used to identify the similarities between interpersonal relationships and mediated relationships.

Thought Listing Procedure: A social psychological procedure for cognitive response evaluation technique used by researchers to gather the cognitive responses of individuals. After exposing subjects to a message, the researcher asks subjects to list the thoughts that ran through their heads during message presentation. Each thought or cognitive response can then be examined to see whether respondent thoughts are consistent or inconsistent with the message and ultimately how effective a particular message may be.

Web Logging or Blogging: Blogs are online diaries or journals used by their authors as vehicles for providing commentary. They are updated on a regular basis and tend to focus on the personal experiences of the author. The critical differences in blogs and diaries are the opportunities for reaching a mass audience and the opportunity for that mass audience to respond to the commentary found within the blog. Because of the interactive nature of the blogs and blogging, software readers are able to add comments, links, pictures, video, or any other media format to the blog for the edification and entertainment of other denizens of the Internet. Blogging, then, is the act of updating a blog or an online diary.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova & R. Fiordo, pp. 302-314, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 7.16
The Generative Potential of Appreciative Inquiry as an Essential Social Dimension of the Semantic Web

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ABSTRACT

The mission of this chapter is to present a framework of ideas concerning the expected form of knowledge sharing over the emerging Semantic Web. Of specific interest is the perspective of appreciative inquiry, which should accommodate the creation of some appreciative knowledge environments (AKE) based on the peculiar organizational concerns that would encourage or better institutionalize knowledge work among people of interest in an organization. The AKE idea is extensible to the building of virtual communities of practice (CoP) whose meta-data requirements have been so much facilitated in today's Web technologies including the ideas of data ownership, software as services, and the socialization and co-creation of content, and it is increasingly visible that the AKE model of knowledge sharing is compatible for the need of virtual collaboration in today's knowledge-centric organizations. The author's investigation should provide a basis to think about the social dimension of today's Semantic Web, in view of the generative potential of various appreciative processes of knowledge sharing among communities of practice distributed throughout an organization.

DOI: 10.4018/978-1-60566-650-1.ch021

INTRODUCTION

In the late 20th century, Tim Berners-Lee (1999) had the idea of providing rapid, electronic access to the online technical documents created by the world's high-energy physics laboratories. He sought to make it easier for physicists to access their distributed literature from a range of research centers scattered around the world. In the process, he laid the foundation for the World Wide Web. Berners-Lee has a two-part vision for the working of the World Wide Web (http://public.web.cern.ch/Public/Welcome.html). The first is to make the Web a more collaborative medium. The second is to make the Web understandable and thus serviceable by machines. Yet, it was not his intention that someday his idea to link technical reports via hypertext then has actually revolutionized essential aspects of human communication and social interaction. Today, the Web provides a dazzling array of information services designed for use by human, and has become an ingrained part of our lives. There is another Web coming, however, where online information will be accessed by intelligent agents that will be able to reason about that information and communicate their conclusions in ways that we can only begin to dream about. This is the Semantic Web (Berners-Lee, Hendler, & Lassila, 2001; Berners-Lee, 1998a, 1998b, 1998c; http://www.SemanticWeb.org), representing the next stage in the evolution of communication of human knowledge. The developers of this new technology have no way of envisioning the ultimate ramifications of their work. Still, they are convinced that "creating the ability to capture knowledge in machine understandable form, to publish that knowledge online, to develop agents that can integrate that knowledge and reason about it, and to communicate the results both to people and to other agents, will do nothing short of revolutionize the way people disseminate and utilize information" (Musen, 2006, pp. xii). This article is meant to provide a strategic view and understanding of the Semantic Web, including its attendant technologies. In particular, our discussion situates on an organization's concerns as to how to take advantages of the Semantic Web technologies, by focusing on such specific areas as: diagnosing the problems of information management, providing an architectural vision for the organization, and steering an organization to reap the rewards of the Semantic Web technologies. Of interest here is the introduction of the appreciative context of organizational systems development based on the philosophy of appreciative inquiry (Cooperrider, 1986; Gregen, 1990), a methodology that takes the idea of social construction of reality to its positive extreme especially with its relational ways of knowing.

THE TECHNOLOGICAL BACKGROUND OF SEMANTIC WEB

Most of today's Web content is suitable for human understanding. Typical uses of the Web involve people's seeking and making use of information, searching for and getting in touch with other people, reviewing catalogs of online stores and ordering products by filling out forms, as well as viewing the confirmation. The main tool of concerns is the search engine (Belew, 2000), with its key-word search capability. Interestingly, despite much improvement in search engine technology, the difficulty remains; namely, it is the person who must browse selected documents to extract the information he or she is looking for. That is, there is not much support for retrieving the information, which is a very time-consuming activity. The main obstacle to providing better support to Web users is the non-machine-serviceable nature of Web content (Antoniou & van Harmelen, 2004); namely, when it comes to interpreting sentences and extracting useful information for users, the capabilities of current software are still very limited. One possible solution to this problem is to represent Web content in a form that is more readily machine-processable and to use intelligent techniques (Hendler, 2001) to take advantage of these representations. In other words, it is not necessary for intelligent agents to understand information; it is sufficient for them to process information effectively. This plan of Web revolution is exactly the initiative behind the Semantic Web, recommended by Tim Berners-Lee (1999), the very person who invented the World Wide Web in the late 1980s. Tim expects from this initiative the realization of his original vision of the Web, i.e. the meaning of information should play a far more important role than it does in today's Web. Still, how do we create a Web of data that machines can process? According to Daconta and others (2003), the first step is a paradigm shift in the way we think about data. Traditionally, data has been locked away in proprietary applications, and it was seen as secondary to the act of processing data. The path to machine-processable data is to make the data progressively smarter, through explicit metadata support (Tozer, 1999). Roughly, there are four stages in this smart data continuum (Daconta, Obrst, & Smith, 2003), comprising the pre-XML stage, the XML stage, the taxonomies stage, and the ontologies stage. In the pre-XML stage where most data in the form of texts and databases, is often proprietary to an application, there is not much smartness that can be added to the data. In the XML stage where data is enabled to be application independent in a specific domain, we start to see data moving smartly between applications. In the third stage, data expected to be composed from multiple domains is classified in a hierarchical taxonomy. Simple relationships between categories in the taxonomy can be used to relate and combine data, which can then be discovered and sensibly combined with other data. In the fourth stage based on ontologies which mean some explicit and formal specifications of a conceptualization (Gruber, 1993), new data can be inferred from existing data by following logical rules. This should allow combination and recombination of data at a more atomic level and very fine-grained analysis of the same. In this stage, data no longer exists as a blob but as a part of a sophisticated microcosm. Thereby, a Semantic Web implies a machine-processable Web of smart data, which refers to the data that is application-independent, composable, classified, and part of a larger information ecosystem (ontology).

Understanding Semantic Web Technologies

Today, XML (extensible markup language; http://www.xml.com) is the syntactic foundation of the Semantic Web. It is derived from SGML (standard generalized markup language), an international standard (ISO8879) for the definition of device- and system-independent methods of representing information, both human- and machine-readable. The development of XML is driven by the shortcomings of HTML (hypertext markup language), the standard language also derived from SGML, in which Web pages are written. XML is equipped with explicit metadata support to identify and extract information from Web sources. Currently, many other technologies providing features for the Semantic Web are built on top of XML, to guarantee a base level of interoperability, which is important to enable effective communication, thus supporting technological progress and business collaboration. For brevity, the technologies that XML is built upon are Unicode characters and Uniform Resource Identifiers (URI). The former allows XML to be authored using international characters, whereas the URI's are used as unique identifiers for concepts in the Semantic Web. Essentially, at the heart of all Semantic Web applications is the use of ontologies. An ontology is often considered as an explicit and formal specification of a conceptualization of a domain of interest (Gruber, 1993). This definition stresses two key points: that the conceptualization is formal and hence permits reasoning by computer; and that a practical ontology is designed for some particular domain of interest. In general, an ontology describes formally a domain of discourse. It consists of a finite list of terms and the relationships between these terms. The terms denote important concepts (classes of objects) of the domain. The relationships include hierarchies of classes. In the context of the Web, ontologies provide a shared understanding of a domain, which is necessary to overcome differences in terminology. The search engine can look for pages that refer to a precise concept in an ontology instead of collecting all pages in which certain, generally ambiguous, keywords occur. Hence, differences in terminology between Web pages and the queries can be overcome. At present, the most important ontology languages for the Web include (Antoniou & Harmelen, 2004): XML (http://www.w3.org/XML/), which provides a surface syntax for structured documents but imposes no semantic constraints on the meaning of these documents; XML Schema (http://www.w3.org/XML/Schema), which is a language for restricting the structure of XML documents; RDF (Resource Description Framework) (http://www.w3.org/RDF/), which is a data model for objects ("resources") and relations between them; it provides a simple semantics for this data model; and these data models can be represented in an XML syntax; RDF Schema, (http://www.w3.org/TR/rdf-schema/) which is a vocabulary description language for describing properties and classes of RDF resources, with a semantics for generalization hierarchies of such properties and classes; OWL (http://www.w3.org/TR/owl-guide/), which is a richer vocabulary description language for describing properties and classes, such as relations between classes, cardinality, equality, richer typing of properties, characteristics of properties, and enumerated classes.

Clarifying the Meta-Data Context of Semantic Web

It is hard to deny the profound impact that the Internet has had on the world of information over the last decade. The ability to access data on a variety of subjects has clearly been improved by the resources of the Web. However, as more data becomes available, the process of finding specific information becomes more complex. The sheer amount of data available to the Web user is seen as both the happy strength and also the pity weakness of the World Wide Web. Undoubtedly, the single feature that has transformed the Web into a common, universal medium for information exchange is this: using standard search engines, anyone can search through a vast number of Web pages and obtain listings of relevant sources of information. Still, we have all experienced such irritation (Tozer, 1999; Belew, 2000) as: the search results returned are incomplete, owing to the inability of the search engine to interpret the match criteria in a context sensitive fashion; too much information is returned; lack of intelligence exists in the search engine in constructing the criteria for selection. Likewise, what is the Semantic Web good for? Perhaps, a simple example in the area of knowledge management could help clarify the situation. The field of organizational knowledge management typically concerns itself with acquiring, accessing, and maintaining knowledge as the key activity of large businesses (Liebowitz, 2000; Liebowitz & Beckman, 1998). However, the internal knowledge from which many businesses today presumably can draw greater productivity, create new value, and increase their competitiveness, is available in a weakly structured form, say, text, audio and video, owing to some limitations of current technology (Antoniou & Harmelen, 2004, p.4) in such areas as: *searching information*, where companies usually depend on keyword-based search engines, the limitation of which is that even though a search is successful, it is the person who must browse selected documents to extract the information he or she is looking for; *extracting information*, where human time and effort are required to browse the retrieved documents for relevant information, and current intelligent agents are unable to carry out this task in a satisfactory manner; *maintaining information*, where there are current problems such as inconsistencies in terminology and failure to remove outdated information; *uncovering information*, where new knowledge implicitly existing in corporate databases is extracted using data mining, but this task is still difficult for distributed, weakly structured collections of documents; and *viewing information*, where it is often desirable to restrict access to certain information to certain groups of employees, and views which hide certain information, are known from the area of databases but are hard to realize over an intranet or the Web. The aim of the Semantic Web is to allow much more adaptable technologies in handling the scattered knowledge of an organization (Swartz & Hendler, 2001) such as: knowledge will be organized in conceptual spaces according to its intended meaning; automated tools will support maintenance by checking for inconsistencies and extracting new knowledge; keyword-based search will be replaced by query answering—requested knowledge being retrieved, extracted, and presented in a human-friendly manner; query over several documents will be supported; and defining who may view certain parts of information will also be made possible.

CRAFTING THE KNOWLEDGE-CENTRIC ORGANIZATION

It is not uncommon to hear any Chief Executive Officer (CEO) respond to the question, "What distinguishes your company from its competitors?" with the emphatic "Our knowledge." Yet, it is also not surprised to see the same CEO become somewhat puzzled when the follow-up question, "What comprises your knowledge assets and value on this knowledge?" is presented. Many leading organizations nowadays are discovering they need to do a better job of capturing, distributing, sharing, preserving, securing, and valuing their precious knowledge in order to stay ahead of their competition, or at least survive (Liebowitz, 1999). By the term knowledge-centric (Daconta, Obrst, & Smith, 2003; Liebowitz & Beckman, 1998), we mean the process of managing knowledge in organizations with the focus to provide mechanisms for building the knowledge base of the firm to better apply, share, and manage knowledge across various components in the company. The use of Semantic Web technologies is a means to achieving the knowledge-centric organization by weaving the underlying technologies into every part of the organization's work life cycle, including production, presentation, analysis, dissemination, archiving, reuse, annotation, searches, and versioning of the knowledge work. To situate our discussion on the Semantic Web context, it is helpful to investigate what a typical non-knowledge-centric organization scenario is like in its daily operations.

Making Sense of Information Overload

To remain competitive, many an enterprise today accrue numerous information resources to use in their problem solving, decision making and creative thinking for improving products, processes, and services. Yet, the critical problem for the typical organization is the sheer volume of information coming in, from a wide variety of sources, in various formats (papers, emails, and different electronic media), and it is difficult to manage such resources and turn them into knowledge, which according to Tom Davenport (1997), is a synthesis of information. The knowledge process in a non-knowledge-centric organization typically comprises five stages of information management. The first stage is often characterized by a capture process, in which a human being in the organization takes information from somewhere (newspaper, radio, Internet, database, phone call, or email), and brings it to the organization, via some means such as vocally by mentioning the information to someone, or electronically by sending it through email to someone. If the data is not lost in the process, the recipient writes a paper or presentation, or even a status report. The second stage is often characterized by a securing process, in which the data is put into a database, recorded to a digital file, or indexed into a search engine. Now that entering information is always the first step, but the potential problem is this: each division, group, or project in the organization may enter the information into different systems. Assuming there is only one database per project, and assuming a division has only ten projects, there may be ten different databases containing data in a division. What if there is a different database system for each project? There then will be ten different software systems containing data. What if there are five divisions in the company, with similar systems in use? We now have many data sources that might be individual stovepipes in the organization, each of which perform a specific task at the expense of trapping the data and robbing the organization of business agility in adapting such data to new systems of interest. The third stage in the knowledge process is often characterized by integration, depending on the complexity of the organization's information architecture, a blueprint based on which different information systems services are rendered. Perhaps, since most of the information systems are stove-piped (namely, information cannot be shared by other systems that need it), there is usually no good way to combine different information systems into a coherent picture. In other words, any attempt to combine the information must involve data conversions across incompatible software systems, in which each database and software system is designed differently and has different interfaces to talk to them. As a result, there is usually little or no integration of these databases, because it is prohibitively difficult and expensive. Even if there is an integration solution, the result is often another stove-piped system. The fourth stage of the knowledge process is often characterized by searching, or discovery of an organization's internal resources. This is a haphazard and time-consuming activity because it involves so many different systems. Imagine we have to login to different databases and search engines, and manually compare and contrast the information we find into a coherent picture or thought. This is the most wasteful part of the knowledge process in person-hours. Finally, the fifth stage is concerned with the application of the search results (if we succeed in the last stage). After the tedious search process, the result is usually a presentation or paper report. Many times, this process of creating the report involves several people. The approval process is done by manual reviews and is often slow. After the new product is created, the information is supposed to be filed, say, onto a Web server that may or may not be indexed by one of the organization's search engines. The issues with this approach of knowledge process are many: How are we to know what version of the document we have? There is no way to tell if the information has been superseded once this new document is integrated into one of the organization's stove-piped databases. How are we to reuse the information, in terms of the ability to discover, refine, annotate, and incorporate past knowledge?

Making Use of Semantic Web Technologies

The knowledge process in a knowledge-centric organization starts with the discovery and production phase where an individual member of the organization receives an information item and would like to turn that into a knowledge item. It is intended as a process that could be repeated by many others in the same organization. With Semantic Web technologies, any new piece of information must be marked up with XML using a relevant organizational schema. Once this is done, the individual should digitally sign the XML document using the XML signature specification to provide strong assurance that the individual verified the validity of the information. The next step is the annotation process, in which the individual may want to use RDF to annotate the new information with his or her notes or comments, adding to the XML document, but without breaking the digital signature seal of the original material. At the end of the annotation process, the author should digitally sign the annotation with XML signature. Then, the annotated information must be mapped to topics in the taxonomy and entities in the corporate ontology so that pieces of the information can be compared to other pieces of information in the organization's knowledge base. Example annotations include: Who is the person that authored this document? What department does he or she work in? Is the individual an expert on this topic? Is this topic in the organization's taxonomy? Once this is completed, it is time to store the information in an application with a Web service interface. If that is a new Web service, the Web service should be registered in the organization's registry, along with its taxonomic classifications. The result of the discovery and production process is that the information coming into the organization has been marked up with standard XML, digitally signed to show assurance of trust, annotated with an author's comments, mapped to the organization's ontology, and published to a Web service and registered in a Web service registry. Consequently, because the Web service is registered in a registry, people and programs in the organization can discover the Web service based on its name or taxonomic classification. Besides, now that any incoming information is stored in an easily accessible format (Web services) and is associated with the organization's ontology and taxonomy, retrieval of information is much facilitated.

Preparing for Change via the Semantic Web

It follows from our previous discussion that in order to take advantage of Semantic Web technologies, most organizations need to change the way they manage information resources (Van den Hoven, 2001) such as: encouraging the sharing of information resources by using common terminology, definitions, and identifiers across the enterprise; establishing an enterprise-wide information architecture, which show the relationships between information held in various parts of the enterprise; ensuring information integrity through procedures to ensure accuracy and consistency; improving information accessibility and usability by putting it in useful formats to make it accessible in any way that makes business sense; and enforcing security to protect the information resources from accidental or deliberate modification, destruction, or unauthorized access. Fortunately, these changes can mostly be implemented evolutionarily over time so as to realize the vision of a knowledge-centric organization. In fact, the most challenging aspect may not be the technology, but the cultural transformation of the mind-set of employees because the use of Semantic Web represents a whole system change of the behavior in accessing, integrating, and leveraging knowledge throughout the organization. So, how do we get started? Our learning indicates that the IDEAL model (Gremba & Myers, 1997) originally conceived as a life cycle model for software process improvement based on the capability maturity model (CMM) for software at the CMU-SEI (Paulk, Weber, Curtis & Chrissis, 1994), has been found helpful in the change management process. IDEAL suggests a useable and understandable approach to continuous improvement by outlining the steps required to establish a sustainable improvement program, through five different stages of work. Initiating (I) is to lay the groundwork for a workable improvement effort. Diagnosing (D) is to determine where we are relative to where we want to be. Establishing (E) is to plan the specifics of how we will reach our destination. Activating (A) is to do the work according to the plan. Learning (L) is to learn from the experience and improve our ability to adopt new technologies in the immediate future. In the context of the knowledge-centric organization using Semantic Web, *Initiating* involves developing a clear vision for changing the information management process in the organization. What is the clear and compelling business case for change? How will the Semantic Web technologies enable the organization to achieve its business goal? How does this change link to other, broader corporate goals? If these issues are not well elaborated, it is very hard for members of the organization to buy into the change. A clear, concise, and simple mission statement may help. *Diagnosing* involves setting clear goals and milestones specific to the organization, based on the vision (or mission) communicated in the Initiating stage. Often, visionary goals (not technical goals) are what are needed. An example is: "Be able to look up all project information across the organization by spring 2009." *Establishing* involves identifying critical stakeholders who will be impacted by the change. Oftentimes, it helps to divide stakeholders into different groups to assess the unique impact on each group and develop targeted plans to help them work through change. For example, what kind of resources or tools can help each group manage the change? It might also help if some change facilitators are made available to address the cultural and organizational change issues identified in the process. *Activating* involves picking a core team to spread the vision throughout the organization. This team preferably composed of both technical and management people, is charged with the mission to mobilize the change efforts among members of the organization. It is also important to identify a change champion to help lead the effort of organizational and cultural transformation to ensure that the company embraces the new technology. At this point, *learning* is the most important because the core team will need to understand the high-level concepts of the Semantic Web, the purpose behind it, and the core business benefits it brings. Once the management and the technical staff are on board the core team, it is time to determine the technical goals to implement the plan. Example technical goals could include (Daconta, Obrst, & Smith, 2003, pp. 252-254): *Mark up documents in XML*—After this step, all new document development in the organization should have XML formats, to enable data content to be separate from presentation, and style sheets can be used to add different presentations to content later. *Expose applications as Web services*—so as to publish the application's interfaces as self-describing knowledge objects, with a goal of delivering small, modular building blocks that can be assembled by the intended users. *Establish an organizational registry*—so as to register different applications and provide query for Web services. *Build ontologies*—so as to overlay higher-level semantic constructs on the documents marked up with XML which provides facilities and syntax for specifying a data structure that can be semantically processed. *Integrate search tools*—so as to allow members of the organization to do searches of documents based on specific ontology. *Provide an enterprise portal*—so as to provide some aggregation points to integrate knowledge management into the organization through specific user-interfaces of search engines.

ORGANIZATIONAL CHALLENGES FACING THE SEMANTIC WEB

Based on our earlier discussion, it is not difficult to see that in an organization with Semantic Web technologies, because any incoming information has been marked up with XML, standard techniques and technologies can be used to store it and style its presentation. Still, because the information has been mapped to the organization's ontology, any new information can be easily associated and compared with other information in the organization. Also, because the original information has been digitally signed, anyone looking at the information will have assurance of its validity. Besides, because author annotations are added and also digitally signed, there is convenient tracking of who found the information and their comments. Furthermore, because it is stored in a Web service, any software program can communicate with it using open standards. Nonetheless, what do all these technology-made conveniences mean for the social dimension of the Semantic Web installed inside an organization? It is no denial that organizational knowledge synthesis (or creation and transfer) is a social as well as an individual process (Nonaka, 2002). Sharing tacit knowledge requires individuals to share their personal beliefs about a situation with others. At that point of sharing, justification often becomes public. Each individual is faced with the tremendous challenge of justifying his or her beliefs in front of others—and it is this need for justification, explanation, persuasion and human connection that makes knowledge synthesis a highly dynamic as well as fragile process (Markova & Foppa, 1990; Vat, 2003). To bring personal knowledge into an organization, within which it can be amplified or further synthesized, it is necessary to have a field (Ichijo & Nonaka, 2007; Von Krogh, Ichijo, & Nonaka, 2000; Nonaka & Takeuchi, 1995) that provides a place in which individual perspectives are articulated, and conflicts are resolved in the formation of higher-level concepts. In the specific context of Semantic Web, this field of interaction is yet to be defined and engineered by the organization architect of the company, or of the organizational change management behind the Semantic Web. Principally, this field should facilitate the building of mutual trust among members of the organization, and accelerate the creation of some implicit perspective shared by members as a form of tacit knowledge. Then, this shared implicit perspective is conceptualized through continuous dialogue among members. It is a process in which one builds concepts in cooperation with others. It provides the opportunity for one's hypothesis or assumption to be tested. Typically, one has to justify the truthfulness of his or her beliefs based on his or her unique viewpoint, personal sensibility, and individual experience, sized up from the observations of any situation of interest. In fact, the creation of knowledge, from this angle, is not simply a compilation of facts but a uniquely human process that can hardly be reduced or easily replicated. Yet, justification must involve the evaluation standards for judging truthfulness, and there might also be value premises that transcend factual or pragmatic considerations before we arrive at the stage of cross-leveling any knowledge (Von Krogh, Ichijo, & Nonaka, 2000); namely, the concept that has been created and justified is integrated into the knowledge base of the organization. The key to understand the social dimension of the Semantic Web is to ask how it could support or facilitate knowledge sharing among individuals. Putting knowledge sharing (or rather conversation among individuals) to work means bringing the right people with the requisite knowledge together and motivating their online interaction. That way, they could work collaboratively to solve real and immediate problems for the organization. To reach that level of practical impact, there must be trust and commitment among the participants apart from software and online connectivity. In light of our discussion, that means leading and fostering the kind of organizational culture that motivates people to share what they know with their peers (co-workers) without a fear of being questioned, critiqued or put on the defense. In the specific context of this article, this culture of knowledge sharing which should be in the driver's seat for selecting and configuring the Semantic Web technologies for an organization, could be developed from the idea of appreciative inquiry (AI) (Cooperrider & Whitney, 2005).

THE GENERATIVE POTENTIAL OF APPRECIATIVE INQUIRY

The contributions behind the work of appreciative inquiry (AI), is mainly attributed to David L. Cooperrider's (1986) doctoral research at Case Western Reserve University. The context of AI is about the co-evolutionary search for the best in people, their organizations, and the relevant world around them. In its broadest focus, it involves systematic discovery of what gives life to a living system when it is most alive, most effective, and most constructively capable in economic, ecological, and human terms. Principally, AI involves the art and practice of asking questions that strengthen a system's capacity to apprehend, anticipate, and heighten positive potential. AI has been described in different ways since its publication: as a paradigm of conscious evolution geared for the realities of the new century (Hubbard, 1998); as a methodology that takes the idea of the social construction of reality to its positive extreme especially with its relational ways of knowing (Gergen, 1990); as the most important advance in action research in the last decade of the 20th century (Bushe, 1995); as offspring to Abraham Maslow's vision of a positive social science (Chin, 1998; Curran, 1991); as a powerful second generation practice of organizational development (Watkins & Cooperrider, 1996); as model of a much needed participatory science (Harman, 1990); as a radically affirmative approach to change which completely lets go of problem solving mode of management (White, 1996), and others as an approach to leadership and human development (Cooperrider & Whitney, 2005). In essence, AI is an attempt to determine the organization's core values (or life giving forces). It seeks to generate a collective image of a future by exploring the best of what is in order to provide an impetus for imagining what might be (Cooperrider & Srivastva, 1987). Positively, Thatchenkery and Chowdhry (2007, p.33) says it well, "To be appreciative, we must experience a situation, accept the situation, make sense of the situation (pros/cons), and do a bit of mental gymnastics to understand the situation, with an appreciative lens. Not only that, the appreciative lens that we put on the situation impacts our next experience as well." Indeed, the interpretive scheme we bring to a situation significantly influences what we will find. Seeing the world is always an act of judgment. We can take an appreciative judgment or a critical or deficit oriented judgment. AI takes the former. Geoffrey Vickers (1965, 1968, 1972), a professional manager turned social scientist, was the first to talk about appreciation in a systematic way. Vickers' main contribution is that of appreciation and the appreciative process which constitutes a system. An appreciative system may be that of an individual, group, or an organization. In explaining appreciation, Vickers used systems thinking (Checkland & Casar, 1986), which provided basic concepts to describe the circular human processes of perceiving, judging, and acting. Specifically, Vickers focused on five key elements of appreciation, including respectively: the experience of day-to-day life as a flux of interacting events and ideas; reality judgments about what goes in the present or moment and a value judgment about what ought to be good or bad, both of which are historically influenced; an insistence on relationship maintaining (or norm seeking) as a richer concept of human action than the popular notion of goal seeking; a concept of action judgments stemming from both reality and value judgments; and action, as a result of appreciation, contributing to the flux of events and ideas, as does the mental act of appreciation itself. This leads to the notion that the cycle of judgments and actions is organized as a system. Simply put, as humans, we are in a state of flux. We judge the events we experience based on our individual history. We make meaning based on the interactions with other humans to enrich our lives. Our judgments, relationships, and values dictate how we act in subsequent events. By framing our perceptions and judgments on appreciation, we can change our behavior. In the context of fostering a knowledge-centric culture for an organization including possibly various communities of practice (Wenger, 1998), we can change the way we hoard knowledge to a philosophy of sharing knowledge. Indeed, the basic rationale of AI is to begin with a grounded observation of the best of what is, articulate what might be, ensure the consent of those in the system to what should be, and collectively experiment with what can be.

VIRTUAL ORGANIZING IN SUPPORT OF APPRECIATIVE INQUIRY

The idea of virtual organizing, attributed to Venkatraman and Henderson (1998), can be considered as a method to operationalize the context of appreciative inquiry, dynamically assembling and disassembling nodes on a network of people or groups of people in an organization, to meet the demands of a particular business context. This term emerged in response to the concept of *virtual organization*, which appeared in the literature around the late twentieth century (Byrne, Brandt, & Port 1993; Cheng 1996; Davidow, & Malone 1992; Goldman, Nagel, & Preiss 1995; Hedberg, Dahlgren, Hansson, & Olve 1997; Mowshowitz, 1997). There are two main assertions associated with virtual organizing. First, virtual organization should not be considered as a distinct structure such as a network organization in an extreme and far-reaching form (Jagers, Jansen, & Steenbakkers 1998), but virtuality is a strategic characteristic applicable to every organization. Second, information technology (IT) (not excluding Semantic Web technologies) is a powerful enabler of the critical requirements for effective virtual organizing. In practice, virtual organizing helps emphasize the ongoing process nature of the organization, and it presents a framework of achieving virtuality in terms of three distinct yet interdependent vectors: virtual encounter for organization-wide interactions, virtual sourcing for asset configuration, and virtual expertise for knowledge leverage. The challenge of virtual organizing is to integrate the three hitherto separate vectors into an interoperable IT platform that supports and shapes any new organizational initiative, paying attention to the internal consistency across the three vectors.

Understanding the Three-Vector Framework

The first of the three vectors of virtual organizing deals with the new challenges and opportunities for interacting with the members of an organization. The second focuses on the organization's requirements to be virtually integrated in a network of interdependent (business) partners, so as to manage a dynamic portfolio of relationships to assemble and coordinate the necessary assets for delivering value for the organization. The third is concerned with the opportunities for leveraging diverse sources of expertise within and across organizational boundaries to become drivers of value creation and organizational effectiveness. All these three vectors are accomplished by the provision of suitable information system (IS) support, whose ongoing design represents the IS challenge of every organization in the Internet age.

- **Virtual Encounter:** This idea of providing remote interaction with the organization is not new, but has indeed been redefined since the introduction of the Internet, and particularly, the World Wide Web. Many an organization feels compelled to assess how its products and services can be experienced virtually in the new medium of the Internet. The issue of customization is important. It requires a continuous information exchange with parties of interest, which in turn requires an organizational design that is fundamentally committed to operating in this direction. Practically, organizations need to change from an inside-out perspective to an outside-in perspective. This is often characterized by the emergence of online customer communities, with the capacity to influence the organization's directions with a distinct focus. It is believed that with virtual organizing becoming widespread, organizations are increasingly recognizing communities as part of their value system and must respond appropriately in their strategies.
- **Virtual Sourcing:** This vector focuses on creating and deploying intellectual and intangible assets for the organization in the form of a continuous reconfiguration of critical capabilities assembled through different relationships in the business network. The mission is to set up a resource network, in which the organization is part of a vibrant, dynamic network of complementary capabilities. The strategic leadership challenge is to orchestrate an organization's position in a dynamic, fast-changing resource network where the organization can carefully analyze her relative dependence on other players in the resource coalition and ensure her unique capabilities.
- **Virtual Expertise:** This vector focuses on the possibilities for leveraging expertise at different levels of the organization. In

today's organizations, many tasks are being redefined and decomposed so that they can be done at different locations and time periods. However, the real challenge in maximizing work-unit expertise often rests not so much in designing the technological platform to support group work but in designing the organization structure and processes. The message is clear: knowledge lives in the human act of knowing, and it is an accumulation of experience that is more a living process than a static body of information; so, knowledge must be systematically nurtured and managed. In effect, organizations are increasingly leveraging the expertise not only from the domain of a local organization but also from the extended network (Figallo & Rhine, 2002) of broader professional community.

Adapting the Three-Vectors to an Appreciative Knowledge Environment

What makes managing knowledge through the Semantic Web a challenge is that knowledge comes often not as an object that can be stored, owned, and moved around like a piece of equipment or a document. It resides in the skills, understanding, and relationships of its members as well as in the tools and processes that embody aspects of this knowledge. In order for knowledge sharing within an organization to be successful, it is convinced that the people involved must be excited about the process of sharing knowledge. For many people, the primary reason for knowledge sharing is not that they expect to be repaid in the form of other knowledge, but the conviction that their individual knowledge is worth knowing, and that sharing this knowledge with others will be beneficial to their reputation (van den Hoof et al., 2004, p.1). There is some psychological benefit to sharing knowledge as the sharer may be held in higher esteem by the receiver(s) of the knowledge and may gain status as a result. Thereby, an appreciative sharing of knowledge must be viewed as the non-threatening and accepting approach that makes people realize what they do can make a difference. One common example is the communities of practice (CoP) (Wenger, McDermott, & Snyder, 2002) (be it physical or online) mentioned earlier. Many organizations today are comprised of a network of interconnected communities of practice each dealing with specific aspects such as the uniqueness of a long-standing client, or technical inventions. Knowledge is created, shared, organized, revised, and passed on within and among these communities. In a deep sense, it is by these communities that knowledge is owned in practice. Yet, knowledge exists not just at the core of an organization, but on its peripheries as well (as part of the knowledge network) (Tsoukas, 1996; Figallo & Rhine, 2002). So, communities of practice truly become organizational assets when their core and their boundaries are active in complementary ways, to generate an intentionally appreciative climate for organizational knowledge synthesis. In response to the knowledge challenge in a knowledge-centric organization, it is useful to conceive of an appreciative knowledge environment (AKE) based on virtual organizing, and experiment with how the ideas of its three vectors can be applied to nurture online the growth of different communities of practice (Wenger, 1998) scattered throughout an organization.

- **Virtual Encountering the AKE:** From a management perspective, it is important to identify what CoP's currently exist in the organization, and how, if they are not already online, to enable them to be online in order to provide more chances of virtual encounter of such communities, to the organizational members. For those communities already online, it is also important to design opportunities of interaction among different online communities, to activate their knowledge sharing. Since it is not a

CoP's practice to reduce knowledge to an object, what counts as knowledge is often produced through a process of communal involvement, which includes all the controversies, debate and accommodations. This collective character of knowledge construction is best supported online with individuals given suitable IS support to participate and contribute their own ideas. An IS subsystem, operated through virtual encounter, must help achieve many of the primary tasks of a community of practice, such as establishing a common baseline of knowledge and standardizing what is well understood so that people in a specific community can focus their creative energies on the more advanced issues.

- **Virtual Sourcing the AKE:** From the discussion built up in the first vector, it is not difficult to visualize the importance of identifying the specific expertise of each potential CoP in the organization, and if not yet available, planning for its acquisition through a purposeful nurture of expertise in various specific CoP's. In order to enable an organization to be part of a vibrant, dynamic network of complementary capabilities, in which the same organization could claim others' dependence and ensure her unique capabilities, an IS subsystem, operated through virtual sourcing, must help the organization understand precisely what knowledge will give it the competitive edge. The organization then needs to acquire this knowledge, keep it on the cutting edge, deploy it, leverage it in operations, and steward it across the organization.
- **Virtual Expertizing the AKE:** It is important to understand that not everything we know can be codified as documents and tools. Sharing tacit knowledge requires interaction and informal learning processes such as storytelling, conversation, coaching, and apprenticeship. The tacit aspects of knowledge often consist of embodied expertise—a deep understanding of complex, interdependent elements that enables dynamic responses to context-specific problems. This type of knowledge is very difficult to replicate. In order to leverage such knowledge, an IS subsystem, operated through virtual expertise, must help hooking people with related expertise into various networks of specialists, to facilitate stewarding such knowledge to the rest of the organization.

FUTURE TREND OF THE SEMANTIC WEB

The future of the Semantic Web must not be seen only from its technological possibilities, but also from its social dimension to operationalize knowledge sharing among members of the organization (Argyris, 1993). In order to facilitate the stewarding of knowledge through the various online communities of practice in an organization, it is important to have a vision that orients the kind of knowledge an organization must acquire, and wins spontaneous commitment by the individuals and groups involved in knowledge creation (Dierkes, Marz, and Teele, 2001; Kim, 1993; Stopford, 2001). This knowledge vision should not only define what kind of knowledge the organization should create in what domains, but also help determine how an organization and its knowledge base will evolve in the long run (Leonard-Barton, 1995; Nonaka & Takeuchi, 1995). The central requirement for organizational knowledge synthesis (or sharing) is to provide the organization with a strategic ability to acquire, create, exploit, and accumulate new knowledge continuously and repeatedly. To meet this requirement, we need an interpretation framework, which could facilitate the development of this strategic ability through the various communities. It is believed that there are at least three major appreciative processes constituting the interpretation framework of a knowledge-centric organization, including the personal process, the social process, and the organizational process. What follows is our appreciation of these three important processes (Checkland & Holwell, 1998, pp.98-109; Checkland, & Casar, 1986) considered as indispensable in the daily operations of the organization with the Semantic Web capability. Of particular interest here is the idea of providing meta-data support for various appreciative settings, which according to Vickers (1972, p.98), refer to the body of linked connotations of personal interest, discrimination and valuation which we bring to the exercise of judgment and which tacitly determine what we shall notice, how we shall discriminate situations from the general confusion of ongoing event, and how we shall regard them.

- **The Personal Process:** Consider us as individuals each conscious of the world outside our physical boundaries. This consciousness means that we can think about the world in different ways, relate these concepts to our experience of the world and so form judgments which can affect our intentions and, ultimately, our actions. This line of thought suggests a basic model for the active human agent in the world. In this model we are able to perceive parts of the world, attribute meanings to what we perceive, make judgments about our perceptions, form intentions to take particular actions, and carry out those actions. These change the perceived world, however slightly, so that the process begins again, becoming a cycle. In fact, this simple model requires some elaborations. First, we always selectively perceive parts of the world, as a result of our interests and previous history. Secondly, the act of attributing meaning and making judgments implies the existence of standards against which comparisons can be made. Thirdly, the source of standards, for which there is normally no ultimate authority, can only be the previous history of the very process we are describing, and the standards will themselves often change over time as new experience accumulates. This is the process model for the active human agents in the world of individual learning, through their individual appreciative settings. This model has to allow for the visions and actions, which ultimately belong to an autonomous individual, even though there may be great pressure to conform to the perceptions, meaning attributions and judgments, which belong to the social environment, which, in our discussion, is the community of practice.
- **The Social Process:** Although each human being retains at least the potential selectively to perceive and interpret the world in their own unique way, the norm for a social being is that our perceptions of the world, our meaning attributions and our judgments of it will all be strongly conditioned by our exchanges with others. The most obvious characteristic of group life is the never-ending dialogue, discussion, debate and discourse in which we all try to affect one another's perceptions, judgments, intentions and actions. This means that we can assume that while the personal process model continues to apply to the individual, the social situation will be that much of the process will be carried out inter-subjectively in discourse among individuals, the purpose of which is to affect the thinking and actions of at least one other party. As a result of the discourse that ensues, accommodations may be reached which lead to action being taken. Consequently, this model of the social process which leads to purposeful or intentional action, then, is one in which appreciative settings lead to

particular features of situations as well as the situations themselves, being noticed and judged in specific ways by standards built up from previous experience. Meanwhile, the standards by which judgments are made may well be changed through time as our personal and social history unfolds. There is no permanent social reality except at the broadest possible level, immune from the events and ideas, which, in the normal social process, continually change it.

- **The Organizational Process:** Our personal appreciative settings may well be unique since we all have a unique experience of the world, but oftentimes these settings will overlap with those of people with whom we are closely associated or who have had similar experiences. Tellingly, appreciative settings may be attributed to a group of people, including members of a community, or the larger organization as a whole, even though we must remember that there will hardly be complete congruence between the individual and the group settings. It would also be naïve to assume that all members of an organization share the same settings, those that lead them unambiguously to collaborate together in pursuit of collective goals. The reality is that though the idea of the attributed appreciative settings of an organization as a whole is a usable concept, the content of those settings, whatever attributions are made, will never be completely static. Changes both internal and external to the organization will change individual and group perceptions and judgments, leading to new accommodations related to evolving intentions and purposes. Subsequently, the organizational process will be one in which the data-rich world outside is perceived selectively by individuals and by groups of individuals. The selectivity will be the result of our predispositions to "select, amplify, reject, attenuate or distort" (Land, 1985, p.212) because of previous experience, and individuals will interact with the world not only as individuals but also through their simultaneous membership of multiple groups, some formally organized, some informal. Perceptions will be exchanged, shared, challenged, and argued over, in a discourse, which will consist of the inter-subjective creation of selected data and meanings. Those meanings will create information and knowledge which will lead to accommodations being made, intentions being formed and purposeful action undertaken. Both the thinking and the action will change the perceived world, and may change the appreciative settings that filter our perceptions. This organizational process is a cyclic one and it is a process of continuous learning, and should be richer if more people take part in it. And it should fit into the context of the appreciative knowledge environment scenario.

REMARKS OF CHALLENGE FOR KNOWLEDGE-CENTRIC ORGANIZATIONS

Earlier in the manuscript, we have associated the social context of Semantic Web to that of a knowledge-centric organization, and the appreciative importance of communities of practice (CoP) online. In this regard, there is an active role such communities can play in enabling the organization to learn from the experience of its members. Traditional organization (hierarchical) structures are designed to control activities and often discourage the easy sharing of knowledge and learning. Communities, nonetheless, help to foster relationships based on mutual trust, which are the unspoken and often unrecognized channels through which knowledge is shared. In fact, CoPs have profound implications for the management of knowledge work. They highlight the limits of management control in that CoPs are voluntary entities, depending entirely on the interest and commitment of their members. They cannot be designed or imposed in a top-down manner. Knowledge does not circulate through them in any officially prescribed form or procedures. Rather knowledge exchange through suitable means such as stories, jokes and anecdotes which serve to enliven and enhance a shared learning experience, has become important under the following contexts:

- **Perceiving the importance of story-telling:** It is not difficult to understand why story-telling has become a more important way of communicating knowledge than codifying it using specific IS/IT systems (Brown & Duguid, 1991): Firstly, stories present information in an interesting way with a beginning, a body, and an end, as well as people behaving goodly or badly. Secondly, stories present information in a way people can empathize with—recounting a situation which each of us might face, so it has greater perceived relevance. Thirdly, stories personalize the information—instead of talking about the situations in the abstract, we hear about the doings of individuals whom we might know or have heard of. Fourthly, stories bring people together, emphasizing a shared social identity and interests—we share knowledge rather than transfer it. More, stories express values—they often contain a moral about certain kinds of behavior leading to either positive or negative outcomes. In this way, stories link information with interest, values and relevance, giving us a sense of the context in which experience has been developed and helping us to grasp the tacit nature of some of the knowledge being communicated.
- **Understanding the nature of community knowing:** Perceptively, the importance of story-telling also provides an insight into the limits of technology for managing knowledge. Often, the design of IS/IT systems is based on a cognitive model of seeing knowledge as a "thing" (Malhortra, 2000) which is possessed by individuals, whereas the CoPs see it as the product of social interaction and learning among members of the same. By being a member of a community, individuals are able to develop their practice, sharing experience and ideas with others involved in the same pursuit. In light of this, the essence of understanding the social dimensions of managing knowledge work through the Semantic Web comes down to a few key points about the nature of knowing (Nonaka and Takeuchi, 1995; O'Leary, 1998; Wenger, 1998; Wenger et al., 2002):
    - **Knowledge lives in the human act of knowing:** In many instances of our daily living, our knowledge can hardly be reduced to an object that can be packaged for storage and retrieval. Our knowledge is often an accumulation of experience—a kind of residue of our actions, thinking, and conversations—that remains a dynamic part of our ongoing experience. This type of knowledge is much more a living process than a static body of information.
    - **Knowledge is tacit as well as explicit:** Not everything we know can be codified as explicit knowledge such as documents or tools. Sharing tacit knowledge requires interaction and informal learning processes which often involve a deep understanding of complex, interdependent elements that enables dynamic responses to context-specific problems, even though it is very difficult to document such knowledge in whatever manner

serves the needs of practitioners.

- ◦ **Knowledge is dynamic, social as well as individual:** It is important to accept that though our experience of knowing is individual, knowledge is not. Appreciating the collective nature of knowledge is especially important in an age when almost every field changes too much, too fast for individuals to master. Today's complex problems solving requires multiple perspectives. We need others to complement and develop our own expertise. In fact, our collective knowledge of any field is changing at an accelerating rate. What was true yesterday must be adapted to accommodate new factors, new data, new inventions, and new problems.

- **Positioning an appropriate appreciation for the Semantic Web:** The move to Semantic Web has been developing rapidly over the last decade, and has attracted a lot of attention in the development of different demonstration projects (Davies, Studer, & Warren, 2006) that can serve as reference implementations for future developers. Yet, what makes managing knowledge work through the Semantic Web a challenge is that today many an organization has come to the realization that unless knowledge is owned by people to whom it matters, it will not be developed, used, and kept up to date optimally. Knowledge is not a thing that can be managed at a distance like in an inventory. It is part of the shared practice of communities that need it, create it, use it, debate it, distribute it, adapt it, and transform it. As the property of a community, knowledge is not static; it involves interactions, conversations, actions, and inventions. Thereby, networking knowledge in a virtual community of practice is not primarily a technological challenge, but one of community development. Addressing the kind of dynamic knowing that makes a difference in practice requires the participation of people who are fully engaged in the process of creating, refining, communicating, and using knowledge. The thrust to develop, organize, and communicate knowledge must come from those who will use it. What matters is not how much knowledge can be captured, but how documenting can support people's abilities to know and to learn when the community itself becomes the living repository of people's knowledge. The Semantic Web works best when it is used to connect communities, not just to capture or transfer knowledge. Because much knowledge is embedded in particular communities, developing a shared understanding and a degree of trust is often the most critical step towards knowledge sharing in an organization. The use of Semantic Web technologies can complement but not replace the importance of social networks in this aspect (DiSessa & Minstrell, 1998). Indeed, the Semantic Web can support the development of new communities of practice through problem-solving interactions that allow individuals to appreciate the different perspectives which others bring to their work. Specifically, the Semantic Web can sustain the development of communities by allowing them to develop and exchange shared cultural objects of interest, such as texts, stories, and images, which help reinforce the meaning and purpose of the communities (Bodker, 1991). From a knowledge-building perspective (Bajjaly, 1999; Cohill & Kavanaugh, 1997), the design of Semantic Web must be based on understanding such concerns as: communities must be viewed as supporting networks of personal relationships in which people can collaboratively construct understanding to enable the exchange of resources and the development of a common framework for the analysis and evaluation of such resources. Thereby, it is important to consider how different strategies of the Semantic Web implementation can progressively involve individual members by helping them become resources for other community members.

- **Managing the knowledge-centric resources:** In 1969, Peter Drucker emphasized that knowledge had become the crucial resource of the economy. He claims the credit for coining the notion of 'knowledge work', which he contrasted with more traditional forms of work such as service work and manual work. Today, the term 'knowledge work' tends to refer to specific occupations which are "characterized by an emphasis on theoretical knowledge, creativity and use of analytical and social skills" (Frenkel et al., 1995, p.773). Knowledge work, interpreted this way, encompasses both what is traditionally referred to as professional work, such as accountancy, scientific and legal work, and more contemporary types of work, such as consultancy, software development, advertising and public relations. Understandably, these types of knowledge work are not susceptible to be easily imitated because there is a significant application of both tacit and explicit knowledge (Nonaka, 1994). Those engaged in these types of work are often individuals with high levels of education and specialist skills, who demand autonomy over their work processes to get the job done; namely, to demonstrate their ability to apply those skills to identify and solve problems. What is significant about these types of knowledge workers is that they own the organization's primary means of production—that is, knowledge. Nowadays, with the advent of the Semantic Web, we are ready to construct knowledge portfolio (Birchall & Tovstiga, 2002; Dove, 1999) for the organization, to track the knowledge contributions of individual knowledge workers, and different grouping of the same in the form of group-based project work. The management of knowledge workers assumes greater importance for sustaining productivity than the management of machines, technologies, or work processes. Like musicians, Drucker (1988) sees such employees exploring outlets for their creative abilities, seeking interesting challenges, enjoying the stimulation of working with other specialists. This, he argues, poses new management challenges in knowledge-centric organizations: developing rewards, recognition and career opportunities; giving an organization of specialists a common vision; devising a management structure for coordinating tasks and task teams; and ensuring the supply and skills of top management people.

CONCLUSION

Finally, in closing our discussion, it is essential to articulate the promise of appreciative inquiry (AI) (Reed, 2007; Lewis, Passmore, & Cantore, 2008) for a knowledge-centric organization. In the broadest sense, the major theme of appreciative knowledge sharing in and among virtual communities of practice (Hoadley & Pea, 2002) could be understood from the perspective of effectively applying information and communications technologies, ICT (including the Semantic Web technologies) to improve the lives of people (organizational members), in terms of getting knowledge to those of a community who need it in the right time. Of much concern here is an effort to theorize the social dimensions of this ICT-based knowledge sharing. In the words of David Hakken (2002, p.362), we have to ask "what kinds of theorizations make sense in analyzing what happens when a concerted effort is made to introduce a technology supportive of knowledge sharing in a 'holistic' way—that is, to try to anticipate and address the social context/consequences of the interventions." In simpler terms, we can describe AI as an exciting philosophy for change. The major assumption of AI is that in every organization something works and change can be managed through the identification of what works, and the analysis of how to do more of what works. A key characteristic of AI is that it is a generative process. That means it is a moving target, and is created and constantly re-created by the people who use it. While the electronic stewarding of knowledge in an online community is based upon the Semantic Web technologies, its success rests with its people (Linn, 2000)—organizers, information and knowledge providers, sponsors, users, volunteers—who support the organization (comprising various CoPs) in a variety of ways. Therefore, when attempting to design technology in support of a knowledge-centric organization, it is important to remember "what is working around here?" in the organization. The tangible result of the appreciative inquiry process should be a series of vision statements that describe where the organization wants to be, based on the high moments of where they have been. Because the statements are grounded in real experience and history, it is convinced that people in the organization know how to repeat their success. In retrospect, think about a time when you shared something that you knew that enabled you or your company to do something better or achieve success. What happened? Share your story. Such activities include not only information capture and transmission, but also the establishment of social relationships in which people can collaboratively construct understanding. It is this energy that distinguishes AI's generative potential that presumably has no end because it is a living process. And it is quite promising for any knowledge-centric organization pursing the Semantic Web technologies.

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KEY TERMS AND DEFINITIONS

Appreciative Inquiry (AI): Appreciative Inquiry is about the co-evolutionary search for the best in people, their organizations, and the relevant world around them. In its broadest focus, it involves systematic discovery of what gives "life" to a living system when it is most alive, most effective, and most constructively capable in economic, ecological, and human terms.

Appreciative Processes: These are processes to leverage the collective individual learning of an organization such as a group of people, to produce a higher-level organization-wide intellectual asset. This is supposed to be a continuous process of creating, acquiring, and transferring knowledge accompanied by a possible modification of behavior to reflect new knowledge and insight, and to produce a higher-level intellectual content.

Appreciative Settings: A body of linked connotations of personal or collective interest, discrimination and valuation which we bring to the exercise of judgment and which tacitly determine what we shall notice, how we shall discriminate situations of concern from the general confusion of ongoing event, and how we shall regard them.

Appreciative Knowledge Environment (AKE): A work, research or learning environment to incorporate the philosophy of appreciative inquiry in support of a cultural practice of knowledge sharing among organizational members.

Community of Practice (CoP): These are people who come together around common interests and expertise. They create, share, and apply knowledge within and across the boundaries of teams, business units, and even entire organizations—providing a concrete path toward creating a true knowledge organization.

Knowledge-Centric Organization: Any organization whose knowledge focus is to provide mechanisms for building the knowledge base of the firm to better apply, share, and manage knowledge resources across various components in the company.

Semantic Web: The Semantic Web is an evolving extension of the World Wide Web in which the semantics of information and services on the web is defined, making it possible for the web to understand and satisfy the requests of people and machines to use the Web content. It derives from W3C director Tim Berners-Lee's vision of the Web as a universal medium for data, information, and knowledge exchange.

Virtual Organizing: A method to operationlize the context of appreciative inquiry, with the technology-enabled capability to assemble and disassemble nodes on a network of people or groups of people in an organization, to meet the demands of a particular business context. In virtual organizing, virtuality is a strategic characteristic applicable to every organization.

This work was previously published in Handbook of Research on Social Dimensions of Semantic Technologies and Web Services, edited by M. M. Cruz-Cunha; E. F. Oliveira; A. J. Tavares & L. G. Ferreira, pp. 411-434, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.17
The Emergence of Agency in Online Social Networks

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ABSTRACT

Social and group interactions in online and virtual communities develop and evolve from expressions of human agency. The exploration of the emergence of agency in social situations is of critical importance to understanding the psychology of agency and group interactions in social networks. This chapter explores how agency emerges from social interactions, how this emergence influences the development of social networks, and the role of social software's potential as a powerful tool for educational purposes. Practical implications of agency as an emergent property within social networks provide a psychological framework that forms the basis for pedagogy of social interactivity. This chapter identifies and discusses the psychological processes necessary for the development of agency and to further understanding of individual's engagement in online interactions for socialization and learning.

DOI: 10.4018/978-1-60566-208-4.ch008

INTRODUCTION

Social and group interactions in online and virtual communities develop and evolve from expressions of human agency. Agency is the capability of individuals to consciously choose, influence, and structure their actions (Emirbayer & Mische, 1998; Gecas, 2003) and is an active exercise of ability and will. The ways in which individuals express agency are associated with their motivational orientation, intentionality, and choice (volition), and relates to their ability to engage these characteristics in social contexts to achieve their goals. As agents, individuals formulate intentions, execute decisions, and produce motivation in an effort to communicate. Understanding how agency develops and emerges within social networks is a key factor in identifying *why* online social networks develop and *how* they influence individual processes such as cognition, motivation, behavior, and ultimately learning.

The exploration of the emergence of agency in social situations is of critical importance to understanding the psychology of agency and group interactions in social networks. Research in social psychology provides a context in which to investigate the psychological effects of online social software as it relates to motivation (see Ryan & Deci, 2000), interactions within the social networks (see Thompson & Fine, 1999), and how individuals vary in their ability to express agency (see Martin, 2003, 2004).

Agency emerges out of interactions and goal directed activities within social networks. Similarly, social networks emerge through the interactions and characteristics of agents support their formation, development, and evolution. Socially situated emergent properties of agency and social networks connect them as a dynamic complex system. Social software is software that "supports, extends, or derives added value from human social behavior" (for a review see boyd, 2007; Coates, 2005). Online friendship websites, massively multiplayer online games, and social groupware, such as Facebook (2008), MySpace (2008), Bebo (2008), and Second Life (Linden Research Inc., 2008) provide frameworks in which social dynamics can mediate the development of agency within social networks.

The purpose of this chapter is to introduce the concept of agency as it relates to the formation, development, and evolution of social networks. This chapter explores how agency emerges from social interactions, how this emergence influences the development of social networks, and the potential role of social software as a tool with educational applications. Practical implications of agency as an ability to engage within social networks provides a psychological framework that forms the basis for a pedagogy of social interactivity. This chapter discusses the psychological processes necessary for the development of agency, how these processes affect an individual's engagement in online interactions for both socialization and learning, and how social software such as Facebook (2008), MySpace (2008), Bebo (2008), and Second Life (Linden Research Inc., 2008) can be used in educational contexts. As agency directly affects how an individual understands their various roles, beliefs, and decisions in social contexts, there are far reaching implications for social software as an educational tool.

AGENCY

Agency is an ability developed through social means and human experience (Mead, 1932, 1934). As an ability to act independently despite the immediate situation, agency engages habit, imagination, and judgment (Emirbayer & Mische, 1998, p. 970). Agency also involves the knowledge, experience, and the ability to achieve one's goals (Little, Hawley, Henrich, & Marsland, 2002). Within the social framework, agency abilities develop through the interaction of social processes, the dynamics of which can be explained using action theory.

For action theorists (e.g. Parsons, 1968), agency is captured in the notion of *effort.* In this view, agency acts as the force that achieves, where conditions for achievement are at one end of a spectrum and the normative rules are at the other (Emirbayer & Mische, 1998). Agency ability is ultimately a *temporal* continuum through which an individual exercises personal influence and in return affects environmental processes that ultimately affect other personal self-processes. Thus, personal influence becomes a reciprocal collective determinant even though it also determines the individual (Martin, 2003). Agency remains a strong dynamic and causal force underlying individual action.

As a dynamic process, agency is a motivating force of action. The ways in which individuals express and develop agency are associated with their motivational orientation, intentionality, and choice, and speaks to their ability to engage these characteristics in social contexts to achieve their particular goals. Internal personal factors, behavioral patterns, and environmental influences require agency ability to facilitate social processes. Agency-related constructs associated with social interaction include self-efficacy, locus of control, and volition.

Self-Efficacy

A belief in one's capability to succeed is an essential condition of human functioning. Whether one believes that they can produce a certain action is as important as having the skills available to succeed (Bandura, 1997). Self-efficacy is a generative property, meaning it is a capacity that originates within the *Self*. It is generative in that it is a belief that an individual holds to be true. Self-efficacy is also an evaluative capacity in which one perceives their ability to perform a particular action. When an individual then deems themselves effective enough to complete a task, they anticipate the result to be positive. Thus, an efficacy belief propagates from the belief in one's own ability and that they have the skill necessary to complete a task successfully. In relation to social networks and social interaction, self-efficacy for socialization is an important part in determining whether an individual feels they can successfully communicate within a social setting. Social software enables the development of self-efficacy for socialization as it removes social barriers that may otherwise inhibit individuals from interacting in certain ways. For example, massive multiplayer online games (MMOG) and social software such as MySpace (2008), Facebook (2008), Bebo (2008), and Second Life (Linden Research Inc., 2008), provide opportunities for interaction where individuals can socialize and develop confidence in their socialization skills without the awkwardness individuals may encounter in a face-to-face setting. Individuals come to believe that they can communicate relatively successfully, and ultimately develop a higher self-efficacy for socialization and feel that they have control over their actions within this particular context. As a result, individuals who have high self-efficacy also have a tendency to believe that they control their actions and the outcomes that result.

Locus of Control

The causal relationship between's one own behavior and that of an outcome affects a range of choices an individual makes (Lefcourt, 1966; Rotter, 1966). Social Learning Theory (Rotter, 1954, 1966), not to be confused with Social Cognitive Theory, posits that control is considered a *generalized expectancy* which operates across a large number of situations and relates to whether or not an individual believes they possess or lack power over what happens to them. How an individual attributes causal beliefs to outcomes is a central argument of Social Learning Theory and the locus of control concept.

Individuals often believe that they have the power to control the outcome of any given situation. If one believes that a cause of an outcome is a result of personal skill, one has an internal control expectancy, or an internal locus of control. Within a MMOG or other online environment, if an individual perceives a threat or is in a situation in which they are required to make a decision, they must first recognize that they have choices available. The individual can then engage the situation or leave it. How an individual reacts to any situation requires self-control and self-regulation in the form of volition.

Volition

Volition incorporates factors of self-control and self-regulation. Contemporary ideas of volition from an information processing perspective were adapted by Kuhl (1985) are based on a theory of motivation and action originally developed by Ach (1910), (as in Corno, 2001). According to Kuhl (1985), self-control and self-regulation are *modes* of volition coordinated through a central executive. *Self-control* is the mode of volition that supports the maintenance of an active goal, whereas *self-regulation* involves the maintenance of one's actions in line with an integrated *Self*. Volition is a "post-decisional, self-regulatory process that energizes the maintenance and enactment of intended actions" (Kuhl, 1985, p. 90). Volition is a self-regulatory process that provides the means for maintaining the commitment and motivation of an individual to their actions. Within social software, volition enables individuals to persist in achieving a desired outcome, such as meeting new friends or getting a date. Volition becomes particularly important in social networks because intentions are fragile and people often waver on commitments especially when they are faced with challenging problems to solve (Corno, 2001). As an agency-related construct, volition ensures that individuals persist in their motivation to achieve their goals.

Volition, self-efficacy, and locus of control are agency-related constructs that demonstrate agency ability. Each of these constructs interacts within the self-system and collectively enables the expression agency. Assumptions within dynamical systems theory assist in interpreting agency as a relationship between several self-processes *emergent* of that relationship.

EMERGENCE OF AGENCY

Agency develops through a socially mediated ability exercised through human interaction (Mead, 1934). As an emergent entity (Martin, 2003; O'Connor & Wong, 2002), agency develops out of the fundamental characteristics of ability (physical, psychological, and behavioral components), will (i.e. volition, locus of control), and action. Emergence, from an ontological perspective is a non-reducible phenomenon, meaning, that if a construct is emergent it has several component parts but is irreducible with respect to them (Martin, 2003; O'Connor & Wong, 2002). For example, water has its own properties that are complex and novel and are not just a collection of the properties of its components, oxygen, and hydrogen. Oxygen and hydrogen are necessary for the creation of water, however, water also has properties that are uniquely its own; in this way the properties of water are *emergent* (Martin, Sugarman, & Thompson, 2003). Martin, Sugarman and Thompson (2003) propose that agency possesses emergence, and that agency itself contains emergent properties generated by a combination of mental and social events. As water has its own properties, when a heat source is applied to water, it boils, as the water molecules act in response to this external force, the property of the water changes from liquid into a gas. Similarly, the properties of agency change when external forces interact with the different *Self*-factors such as self-efficacy, locus of control, and volition. Thus, agency is a systemic construct, a dynamic interaction among a number of associated agency factors. Changes in the properties of agency are a result of mental (internal) and environmental (external) relationships. Similarly, social networks emerge as a construction of the individuals who interact (internal) and the groups they form (external), however, social networks are not simply sum of their parts.

EMERGENCE OF SOCIAL NETWORKS

Individuals are both a product of and producer of their socio-cultural world (Martin, 2003; Martin et al., 2003). Environmental and social factors through interactions with people are both producers and are a products of social systems (Bandura, 1997) and involve the coordination and interdependence of personal and situational forces (Markus & Nurius, 1984). The dynamics of a social network are a function of both informal and formal factors and affect the emergence of social roles, specifically informally self-generated social roles referred to as virtual identities (see Code & Zaparyniuk, this volume). The emergence of informal social roles have variable effects on the patterns of interaction and connection among individuals in the network and ultimately on the performance, productivity, evolution, and sustainability of the social network (Jeffrey C Johnson, Palinkas, & Boster, 2003). Critical aspects of these emergent properties are the adaptability of the social network to internal and external patterns of change.

The adaptability of a social network is dependent upon the cohesion of individuals within the network. As individuals utilize, model, and emulate behaviors (cognitive and otherwise) projected by their peers and other agents, they effectively co-regulate their development of social competence. Through this process, individuals exploit the abilities of others to enhance their own capabilities, but also to facilitate their achievement of social outcomes. In this context, individuals co-regulate in social networks to achieve personal social goals. This c*o-regulation* is a result of an individual resolution to utilize the abilities and efforts of others to achieve personal, social, or other goals. As co-regulation is an on-going collaborative process, the cooperative relationship between individuals within a social network enables adaptation.

During co-regulation, individuals become agents or 'causal contributors' (Bandura, 1997) of their own social experience. Seeking the meditative efforts of others, helps develop the competence to self-regulate. Self-regulatory competence is a skill, an instrument of agency, that is acquired through collaboration (Bruner, 1997). Ultimately, agency is expressed by the capability of individuals to consciously choose, influence, and structure their actions (Emirbayer & Mische, 1998; Gecas, 2003), and in the context of social networks enables them to formulate intentions, execute decisions, and produce motivation in their effort to interact and communicate within the network.

AGENCY AND SOCIAL NETWORKS AS DYNAMIC COMPLEX SYSTEMS

The emergence of agency and social networks involves particular mental and social causations. On the assumption that agency develops as a result of the interaction of these mental causations (Martin, 2003; Martin et al., 2003), and social networks emerge as result of informal social roles and cohesion, agency and social networks can be described as dynamic systems. As agency and social networks are dynamic, they also contribute to their own creation and evolution (see Code & Zaparyniuk, this volume); however, the system is irreducible with respect to them. Just as one individual or group does not embody the dynamics of the social network, the interaction of the group entities brings about group formation. Any one of the agentic factors alone cannot measure agency, but they may be able to indicate it collectively through their interaction. Similarly, each of the individuals within a social network can only create a network (system) through their interactions. Dynamic systems theorists describe general functions of a nonlinear dynamical system (e.g. Carver & Schier, 2002; Neil F Johnson, 2007; Vallacher, Nowak, Froehlich, & Rockloff, 2002), however relative to a discussion of agency and social networks as dynamic systems, four of these factors are briefly outlined.

Factor 1. The System Cannot be Decomposed into Separate Additive Influences.

As agency is an emergent abstraction of the relationship among factors such as self-efficacy, locus of control, and volition, social networks are similarly an emergent abstraction of the relationships between the individuals within the system. From an ontological perspective, an emergent entity cannot be broken down into its constituent parts. Agency is not merely a sum of self-efficacy, locus of control, and volitional measures. Social networks do not exist without its members; however, each individual member on their own does not characterize it.

Factor 2. The System has Memory or Includes Feedback.

As agentic variables attributed to self-efficacy, locus of control, and volition, are interdependent; they affect and influence each other in both positive and negative ways. From the perspective of agency, self-regulatory competence (e.g. Bouffard, Bouchard, Goulet, Cenoncourt, & Couture, 2005; Wolters, 1999) is affected by a student's self-efficacy for the task (e.g. Loedewyk & Winne, 2005; Schunk & Ertmer, 2001) and motivation to complete the task (e.g. Wolters, 2003; Wolters, Yu, & Pintrich, 1996). Similarly, social networks and the individuals within them are interdependent and influence each other. Within social networks, the presence or absence of factors such as informal social roles has an impact on a network's emergent properties such as stability, adaptability, and robustness (Neil F Johnson, 2007).

Factor 3. TheSystem can Adapt itself According to its History, Feedback, and Environment.

A system's properties and their patterns of change emerge from 'rules' specifying how the system's elements interact. Emergent or 'macro-level' properties can be understood as features (usually in the case of events and processes) that supervene on, and are thus realized in, 'lower-level' features (Henderson, 1994). Related to agency, characteristics of metacognition are identified through personal awareness and cognitive control (Brown, 1987; Flavell, 1979), and provide feedback for such high-order functions as planning, strategy selection, and monitoring (Sternberg, 1999). Alternatively, social networks have 'group' level properties such as cohesion and coherence that supervene on, and are realized in the members of the network.

Factor 4. The System is Self-Organizing and Non-Linear.

A system can only exist if it has autonomous organizing capacities (Gergen, 1984). As a system, agency is self-organizing as it is an emergent function of its constituents, as are social networks an emergent function of its membership. Self-organization of cognitive and affective elements into higher order structures have been revealed in experimental work on social judgment and action identification (Vallacher, Nowak, Markus, & Strauss, 1998) and in computer simulations of self-reflection processes (Nowak, Vallacher, Tesser, & Borkowski, 2000).

Agency and social networks as dynamic systems have particular explanatory value on the causes of human action, but also on the formation of particular social groups. Within education, this explanatory value provides new opportunities for teaching and learning.

IMPLICATIONS FOR EDUCATION

Agency and social networks emerge within social contexts. Social software as a tool for facilitating the development of social networks and agency development has far-reaching implications for educational practice. As individuals interact and groups form the purpose of learning, agency and social networks will also emerge within educational contexts. Conceptualizing social software as a cultural tool, using social networks to represents multiple ways of knowing, knowledge-building, promoting communities of practice, and enabling self-regulated learning, enables a clear application of social software as an educational tool.

Social Software as a Cultural Tool

Cultural tools mediate communication within social settings. Social experience involves the interactions between individuals, and involves the tools, symbols, and values that influence the action (Gauvain, 2001). Vygotsky's sociocultural theory of development posits that the transformation and development of cognitive and social skills occurs within social interactions. Vygotsky (1962, 1978) believed that children (and individuals) learn using *cultural tools* which mediate higher-order mental processes such as reasoning and problem solving. Cultural tools include both *technical tools* such as books, media, and computers, and *psychological tools* such as language, signs, writing, and symbols.

"By being included in the process of behavior, the psychological tool alters the entire flow and structure of mental functions" (Vygotsky, 1981, p. 137).

Online social networks and social software changes the way we perceive and act within social settings. As social software is both a social and psychological tool, it provides a computing environment in which actions are mediated through the appropriation of language, writing, signs, and symbols. As a result, online social networks and social software are cultural tools, and are carriers of social, cultural, and historical formations that amplify certain social actions (Jones & Norris, 2005). The enactment of social software as a cultural tool promotes the development of a unique and particular social language that mediates agentic expression.

Mediated Agency

Mediated agency aids individuals in interpreting the meaning of a situation. As a social construction, agency is mediated within a social setting by psychological tools such as language, and technical tools such as computers. Wertsch, Tulviste, and Hagstrom (1993) refer to agency within a sociocultural situation as *mediated agency* as agency is 'mediated' by the available cultural tools. Psychological and technical tools mediate agency as individuals usually "operat[e] within [these] meditational means" (Wertsch et al., 1993, p. 342). Meditation of thought and action through social software enables the generation of social structures, histories, and ideologies (Jones & Norris, 2005). Individuals and groups use these cultural tools to understand their social world and to draw meaning from their interactions.

Multiple Ways of Knowing in Social Software

Meaning making is entirely situational. Individual construction of meaning is dependent upon the active interpretation of the situation by the participants which is referred to as a *situation definition* (Park & Moro, 2006). Situation definitions are of interest in a discussion of online social networks because how one interprets a situation includes how to use particular mediational means such as cultural tools (social software) and social genres (social language) within a given social context. Understanding how individuals actively interpret situations and construct meaning involves 'multiple ways of knowing' in which individuals use situation definitions to establish contexts for meaning making that are dynamic and only partially shared. Situation definitions enable a shift in authority structure that makes the individual the 'author' of any virtual situation (Rowe, 2005).

Situational definitions within online social software establish *contexts* for meaning making. Contexts describe circumstances that give meaning and form the setting for an event; a focal event set within its cultural setting (Duranti & Goodwin, 1992). Situation definitions activated within the context of online social software have four general attributes as outlined by Duranti and Goodwin (1992) and Gilbert (2006). Relative to online social software, these attributes provide a strong educational context in which learning can take place. First, the situation definition is within a social, spatial, and temporal framework in which individual encounters with events are situated. In other words, social software provides a social, spatial, and temporal framework in which social educational encounters can occur. Second, the situation definition provides a behavioral environment to frame the 'talk' that takes place. Social software provides a collaborative framework to formulate ideas and associate tasks and actions. Third, the use of specific language associated with the focal event enables a situational definition to develop within the socially networked environment. Social software provides a context in which *social languages* or *social genres* (Bakhtin, 1986/1978) are developed. Finally, situation definitions enable individuals to connect relationships between prior knowledge. Social software enables the connection between ideas and tasks situated within the network to be readily associated to background knowledge.

Situation definitions within are only partially shared between individuals and others within the network. Multiple situation definitions can exist simultaneously as individuals change their representation and understanding of events over time (Rowe, 2005). Interaction with others' competing understanding of an event or situation and the process of coming to share situation definitions is a crucial feature of learning and perspective taking (Wertsch, 1985). Thus, socio-cultural accounts of learning within social software are intersubjective, engaging participants in dynamic and discursive interactions shifting the authority of defining the situation from one individual to another.

Situation definitions within social software are associated with a shift in authority structure. "The authority to define situations is the authority to author one's own life and circumstances rather than simply to respond to what is given" (Rowe, 2005, p. 128). Within the context of social software, this enables individuals to become the authors of their own 'situations' or contexts. As a result, an individual could take on any particular identity by defining the 'rules' in which they choose to engage with others thus enacting on their agency. The *authority* of any given situation resides within the recognition of the power an individual has to create a context (enact a situation definition) rather than simply to engage within one, which by definition is an engagement of agency. The recognition that individuals have authority to enact and define a particular situation contributes to their perceived value in the online social community and for contributions to the community's growing knowledge.

Social Software as a Knowledge Building Environment

Knowledge building is a collective inquiry embedded in cultural practice. "Knowledge advancement is fundamentally a socio-cultural process, enhanced by cultures of innovation" (Scardamalia, 2004). A shift in authority structure encourages agency mediation, which makes online social software conducive to knowledge generation or *knowledge building*.

Knowledge building environments "enhance collaborative efforts to create and continually improve ideas" (Scardamalia, 2004). Embedded in practice, knowledge building characterizes learning as an evolutionary and creative process but also recognizes the importance of 'tools' necessary to facilitate learning as a collective endeavor making learning a complementary process (Bereiter & Scardamalia, 1996).

Social software shares similar characteristics of knowledge building environments. Scardamalia (2004) outlines several characteristics that distinguish knowledge building environments from other similar environments, such as those commonly discussed in the Computer Supported Collaborative Learning (CSCL) literature. Using Scardamalia's outline, each characteristic is adapted to the application of online social software as knowledge building environments for the purposes of education.

1. Online social software provides shared, user-configured spaces that represent the

collective contributions of group members. Providing users with shared, user-contributed spaces that represent the collective contributions of group members enables a sense of community 'authorship' in which each member develops a sense of accountability to the group. The value on their individual contributions increases as their motivation to contribute increases. From the perspective of education, collective ownership and accountability enhances collaborative inquiry and cooperation.

2. Online social software supports linking and referencing ideas so that the development of the ideas can be traced. Providing users with the ability to track idea formation and development, social software promotes the recognition of group participation in the idea creation process and acknowledges that ideas have a 'history of thought.' As an educational tool, social software provides a framework for the discovery of the origins of ideas within the collaborative setting, further enhancing a sense of community authorship, value in individual contribution, and accountability to the collective.
3. Online social software provides ways to represent higher-order organizations of ideas. Social software enables the visualization of idea organization which scaffolds individual schema formation and linkages to prior knowledge. Scaffolding the connection between a learner's prior knowledge is a critical component in aiding in the transformation of conceptual understanding, which is a foundation of learning and development.
4. Online social software provides ways for the same idea to be worked within varied and multiple contexts and to appear in different higher-order organizations of knowledge. As social software enables the visualization of idea organizations, linkages to prior knowledge within multiple contexts promotes cross 'disciplinary' innovation. Further to characteristic 3, social software that enables the connection between multiple contexts promotes cross organizational understanding and individual conceptual change.
5. Online social software has different kinds of systems of feedback to enhance self- and group-monitoring processes. Within the context of social software, users have the ability to provide feedback enabling the group to collectively 'self'-organize and 'self'-monitor ongoing knowledge creation processes. The ability of a learner to be self-reflective is a critical component in self-regulated learning and metacognitive development. As social software enables collective and individual feedback processes, individuals within the social network have frequent opportunities to give and receive feedback on collaborative idea development.
6. Online social software provides opportunistic linking of persons and groups—with the possibility of crossing traditional disciplinary, cultural, and age boundaries. As social software enables temporal relationships among members, opportunity for interactions among individuals is exponential. The possibilities of linking individuals from cross disciplinary fields, cultural, and age groups are more likely, thus encouraging alternative perspective taking; a critical component in higher-order thinking.
7. Online social software supports ways for different user groups to customize the environment and to explore within- and between community trajectories. As social software enables individual and group customization, identity formation at the individual generates a sense of ownership over the 'cultural' space. Further to a sense of community membership, individuals have the ability to construct their own 'situation definitions' and express different aspects of their personalities within the social network.

Characteristics of social software may vary with different kinds; however, if researchers and educators are to understand how to implement social software in education, then identifying the aforementioned characteristics in practice is critical for facilitating learning. Each kind of characteristic *in situ* has its own distinctive knowledge acquired through an individual's complete participation within the 'community of practice' (Bereiter & Scardamalia, 1996).

Social Software Promotes Communities of Practice

Members of an online social community are bound by what they do together and develop around a collective sense of meaning (Wenger, 1998). "Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger, McDermot, & Snyder, 2002, p. 4). Online social networks form 'communities of practice' as individuals within these environments share concerns, as in advocating for social justice for women (Pierce, 2007), collaborate on a solution to set of problems, as in solving school management issues by principals (Smith, 2007), and deepen their knowledge and expertise, as in contributing to open-source software development projects (Hemetsberger & Reinhardt, 2006). Ultimately, members of a 'community of practice' share a collective sense of purpose supported by the structural elements the social software provides.

Communities of practice arise out of a collective sense of need and intention. To achieve a particular outcome communities of practice develop initially because of a necessity to fulfill a particular purpose, perform a particular function, and produce a particular product or action. Key ideas Wenger (1998) identifies as the primary characteristics of a community of practice involve questions of 1) what is the network about, 2) how the network functions, and 3) what the network produces. Within the context of online social software, particularly in its use in education, these particular questions are essential in determining the context, tasks, and outcomes for learning. Online social software enables the expression of these intentions as it provides particular structural elements that aid in the development of the community.

Online social software establishes a social, spatial, and temporal framework for the development of communities of practice. Structural capabilities of online social software do not inhibit the size of a network (small or large), how long the network exists (long-lived or short-lived), where members of the network are situated (co-located or distributed), whether members are homogenous or heterogeneous, and whether networks develop within (inside) and across boundaries (organizational, corporate, educational, country) (Wenger et al., 2002). Although, traditional social networks and communities of practice also share many of these structural elements, online social software makes each of these capabilities more prevalent and strategically adaptable to the educational and classroom setting. Incorporating social software for the purposes of teaching and learning within and beyond the classroom context engages a student in multiple ways of knowing through knowledge building, which, in turn cultivates a community of practice in the classroom and enables self- and co- regulated learning.

Social Software Enables Self-Regulated Learning

Social and academic competence is a highly improbable occurrence without the ability to self-regulate. The conditions that promote the development of self-regulatory systems are fundamental considerations in understanding the emergence of complex dynamic systems. Agency, social networks, as well as self-regulation are not isolated occurrences. They require the presence of multiple interacting factors that influence their dynamic relationship.

Individuals manipulate and reframe on-going activity to situate meaning construction through self-regulation. Self-regulated learning (SRL) involves an active, effortful process in which learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour (Pintrich, 2000). Guiding and constraining SRL processes are contextual features of the social and learning environments, such as teachers and other students, learning outcomes, and acceptable 'norms and practices' as defined by culture. Thus, SRL is a personal and collective process that is both meta-cognitive and socially mediated by *others*. Social software facilitates SRL as an individual system exercised through socially mediated means, and enables forethought, performance control, and self-reflection (Bandura, 1986, 1997, 2001, 2006; Zimmerman, 1998, 2004).

Forethought. Influenced by personal motivational factors, the process of forethought involves the ability to anticipate the outcomes of a particular action and then strategically plan for a desired goal. In regards to academic learning, forethought involves goal setting, task analysis, motivational beliefs (goal orientation), and self-efficacy for the specified academic task. For example, a student believes that they are good at organic chemistry and is effacious about their upcoming midterm. The student then sets a goal to achieve an *A* on the midterm and begins to plan on how to study for the exam. In this example, the student believes they will do well, is confident in their abilities in the domain, sets a goal to achieve a particular grade on an assessment task, then makes a plan on how to achieve this academic outcome. Thus, in this manner, the student has "a forethoughtful perspective [that] provides direction, coherence, and meaning" to their achievement (Bandura, 2001, p. 7). Social software provides a supportive environment in which students are scaffolded through the analysis of a task, which in turn affects their motivation and self-efficacy for the task in question. In addition to forethought, learners must also be able to control and monitor the implementation of the plans they consider during forethought.

Performance control. Involving strength of will, self-control, and self-observation, learners engage in strategies to monitor and implement plans developed during forethought. In the development of academic competence, this stage of the SRL process is particularly important as the strategies learners employ, or develop, are of critical import if they are to achieve their desired outcome. For example, research on proactive learners suggests that a large percentage of them control environmental variables. Minimizing distractions in their study space by using earplugs while they study is a type of attention-focusing strategy (Corno, 1993; Corno & Kanfer, 1993), and just one example of the types of self-control strategies competent self-regulated learners use to achieve.

Using self-control strategies, proactive learners exercise self-observation processes to metacognitvely monitor their progress. Self-observation processes include self-monitoring, which refers to mentally tracking one's performance, and self-recording which involves a physical record of how one is doing (Zimmerman, 2004). For example, research on learners who use self-recording strategies demonstrated enhanced self-regulatory processes such as self-efficacy beliefs, which in turn improved goal attainment (Zimmerman & Kitsantas, 1997, 1999). Within social software, students have opportunities to practice regulatory strategies and observe other, potentially more effective strategies through other students in the network and have the control to monitor how they are performing and make adaptations as needed. To develop self-regulatory competence, in conjunction with performance control strategies, learners must also continuously reflect and evaluate on their progress on a task.

Self-reflection. A critical component in the self-regulatory process involves the continuous comparison of present levels of achievement with personal goals and standards. Self-regulatory comparisons or *judgments of success* involve comparisons along three different dimensions (Zimmerman, 2004). First, during self-improvement a learner evaluates their achievement based on progress over prior experience. Second, learners evaluate their achievement relative to the performance of their peers and thus, make comparative judgments along a *social* dimension. Finally, learners also use *mastery judgments* whereby they compare their achievement relative to a mastery source. Through *self* and *other* comparative processes reflective "actions give rise to self-reactive influence through performance comparison with goals and standards" (Bandura, 2001, p. 8). The comparison of goals and standards demonstrates judgments of success, decision-making, and is an ultimate expression of agency. Social software provides an environment in which self and other comparative processes are possible within the social dimension (network). Agency not only includes the ability to make choices, but also the ability to take appropriate courses of action and evaluate success based on standards set both by the individual learner and by social others.

CONCLUSION

Social and group interactions in online communities develop and evolve from expressions of human agency. Agency is a result of an emergent causal relationship between ability, will, and action. Social networks are a result of mediated expressions of agency that challenge the existing authority structure of classroom discourse. Social software provides students with opportunities to manipulate contexts and strategically interact with other students (agents) to achieve a desired outcome. Thus, agency ability links attributes of motivation to courses of action. Expressions of agency through online social networks, promotes the idea that an individual has authority over their *virtual* cultural space.

Understanding human interaction within online social networks begins with an appreciation of agency. Agency ability is a social construction that develops through mediation, the appropriation of cultural tools, and facilitates a novel means of community formation. Social software in education gives students the power (ability) to do what they want in the absence of internal or external constraints, to understand and reflectively evaluate their intentions, reasons, and motives, and to control their own behavior. The authors suggest that future research explore questions of:

1. The impact of the formal or informal nature of the educational context on agency;
2. The affordances different types of social software tools have relative to the emergence of human agency;
3. The role of the facilitator in orchestrating and encouraging agency emergence; and
4. The potential implications each of these aspects have on learning design.

Education has a responsibility to engage the use of social software to encourage student's development of agency and responsible social action. A shift in authority structure is required to utilize online social networks as a means for knowledge construction, meaning making, and building community within the classroom. Educators can encourage the emergence of agency in social networks through establishing contexts for meaning making, collective inquiry, and knowledge building that develop a community of practice. Recognizing social software's potential as a cultural tool is critical for education as cultural tools not only enhance human thinking, they transform it (Gauvain, 2001).

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KEY TERMS

Agency: The capability of individuals to consciously choose, influence, and structure their actions (Emirbayer & Mische, 1998; Gecas, 2003) and is an exercise of ability and will through action.

Communities of Practice: Involve groups of people who share concerns, problems, and passions about a topic, and who choose to interact to deepen their knowledge and expertise in this area by interacting on an ongoing basis (Wenger et al., 2002).

Cultural Tools: Mediate higher-order mental processes such as reasoning and problem solving (Vygotsky, 1962, 1978). Cultural tools include both *technical tools* such as books, media, computers, and social software, and *psychological tools* such as language, signs, writing, and symbols.

Emergence: From an ontological perspective is a non-reducible phenomenon. Meaning, that if a construct is emergent it has several component parts but is irreducible with respect to them (Martin, 2003; O'Connor & Wong, 2002).

Knowledge-Building Environments (KBES): Environments that "enhance collaborative efforts to create and continually improve ideas" (Scardamalia, 2004).

Locus of Control: A belief in the causal relationship between's one own behavior and that of an outcome affects a range of choices an individual makes (Lefcourt, 1966; Rotter, 1966).

Self-Efficacy: A belief in one's capability to succeed at a given task (Bandura, 1997).

Social Software: Software which "supports, extends, or derives added value from human social behavior" (Coates, 2005).

Volition: A "post-decisional, self-regulatory processes that energize[s] the maintenance and enactment of intended actions" (Kuhl, 1985, p. 90).

This work was previously published in Handbook of Research on Social Software and Developing Community Ontologies, edited by S. Hatzipanagos & S. Warburton, pp. 102-118, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.18
Two Informational Complexity Measures in Social Networks and Agent Communities

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ABSTRACT

Several informational complexity measures rely on the notion of stochastic process in order to extract hidden structural properties behind the apparent randomness of information sources. Following an equivalence approach between dynamic relation evolution within a social network and a generic stochastic process two dynamic measures of network complexity are proposed.

INTRODUCTION

Most of the statistical social network analysis methods rely on a fixed network structure. Earlier methods of dyadic statistical analysis manage to provide quantification on degrees of mutuality between actors and triadic analysis does a step forward allowing validation of theories of balance and transitivity about specific components of a network. Each of these constitutes a subset of a more general *k-sub graph analysis* based on *k-sub graph census* extracted from the network architecture. Some sort of frequency analysis is done over these censuses from which probabilistic distributions can be evaluated. More recent single relational statistical analysis additionally allows the validation of statistic models through parametric estimation. Looking further for positional assumptions of groups of actors, stochastic block model analysis measure the statistical fitness of defined equivalent classes on the social network (Carrington, 2005) (Wasserman, 1994). All of these tools assume some sort a static network structure, a kind of snapshot of reality, over which statistical measuring is done and some degree of confidence is evaluated against real data. It is not of our knowledge any method of providing some sort of analysis on the dynamic structure of social networks in which the set of relations evolves over a certain amount of time. The method we propose has the purpose of allowing a probabilistic informational based evaluation of each actor's inner complex motivated behaviour on the process of relation change inside his network. The evaluation is supported on the measurement of the *Entropy Density* and after of the *Excess Entropy* over the stochastic relational changing. Measuring the evolution of this interplay complexity measure can provide some insights into each actor degree of inner structure pertaining to the specific kind of relation that the network is supposed to represent. *Entropy Density* and *Excess Entropy* are theoretical measures and for practical purposes only estimative can be obtained. The study of estimative computation for entropy is still subject to intense research in the Physics community. As the measurement only approaches the real relational entropy of each actor, it can be considered within the context of the set of members of the social network an absolute measure as the same estimate bias is applied to the community as an all.

NETWORK DYNAMICS AND INFORMATION

The complexity of the information that may be extracted from observations of a source, as a phenomenological observation of its behavior, without any prior knowledge of the source's internal structure, may reveal missed regularities and structural properties hidden behind the apparent randomness of the stochastic process that the source generates. This information can provide useful clues in order to predict the source future behavior or its characteristic properties. In social network dynamics each actor generally performs some sort of action, communication acts; exchange of capital or economic goods or any other possible social interplay or attribute for which a well defined time limit and intensity can be pinpointed in time. This definition can generally be extended and even applied to objects as for example a correlation of goods purchased by each client of a supermarket. The agent that determines the dynamic nature of a network is primarily Time. Topologically a network that evolves as the one depicted in *Figure 1* is completely defined as a set of graphs, each constituted by a set of nodes and link, eventually tagged with some intensity attribute, that have been established during a defined time slot *T* of the interval of observation. The sequence of the *n* time slot started at time t_0 pretend to report the dynamical relational evolution that the network is supposed to represent. There are some approaches to dynamic network that take into account possible resilience of links as an intensity attribute. In fact, the process of time partitioning can be tricky, dynamic features that appear relevant at some time slot durations can in fact be insignificant look at other time spans. There exist ways to circumvent this problem taking into account the kind of relation the network represents. For example normalizing the duration of the interplay through an inverse exponential function of time slot duration can avoid some dependence on value of *T*.

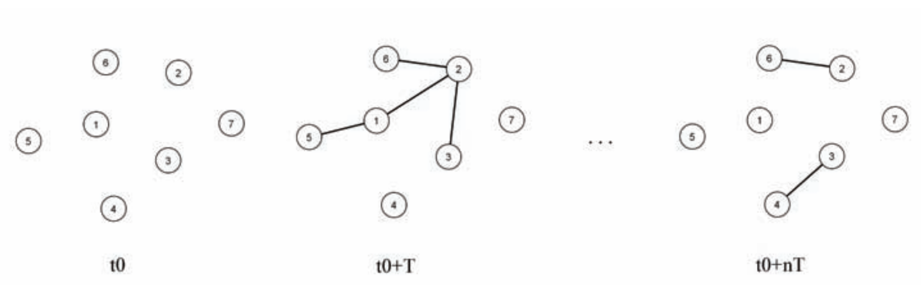
Having a dynamic network and coding the combination of all the established links that each node performed during each time-slot, we obtain a relational stochastic process for that particular node. This process will symbolically represent the node relational evolution within the community. The extraction of informational quantities from this process is straightforward.

INFORMATIONAL MEASURES OF COMPLEXITY

Given a symbolic process $\vec{S} \equiv \cdots S_{-2}, S_{-1}, S_0, S_1, S_2 \cdots$ of random variables S_{T_i} that range over an alphabet A, taking sequence values $\ldots s_{-2}, s_{-1}, s_0, s_1, s_2 \cdots \in A$, the total Shannon entropy of *length-L* sequences of $\vec{S}$ is defined as (Cover, 2006):

$$H(L) = \sum_{s^L \in A^L} Pr(s^L) \log_2 Pr(s^L)$$

Figure 1. A network that evolves over time. The arcs between the nodes represent all the interplay activity performed during the timeslot $nT, (1 \leq n \leq N)$



Where s^L are symbols belonging to these sequences of L length that represent combinations of symbols of A constituting the alphabet A^L. On a binary alphabet with $A^L = \{0,1\}$ and with L=3, $A^L = \{000, 001, 010, 011, 100, 101, 110, 111\}$. $H(L)$ is calculated over all the extension of the process $\overleftrightarrow{S}$ for any possible consecutive combination of L symbols. It happens that $H(L)$ is a non-decreasing function of L: $H(L) \geq H(L-1)$ and it is also a concave function: $H(L) - 2H(L-1) + H(L-2) \leq 0$. This fact can easily be understood if we notice that the size of A^L increases exponentially with L and so inversely does $Pr(s^L)$. Figure 2 depicts the growth of $H(L)$ function of increasing L length:

$$h_\mu \equiv \lim_{L \to \infty} \frac{H(L)}{L}$$

REDUNDANCY

The entropy rate h_μ quantifies the amount of *irreducible randomness* that remains after all the correlations and patterns embedded in longer and longer *length-L* sequence blocks are extracted from the entropy computation (Crutchfield, 2001). It is the rate at which the source transmits *pure randomness* and it is measured as *bits/symbol*. Since each symbol belongs to an alphabet of size $|A|$ the *Redundancy* within the source, R, is given by the difference between this maximum theoretical entropy rate, the *channel capacity* that is needed to transmit any optimally coded message from an arbitrary source using an alphabet A, $C = \log_2 |A|$, and h_μ:

$$\mathrm{R} \equiv \log_2 |\mathrm{A}| - h_\mu$$

The redundancy R is a measure of the information that an observer gains after expecting a maximally entropic uniform probability distribution from the source and actually learns the correct distribution $Pr\left(\overleftrightarrow{S}\right)$ of the sequence.

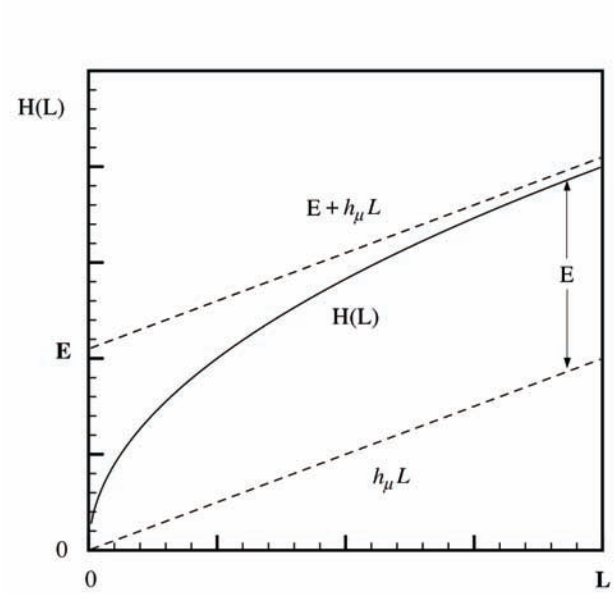
It is possible to define derivatives for $H(L)$. Having the first derivative we obtain the *apparent entropy rate* or *apparent metric entropy* at a given length L:

$$h_\mu(L) \equiv \Delta H(L) \\ = H(L) - H(L-1), L \geq 1$$

This derivative constitutes an *information gain*. The function $h_\mu(L)$ is an estimate of how random the source appears if only blocks of the process up to length L are considered. The difference between $h_\mu(L)$ and the true h_μ on the measure into the infinite L limit, give a related L-estimate, the *per-symbol L-redundancy*:

$$r(L) \equiv \Delta R(L) \equiv h_\mu(L) - h_\mu$$

Figure 2. Growth of H(L) function of L. The picture also shows the metric entropy coefficient h_μ as the rate of increase with respect to l of the total Shannon entropy in the large L limit



$r(L)$ measures how the *apparent entropy rate* computed at a finite L exceeds the actual *entropy rate*. Any difference between the two indicates there is redundant information in the L-blocks in the amount of $r(L)$ bits. Interpreting $h_\mu(L)$ as an estimate of the source's unpredictability we can look further at the rate of change of $h_\mu(L)$, the rate at which the unpredictability is lost. This is given by the second order derivative:

$$\Delta^2 H(L) \equiv \Delta h_\mu(L) = h_\mu(L) - h_\mu(L-1)$$

PREDICTABILITY GAIN

The previous second order derivative provides a measure of the change, for each increment on the size of increasing larger L blocks, of the *metric entropy* estimate $h_\mu(L)$. This measure constitutes a *predictability gain* (Crutchfield, 2001). From the previous equation we can see that the quantity $-\Delta^2 H(L)$ measures the reduction in per-symbol uncertainty in going from (L-1) to L block statistics. Computing how this derivative converges to the limit $L \to \infty$, which is to say that for every possible large combinations of symbols, we obtain the a *Total Predictability* G of the process.

G is defined as:

$$\mathrm{G} \equiv \sum_{L=1}^{\infty} \Delta^2 H(L)$$

And as $h_\mu(L)$ is always positive it can be sown that $\Delta^2 H(L) \leq 0$ and also that:

$$\mathrm{G} = -R$$

Like R the unit of G is *bits/symbol*. For a periodic process $\mathrm{G} = \log_2 |A|$, $h_\mu = 0$ so it assumes its maximum value for a completely predictable process. G however does not tell us how difficult it is to carry out any prediction, nor how many symbols must be observed before the process can be optimally predicted, but in fact give us a measure "disequilibrium" between the actual entropy rate of the process h_μ and the maximum possible entropy rate of a periodic process with the same alphabet A.

A finite *L* estimate of G is given by:

$$\mathrm{G(L)} = H(1) + \sum_{l=2}^{L}[H(l) - 2H(l-1) + H(l-2)]$$

FINITARY AND INFINITARY PROCESSES

If, for all i and j, the probabilistic distribution of each symbol obeys the equality $Pr(S_i) = Pr(S_j)$, the probability distribution of the stochastic process:

$$Pr(\overleftrightarrow{S}) = Pr(\cdots, S_i, S_{i+1}, S_{i+2}, S_{i+3}, \cdots)$$

is given by:

$$Pr(\overleftrightarrow{S}) = \cdots Pr(S_i)Pr(S_{i+1})Pr(S_{i+2})\cdots$$

and we say that the process is *independently and identically distributed*. If however the probability of the next symbol depends on the previous symbol, we then call the process *Markovian*:

$$Pr(\overleftrightarrow{S}) = \cdots Pr(S_{i+1} \mid S_i)Pr(S_{i+2} \mid S_{i+1})\cdots$$

In a general case, if the probability depends on previous *R* symbols of the sequence:

$$Pr(S_i \mid \cdots, S_{i-2}, S_{i-1}) = Pr(S_i \mid S_{i-R}, \cdots, S_{i-1})$$

Then we call this type of process an *order-R Markovian*. A *hidden Markov* process consists of an internal *order-R Markov* process that is observed by a function of its internal-state sequences. These are usually called *functions of a Markov chain* which we suppose is embedded inside the system. These kind of processes are considered *finitary* since any Markov Chain as a finite amount of memory.

Generally any stochastic process is said to be *finitary* if at the $L \to \infty$ limit:

$$H(L) \sim h_\mu L$$

$$\lim_{L\to\infty} \Delta H(L) = h_\mu,$$

$$\lim_{L\to\infty} \Delta^n H(L) = 0 \text{ for } \lim_{L\to\infty} \Delta^n H(L) = 0$$

$$n \geq 2 \text{ for } n \geq 2$$

On a *finitary* process the *entropy rate* estimate $h_\mu(L)$ decays faster than 1/*L* to the actual entropy rate h_μ. Other way of defining a finitary process is to admit that the *Excess Entropy* E, the second measure we will examine, is finite on *finitary* processes and infinite otherwise.

EXCESS ENTROPY

In order to capture the structural properties of memory embedded into the system, we need to look at other entropy convergence integrals. Several authors (Packard,1982) (Grassberger,1986) (Li,1991) (Crutchfield,2001) defined a quantity named *Excess Entropy* E or *Complexity*, *Effective Measure of Complexity* or *Stored Information*, as measure of how $h_\mu(L)$ converges to h_μ. This quantity is expressed as:

$$\mathrm{E} \equiv \sum_{L=1}^{\infty}\left[h_\mu(L) - h_\mu\right] = \sum_{L=1}^{\infty} r(L)$$

The unit of E is *bits*. Following the reasoning explained above this quantity gives us the difference between the per-symbol entropy conditioned on *L* measurements and the per-symbol entropy conditioned on an infinite number of measurements. As the source appears less random at length *L* by the amount $r(L)$ this constitutes a measure of information carrying capacity in the *L*-blocks that is not actually random but due instead to correlations. If one sums these individual per-symbol L-redundancy contributions we obtain the total amount of apparent memory in the source, which can be interpreted as an *intrinsic redundancy*. The entropy-rate convergence is controlled by this intrinsic redundancy as a property of the source. At each L we obtain additional information on the way about how $h_\mu(L)$ converges to h_μ, this information is not contained in $H(L)$ and $h_\mu(L)$ for smaller L. Thus each measure of $h_\mu(L)$ is an independent indicator of how $h_\mu(L)$ converges to h_μ. For *non-finitary* processes E does not converge at all. We will admit however, as we will deal with estimates for finite L relative within a definite context of similar estimates, that they provide an absolute characterization of *intrinsic redundancy* up to L-block estimates within the context. The structure of this quantified memory of the system cannot be analyzed within the framework of information theory, for this purpose complexity measures based on computation theory like *Kolmogorov Complexity* or *Logic Depth* must be used (Shannon, 1948)(Kolmogorov,1965).

The excess entropy can also be seen as the mutual information between the left and right (past and future) semi-infinite halves of the process $\overleftrightarrow{S}$:

$$\mathrm{E} = \lim_{L\to\infty} MI\left[S_0 S_1 \cdots S_{2L-L}; S_{L+1} S_{L+2} \cdots S_{2L}\right]$$

Whenever this limit exist.

A finite L estimate of E is given by:

$$\mathrm{E} = \sum_{l=1}^{L}\left[h_\mu\left(l\right) - h_\mu(L)\right]$$

$$= \sum_{l=1}^{L}\left[H(l) - H(l-1)\right] - L\left[H(L) - H(L-1)\right]$$

MEASURING COMMUNITY DYNAMICS

Having a social network or a community of actors which relations evolve over a specific time interval we now want to quantify each agent's degree of complex intentionality that determines dynamical structural change within the community network of interactions. Recalling the equivalence of relational change with a stochastic process examined in the above section, it is reasonable to establish a phenomenological equivalence between each agent's observed dynamical changing of relations process as a stochastic process eventually determined by each actor specific structure.

Assuming a community with N actors, we may divide the interval duration of our observation into K time slots of duration T. At each time slot k each agent or node $ni, \left(1 \le i \le \mathrm{N}\right)$ has a domain $A = 2^{N-1}$ of possibly different relation configurations c_i^k directly with other agents. The L-block entropy of this stochastic process C_i as A^L possibly different configurations c_i^l for each of the blocks which is given by:

$$H_i(L) = -\sum_{k=1}^{K-L} Pr(c_i^{kL}) \log_2 Pr(c_i^{kL})$$

Where:

$$Pr\left(c_i^{kL}\right) = \frac{1}{A^L}\sum_{l=1}^{\left|A^L\right|} \delta_{c_i^{kL}, c_i^L}, \quad c_i^{kL} \in A^L,$$

$$Pr\left(c_i^{kL}\right) = \frac{1}{A^L}\sum_{l=1}^{\left|A^L\right|} \delta_{c_i^{kL}, c_i^L} \quad c_i^{kL} \in A^L \; c_i^L \in A^L,$$

$$c_i^{kL} \in A^L, \; c_i^L \in A^L$$

c_i^{kL} is the L-length configuration c_i^{kL} c_i^l is the L-length configuration c_i^l that starts at time slot k.

Recalling the above definition of G, an estimate of the total predictability $G_i(L)$ for a time interval of K time slots, with a sufficiently large L (L can be as large as K, but we should note that the computational effort grows exponentially with the size *L*) is given by:

$$\mathrm{G}_i(L) = Hi(1) + \sum_{l=2}^{L}\left[H_i(l) - 2H_i(l-1) + H_i(l-2)\right]$$

And an estimate of the excess entropy $\mathrm{E}_i(L)$ for each agent of the community is given by:

$$Ei(L) = \sum_{l=1}^{L}\left[H_i(l) - H_i(l-1)\right] - L\left[H_i(L) - H_i(L-1)\right]$$

With respect to the definition of *total predictability* we can interpret $G_i(L)$ at the end of the network evolution observation, as the node or actor n_i *predictability*, which is an equivalent of measuring the periodicity of the actor's interplay within the community. An actor with a large amount of *predictability* should stick to regular patterns of relations both in time and in interplay with other actors. On the other hand the quantity $E_i(L)$ provides an estimate of the n_i node or actor magnitude of *complex subjective commitment* to its relational choices within the network. This means to have some kind of memory that dictates his relational patterns, in other word to be socially complex.

At this point we should note that these two measures, although egocentric and also estimates, should be considered absolute within the complete set of relations between nodes of the network. In fact, when both measures are using the same *L* estimate and are applied to the set of nodes as an all, they can be considered as an absolute measurement with respect to all the nodes of a particular observation. Then, when we are referring to the *complex subjective commitment* or *predictability* on some node on the context of one observation, we are considering two properties of the particular situated role of each node in respect to the particular kind of relation that the network is supposed to describe.

As we have stated above, there is an equivalence of E_i with the mutual information between the past and the future of the series of connections each node performs. Thus, we can see why E_i is adequately defined as a *commitment* towards a subjective preference for some dynamic pattern of relations within the network as opposed to no preference at all. The excess entropy E_i quantifies the magnitude of correlation between the past observations of the set of relational patterns at each node with future observations and vice versa, thus reflecting the commitment of the node to enforce the observed set of patterns.

THE COMMUNITY OF AGENTS PARALLEL

Until now we have been considering normal human interactions, however these same two measures of complex social activity can also be applied to computer agent communities. Multi-agents systems normally implement some kind of protocol for message exchange that allows the agents to cooperate and coordinate (Weiss, 2000)(Shoham, 2009). The fine tuning of message exchanging and work distribution among agents can benefit from informational measuring of agent communication. The application of these two measures can provide useful tools to adjust agent communication in very sophisticated and complex agent environments.

AN EXAMPLE

In order to better illustrate the measures proposed on the previous section we will examine a hypothetical community of agents constituting an artificial social network with some given assumptions about the agent roles. A general human social network could be used instead. Let us consider the message exchange between agents during a defined period *T*. Admissibly we have a chronological log of all the messages which we partition at a fixed time intervals. Let us also assume that we want to restrict the focus of our study into a restrict subset of agents and that those agents have arbitrarily complex cognitive and communication capabilities:

1. One coordinator for a given task
2. A agent that performs part of the task
3. A directory facilitator

We want have some insight, having only logged timestamp; sender and receiver for each message, on the memory extent and role of each agent. Considering that we have *a posteriori* knowledge that these agents have the following roles:

1. The coordinator communicates only with the agents under his responsibility in order to perform his coordinated task. At fixed intervals he checks with a non coordinated agent the state of accomplishment of the task.
2. The coordinated agent periodically consults the coordinator in order to adjust his goal. Otherwise he just silently prosecutes his goal.
3. The directory facilitator randomly exchanges messages with every agent of the community at their request in order facilitate agent communication.

From this description we should expect to obtain at the end of our observation a great level of *predictability* for the working agent, a moderate level for the coordinator and vanishing levels for the directory facilitator. On the other hand the *subjective commitment* to patterns of communication should be greater for the coordinator as he should possess a greater amount of memory that should allows him to coordinate his well defined team of agents, a lesser one for the directory facilitator, as although communicating randomly within the community he should however reflect some patterns of communication behavior product of the system's global memory, and a lesser degree for the worker agent as he only communicates at regular interval with his single coordinator.

CONCLUSION

We strongly believe these two measures of ego-centric social complexity have great potential on the evaluation of social networks. Actor or agent *social predictability* constitutes an important indicator in many evaluations. Also the *commitment to the community* is an important factor on distinguishing and characterizing its members. We should recall that the nature of the social relation that is evaluated for each particular network as direct influence on the interpretation of these measures. Social network science abstracts the nature of the relation from the actors involved. A dynamic relation, as we stated above, could mean communicating but also buying and selling or just having some kind of affinity between actors or agents. Thus the nature of the relation that is studied has direct impact on the nature of the measurements. Also a correct choice of sampling rate of the network timeline constitutes a critical matter that directly influences the results. For each dynamics, different time slot duration will have direct impact on the results obtained. This impact should be subject of further investigation, it is more or less obvious however that each dynamic process has his own time scale. This scale has thus direct influence on the correct choice of time partition. A concrete application of these measures to a real case scenario will follow.

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This work was previously published in International Journal of Agent Technologies and Systems, Vol. 1, Issue 4, edited by G. Trajkovski, pp. 49-57, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 7.19
Social Self-Regulation in Computer Mediated Communities:
The Case of Wikipedia

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ABSTRACT

This article documents the findings of research into the governance mechanisms within the distributed on-line community known as Wikipedia. It focuses in particular on the role of normative mechanisms in achieving social self-regulation. A brief history of the Wikipedia is provided. This concentrates on the debate about governance and also considers characteristics of the wiki technology which can be expected to influence governance processes. The empirical findings are then presented. These focus on how Wikipedians use linguistic cues to influence one another on a sample of discussion pages drawn from both controversial and featured articles. Through this analysis a tentative account is provided of the agent-level cognitive mechanisms which appear necessary to explain the apparent behavioural coordination. The findings are to be used as a foundation for the simulation of 'normative' behaviour. The account identifies some of the challenges that need to be addressed in such an attempt including a mismatch between the case findings and assumptions used in past attempts to simulate normative behaviour.

INTRODUCTION

The research documented in this article is part of the EU funded project titled 'Emergence in the Loop: Simulating the two way dynamics of norm innovation' (EMIL) which aims to advance our understanding of emergent social self-organisation. The project involves conducting several empirical case studies the first of which is the Wikipedia.

When people encounter Wikipedia for the first time and learn how it works, they commonly express surprise. The expectation appears to be that an open collaborative process of such magnitude should not work. Yet the Wikipedia has been shown to produce credible encyclopaedic articles (Giles, 2005) without the hierarchical and credentialist controls typically employed for this type of production.

The research presented here is framed within the debate about governance mechanisms associated with Open Source production systems. This is not the only perspective which could be adopted but it does serve to provide some initial orientation. Consistent with the wider project focus, the relationship between these theories and the theory of social norms is examined.

In the empirical research we examine the extent to which communicative acts are employed by editors to influence the behaviour of others. Particular attention is given to the illocutionary force of utterances (Searle, 1969) and the effect of deontic commands linked to general social norms and Wikipedia specific rules. In the conclusion some observations are made about the agent-level cognitive mechanisms which appear necessary to explain the observed social order as well as the apparent influence of social artefacts, goals and the wiki technology.

The following questions are canvassed through this research.

- What processes appear to operate in computer mediated organizations which enable them to be, in effect, self-regulating?
- How consistent are the findings with established theories for understanding norms and governance, particularly in on-line environments?
- What alternative hypotheses are there which appear to explain the phenomena and which can provide the foundation for future research?

Governance Theory

According to the relevant Wikipedia article, the word 'governance' derives from the Latin that suggests the notion of "steering". The concept of governance is used in a number of disciplines and a wide range of contexts and the range and type of steering mechanisms differ depending on whether the focus is with states or institutions. While both have been applied to Open Source, it is most common (and arguably most appropriate) to use institutional concepts of governance. Institutional steering mechanisms may be: formal (designed rules and laws) or informal (emergent as with social norms); extrinsic (involving contracts and/or material incentives) or intrinsic (involving values and principles); and the mechanisms by which governance operates may be top down (imposed by authority) or bottom up (invented by the participants as a basis for regulating each other). Theories vary with respect to the mechanisms advanced and the emphasis placed on different mechanisms. Theory is also advanced for different purposes: to explain or to prescribe. In broad terms the debate is often dichotomised with economics derived theories (Agency and Transaction Cost) on one side and sociological theories (stewardship) on the other (see J. H. Davis, D. Schoorman, & L. Donaldson, 1997; Donaldson & Davis, 1991). Depending on the position of the advocate these may be presented as antithetical or as viable alternatives for different contexts.

Agency theory derives from neo-classical economics and shares the foundational assumption of agent utility maximization. Advocates argue that many productive transactions involve *principals* who delegate tasks to *agents* to perform on their behalf (Donaldson & Davis, 1991). This gives rise to what is known as the 'principal's dilemma'. Simply stated this dilemma asks *'how can the principal ensure that the agent will act in its interest rather than on the basis of self-interest?'* Note that this dilemma arises from the assumed self-interested nature of agents –it is a dilemma intrinsic to the assumptions upon which the theory is based even though this is argued to have empirical support. Two general solutions are offered: the use of formal contracts and sanctions and the use of material incentives.

Critics argue that not all human decisions are made on the basis of self-interest. Sociological and psychological models of governance posit various alternatives: some remain committed to assumptions of rational action and goal seeking, while others address issues of power or various forms of intrinsic motivation, including a desire to conform to social norms. These latter positions generally form the basis of theories of *stewardship* (J. H. Davis, D. F. Schoorman, & L. Donaldson, 1997).

While these two broad sets of ideas form the backdrop to most debates about governance in traditional institutions increased recourse has also been made to

(Coase, 1993, 1995; Williamson, 1996). TCE is concerned with the relative merit of alternative governance arrangements for differing production environments. Oliver Williamson (1985), a key contributor, states *'The choice of governance mode should be aligned with the characteristics of the transaction…'*. Principals are presented with a continuum of possible ways of trying to achieve effective regulation from open markets to hierarchy. Both of these are seen as imposing costs (agency costs for hierarchy and transaction costs for markets). The aim is to combine them to achieve an optimum balance between these costs. This 'balancing' implies a top down rational decision making role for institutional managers.

More recently two additional categories of governance have been added to the TCE family – 'networks' and 'bazaars'. Both have arisen to explain the emergence of production and exchange arrangements which do not seem to fit on the market-hierarchy continuum. Both Network Governance (Candace Jones, William S Hesterly, & Stephen P Borgatti, 1997) and Bazaar Governance (Demil & Lecocq, 2003) are argued to be particularly relevant to understanding the flexible structures associated with Open Source production. Demil & Lecocq (2003: 8) cite Jones et al (1997: 916) and argue that network governance:

> *…involves a select, persistent, and structured set of autonomous forms [agents] engaged in creating products or services based on implicit and open ended contracts to adapt to environmental contingencies and to coordinate and safeguard exchanges. These contracts are socially – not legally – binding.*

The final sentence highlights the key difference between network and more conventional TCE mechanisms. To achieve cooperation the network form of governance relies on social control, such as *'occupational socialization, collective sanctions, and reputations'* rather than on formal authority.

Bazaar governance is also argued to rely heavily on the mechanism of reputation (Demil & Lecocq, 2003: 13). Reputation is assumed to provide the incentive to become involved and to comply with group expectations and norms. Unlike network systems, however, agents are free to enter or leave the exchange process – there are no obligations to become or to remain engaged. Raymond (1999) states that *'contrary to network governance, free-riders or opportunistic agents cannot be formally excluded from the open-source community'*.

To summarise:

- Free markets are characterised by: a lack of obligation to engage in a transaction; low interdependence between parties involved with the exchange; and transactions regulated only by price. Within a pure market the individual identities of the transacting parties are not important.
- In Hierarchies, there are formal contracted obligations on all parties, these are maintained by fiat but may also be supported by wider formal institutions e.g. Courts. Obligations are associated with formal position making the official (role) identity of the parties the key determinant of the relationship.
- Within network structures, exchanges are

regulated using relational contracts – there is a formal obligation to remain engaged even though specific actions and operational responsibilities may not be included in a contract. There is also some reliance on social norms– the socialised position of actors becomes important. Exchange commitments may be relatively short lived and persist only so long as they offer mutual benefit.

- With bazaar governance there is no obligation on any party to perform particular duties or even to remain engaged: there are low entry and exit costs. There are few formal mechanisms for policing or sanction but sufficient regulation is achieved by means of shared task, reciprocity norms and/or informal group sanctioning with participants influenced by their desire to build reputation.

Understanding the Role of Norms

As can be seen, 'norms' are argued to play a role in a number of theories of governance, with their being particularly significant in Stewardship, Network and the Bazaar theories. Sociologists have long argued that norms are fundamental mechanisms for social regulation. What though is a 'norm'? How do norms emerge and how are they influenced and by what?

Gibbs (1981) argues that *'Sociologists use few technical terms more than norms and the notion of norms looms large in their attempt to answer a perennial question: How is social order possible?'*. Not surprisingly then the concept has been incorporated into a wide range of alternative and often competing bodies of theory.

The normative literature can be divided into two fundamentally distinct groups. In the social philosophical tradition (Lewis, 1969) norms are seen as a particular class of emergent social behaviour which spontaneously arise in a population. From this perspective, a 'norm' is a pattern identified by an observer ex-post. The defining characteristic of the pattern is the apparently prescriptive/proscriptive character: people behave 'as if' they were following a rule. By contrast, the view offered by the philosophy of law sees norms as a *source* of social order. This standpoint assumes the prior existence of (powerful) social institutions and posits them as the source of rules, which, when followed, lead to social patterns. These positions appear antithetical although following the work of Berger and Luckman (1972) each may be seen as a part of a dialectic whereby emergent social patterns become reintegrated and formalised in institutions.

Therborn argues (2002: 868) that people follow norms for different reasons. The extremes run from habit or routine to rational knowledge of consequences for self or the world. Between these lie:

- Identification with the norm or values – linking sense of self (identity) to the norm source (person, organization or doctrine) often leading to in-group-out-group.
- Deep internalization – self-respect – done independently to what others are doing.

Bicchieri (2006: 59) provides a rare hint at the cognitive process involved stating:

To 'activate' a norm means that the subjects involved recognise that the norm applies: They infer from some situational cues what the appropriate behaviour is, what they should expect others to do and what they are expected to do themselves, and act upon those cues.

This suggests a complex process of self-classification (how am 'I' situated with respect to this group and what is the nature of the situation in which 'I' find myself, does a norm pertain to 'me' in this situation and under what conditions and to what extent am I obliged to comply?).

To begin to identify which (if any) of these loosely defined mechanisms might be supported by evidence and to aid in the development of a theory of norms helpful for understanding the more general mechanisms at play in social self-regulation we selected the Wikipedia as a preliminary case study. Wikipedia belongs to the Open Source movement as it has adopted the Open Source License. It was originally designed to operate under the umbrella of a conventional hierarchical form of governance and its unanticipated success as a radical governance experiment makes it a particularly interesting case study. It was anticipated that findings in relation to the Wikipedia may have some wider relevance to understanding the open source phenomena but also serve to cast light on mechanisms which underpin human institutions– particularly those that are more normative in nature. In order to be able to judge the degree of generalisation that may be possible it is first important to identify the distinctive features of the Wikipedia.

The Wikipedia

Wikipedia grew out of an earlier Web encyclopaedia project called Nupedia founded by Jimmy Wales with Larry Sanger appointed as its first editor-in-chief. From its inception Nupedia was linked to a free information concept and thus the wider open source movement. Nupedia used traditional hierarchical methods from compiling content with contributors expected to be experts. The resulting complex and time consuming process and an associated lack of openness have been argued to explain the failure of the Nupedia. Sanger (2006; 2007), however, questions this view, arguing that the expert model was sound but needed to be simplified.

Sanger was introduced to the WikiWiki software platform in 2001 and saw in it a way to address the limitations hampering Nupedia. The inherent openness of the Wikiwiki environment was, however, seen as a problem so Wikipedia began as an experimental side project. Sanger notes that a majority of the Nupedia Advisory Board did not support the Wikipedia, being of the view '*…that a wiki could not resemble an encyclopaedia at all, that it would be too informal and unstructured'* (Sanger, 2007). However the intrinsic openness of Wikipedia attracted increasing numbers of contributors and quickly developed a life of its own. Almeida et al (2007) note that growth in articles, editors and users have all shown an exponential trajectory. From Sanger's earlier comments it is clear that he had been surprised at the rate of development and of the quality achieved by the relatively un-coordinated action of many editors.

The Debate Over Governance in Wikipedia

The use and enforcement of principles and rules has been an ongoing issue within the Wikipedia community with a division emerging between the founders and within the wider community about whether rules were necessary and if they were, how extensive they should be and how they should be policed. The power to police rules or impose sanctions has always been limited by the openness of the technology platform. Initially Sanger and Wales, were the only administrators with the power to exclude participants from the site. In 2004 this authority was passed to an Arbitration Committee which could delegate administrator status more widely. The Arbitration Committee is a mechanism of last resort in the dispute resolution process, only dealing with the most serious disputes. Recommendations for appointment to this committee are made by open elections with appointment the prerogative of Wales.

In the early stages Sanger argues the need was for participants more than rules and so the only rule was 'there is no rule'. The reason for this, he explains, was that they needed to gain experience of how wikis worked before over prescribing the mechanisms. However, *'As the project grew and the requirements of its success became increasingly obvious, I became ambivalent about this particular "rule" and then rejected it altogether'* (Sanger, 2007). However, in the minds of some members of the community, it had become 'the essence' of Wikipedia.'

In the beginning, complete openness was seen as valuable to encourage all comers and to avoid them feeling intimidated. Radical collaboration – allowing everybody to edit everyone's (unsigned) articles – also avoided ownership and attendant defensiveness. Importantly it also removed bottle necks associated with 'expert' editing. That said the handpicking of a few core people is regarded by Sanger as having had an important and positive impact on the early development of Wikipedia. Sanger argues for example *'I think it was essential that we began the project with a core group of intelligent good writers who understood what an encyclopaedia should look like, and who were basically decent human beings'* (2005). In addition to 'seeding' the culture with a positive disposition, this statement highlights the potential importance of establishing a style consistent with the Encyclopaedia genre – a stylistic model which might shape the subsequent contributions of others.

Sanger argues that in the early stages 'force of personality' and 'shaming' were the only means used to control contributors and that no formal exclusion occurred for six months, despite there being difficult characters from the beginning. The aim was to live with this 'good natured anarchy' until the community itself could identify and posit a suitable rule-set. Within Wikipedia rules evolved and as new ones were needed they were added to the 'What Wikipedia is not' page'. Wales then added the 'Neutral Point of View' (NPOV) page which emphasised the need for contributions to be free of bias. The combination of clear purpose and the principle of neutrality provided a reference point against which all contributions could be easily judged. Sanger regards the many rules, principles and guidelines which have evolved since as secondary and not essential for success.

How do newcomers learn these (ever increasing) rules and do they actually influence behaviour? Bryant et al (2005) suggest that there is evidence of 'legitimate peripheral practice', a process whereby newcomers learn the relevant rules, norms and skills by serving a kind of apprenticeship. These authors argue that this is evident in new editors of Wikipedia initially undertaking minor editing tasks before moving to more significant contributions, and possibly, eventually, taking administrative roles. These authors tend to project a rather idealistic view of involvement, however, overlooking a key attribute of the wiki environment –newcomers have the same rights as long standing participants and experts and this mechanism for socialising newcomers can be effectively bypassed.

In some Open Source environments (such as Open Source Software) it is possible to gain reputation which may be usable in the wider world. The commitment to the community is often explained (for an excellent overview see Rossi, April, 2004) by arguing that a desire for reputation increases compliance. However, in the Wikipedia environment there is no list of contributors to which an editor can point as evidence of their contribution (although they can self-identify their contributions on their user page). Contributions are, in essence, non attributable. In the case of Wikipedia identification with product, community and values appears a more likely reason for remaining involved than does reputation.

In a study specifically designed to study the conflict and coordination costs of Wikipedia, Kittur, Suh, Pendleton, & Chi (2007: 453) note that there has a been a significant increase in regulatory costs over time. *'…direct work on articles is decreasing, while indirect work such as discussions, procedure, user coordination, and maintenance activity (such as reverts and anti-vandalism) is increasing'*. The proportion of indirect edits (i.e. those on discussion or support pages) has increased from 2% to 12%. Kittur et al cite an interview respondent as stating *'the degree of success that one meets in dealing with conflicts (especially conflicts with experienced editors) often depends on the efficiency with which one can quote policy and precedent.'* (Kittur et al., 2007: 454). This suggests that force of argument supported by the existence of the formal rules and etiquette are important to the governance process.

This is however based on ex post attributions.

Wiki Technology: The Artifact

Wiki technology has a very flat learning curve: contributing is extremely simple. There are few technical impediments confronting novice users. Wiki platforms are intrinsically open supporting decentralised action unless modified to control or restrict access. Division of labour emerges as editors choose which pages interest them and which they want to focus on contributing to or maintaining.

Wikipedia has added a number of facilities which support the ready detection and correction of vandalism. Watch lists support users in taking responsibility for the oversight and monitoring of particular topics. Changes made to a page are logged using a history list which supports comparison between versions as well as identifying the time and date of any change and the ID of who made that change. The reversion facility supports the rapid reinstatement of the page content. Lih (2004: 4) attributes significance to this feature noting that *'This crucial asymmetry tips the balance in favour of productive and cooperative members of the wiki community, allowing quality content to emerge'*. and Stvilia et all (2004: 13) note that *'By allowing the disputing sides to obliterate each others contributions easily, a wiki makes the sides interdependent in achieving their goals and perhaps surprisingly may encourage more consensus building rather than confrontation'*.

Stvilia, Twidale, Gasser, & Smith (2005) among others identify discussion pages as an important *'...coordination artefact which helps to negotiate and align members perspectives on the content and quality of the article.'* Discussion pages provide an opportunity for managing minor disputes about content or editing behaviour and for movement towards the agreement.

Ciffiolilli (2007) has argued that a significant consequence of these technical features is the way in which they alter transaction costs (Coase, 1993; Williamson & Winter, 1993). Transaction costs result from information overheads associated with complex coordination. However, the technology does not cancel other costs of coordination and control. These are commonly referred to as agency costs and the highly open nature of the wiki may increase them. In hierarchies, this cost is evident in the cost of command and control (management overhead) whereas in the Open Source environment they are borne by the participating community (and not necessarily equitably). The cost burden will be less where there is a high level of self-regulation and lower where a lack of goal alignment or low social commitment leads contributors to disregard others and act individualistically or opportunistically. The efficacy of cultural control will be influenced by factors such as the homogeneity of the user group and that group's propensity for self-organisation (endogenous norm formation), rates of turnover of the group, and the effect of external perturbation of the group or of the task on which they are working. This may also be subject to feedback effects: reduced norm compliance may lead to higher turnover and reduced commitment, further reducing norm compliance for example.

In conclusion then, Wikipedia is a volunteer open source project characterised by low ties between contributors, no formal obligations and very few means for the exercise of formal sanction. There is a low level of reciprocity with contributors under no obligation to maintain engagement. The wiki technology is open, inviting many to the task and imposing low costs to participation while reducing transaction costs. There is however high reliance on pro-social behaviour dominating if agency costs (borne by individuals) is not to lead to high turnover and possible governance failure. The anonymity of Wikipedia precludes any significant reputation effects outside of the small group of co-editors who maintain extended involvement with an article and to a very limited degree the wider Wikipedia community.

Wikipedians have produced a set of permissions, obligations, rules and norms which have been documented in guidelines and etiquettes as well as embedded in technical artefacts such as style bots. The need for and effect of these is however controversial. From a governance perspective there are relatively few means within Wikipedia by which formal control can be exercised using these rules and the community relies instead on the use of informal or 'soft' control. These mechanisms need to be effective in the face of perturbation from 'vandals' (task saboteurs), 'trolls' (social saboteurs), as well as turnover of contributors in the context of a task which can require the accommodation of emotionally charged and value based issues.

Analysis of Governance Micro-Mechanisms

In Wikipedia there are two classes of activity: editing; and conversation about editing. This article is not concerned with the editing activity (although this is to be considered in future research) but with the self-organising and self-regulating phenomena which make it possible. Insight into this can be gained by examining the Discussion pages which accompany many of the articles rather than the articles themselves. The activity on the Discussion pages comprises a series of 'utterances' or speech acts between contributors about editing activity and the quality of product. On the face of it then, these pages should provide a fertile source of data to support analysis of how governance operates in the Wikipedia, in particular informal or 'soft' governance.

Within these pages we expected to see attempts by editors to influence the behaviour of one another through the only means available to them – communicative acts. We anticipated that these may exhibit some regularity which would allow us to examine both the range and type of events that led to the explicit invocation of rules and norms and which revealed emergent influence patterns which were themselves normative. We wanted also to examine what conventions prevailed and how these compared and interacted with the goal of the community and its policies. A convention is defined here as a behavioural regularity widely observed by members of the community. Policies include explicit codes of conduct as well as guidelines (etiquettes) and principles.

Methodology

For the study we randomly selected a sample of Discussion pages associated with both Controversial and Featured articles. At the time of the study (May/June 2007) there were 583 articles identified by the Wikipedia community as controversial. The featured articles are more numerous. At the time of the study there were approximately 1900 of them. The analysis reported here is based on a sample of nineteen Controversial and eleven Featured articles. The most recent three pages of discussion were selected for analysis from each Discussion page associated with the article included in the sample.

These were subjected to detailed coding using the Open Source qualitative analysis software WeftQDA. Both qualitative and quantitative analysis was performed. The latter was undertaken by re-processing the coded utterances such that each utterance constituted a case and each applied code a variable associated with that case. This data set was then analysed using SPSS.

A number of coding schemes for natural speech were considered before choosing to use the Verbal Response Mode (VRM) taxonomy (Stiles, 1992). VRM has been developed over many years and used in a wide range of communication contexts. Stiles defines it as *'a conceptually based, general purpose system for coding speech acts. The taxonomic categories are mutually exclusive and they are exhaustive in the sense that every conceivable utterance can be classified.'* (Stiles, 1992: 15). The classification schema is attractive where there is a need (as here) to capture many of the subtleties of natural language use that derive from and rely on the intrinsic flexibility and ambiguity of natural language yet map them to a more formal system needed for computer simulation.

Additional codes were applied to identify: valence, subject of communication, explicit invocation or norms or rules and the associated deontic and trigger, whether the receiver/s accepted the illocutionary force of the utterance and the ID and registration status of the person making the utterance.

There were 3654 utterances coded in these thirty three documents.

FINDINGS

Style of Communication

There was a statistically significant correlation between the article group (Controversial vs Featured) and broad style of communication. This was however very small at -0.078 (p=.01 2-tailed). This difference was most apparent when examined at the level of specific styles. Both groups had approximately similar proportions of neutrally phrased utterances (approximately 64%). Nearly one quarter (22.5%) of all utterances in Featured articles were positive compared to only eleven percent in controversial sites. By comparison nearly one quarter (23.9%) of all utterances in controversial sites were negative compared to fourteen percent for featured. The positive styles of 'affirming', 'encouraging' and 'acknowledging' were significantly overrepresented in the featured articles but underrepresented in the controversial articles. The reverse was the case for the negative styles of 'aggressive', 'contemptuous' and 'dismissive'.

There was a statistically significant correlation between the broad style of communication and the editor status. The correlation was again very low at -.054 (p=.01 two tailed).

Overall, the most common positive utterance was affirming (4.7%) closely followed by encouraging (4.7%) and acknowledging (4.3%). The most common negative utterance was dismissive (8.2%) followed by defensive (6.4%) and contemptuous (3.5%).

All the Wikipedia discussions sampled reflected a strongly neutral-objective *style* (although from the qualitative observations it was apparent that the content was sometimes far from objective or balanced). The statistically significant difference between Controversial and Featured sites was in the relative balance of positive and negative utterance and was not so great as to explain the different status awarded the associated articles.

Validation

Within speech act theory (Habermas, 1976; Searle, 1969), validation refers to whether an utterance made by one speaker is accepted, rejected, ignored or let go unquestioned by the intended recipient/s.

In the Wikipedia sample half of all utterances were accepted without question. A further eighteen percent were explicitly accepted by at least one editor; eleven percent were explicitly rejected and a substantial twenty two percent were ignored. Twenty five percent of positive style utterances were accepted by at least one editor compared to eighteen percent of neutral and only nine percent of negative. By comparison only two percent of positive utterances were rejected compared to nine percent of neutral and twenty six percent of negative. Positive utterances were more likely to be accepted without question (61%) compared to negative (21.7%) and neutral (54.4%). Negative comments were more likely to be ignored (44.1%) compared to neutral (18.2%) and positive (11.4%).

From this we can conclude that positive utterances are more likely to be validated than negative, but that overall, a significant number of utterances are ignored or rejected.

Normative and Rule Invocation

Overall 5.2% of all utterances involved norm or rule invocation. This meant that Wikipedia rules were invoked 122 times and general social norms a further 77 times in 3654 utterances. This overall number was contributed to disproportionately by three (outlier) articles in the sample. Rules were most commonly invoked in response to neutral style communication (63.9%) followed by twenty seven percent in response to a negative style. Only nine percent of positive style utterances were responded to with a rule invocation. By comparison, norms were most commonly invoked in response to negative style utterances (53.2%) followed by neutral (44.2%) and then positive (2.6%). The difference in likelihood of invocation by style was statistically significant (p=.001).

A Wikipedia rule invocation was most likely to be triggered by the *form* of an article (44.9%) an *edit action* (22%); an *article fact* or a *person's behaviour* (both 16%). A norm was most likely to be triggered by a *person's behaviour* (35.6%), an *edit action* (23.3%), *article form* (21.9%), or *article fact* (19.2%). This pattern did not differ to a significant degree between the Featured and Controversial sites.

Nearly three quarters (73.6%) of rule invocations had the implicit deontic of 'it is obligatory' Norms also were most likely to carry this deontic (61.3%). The second most likely deontic was 'it is permissible that' (9.7%).

While there was no statistically significant difference in the degree to which either norms or rules were invoked between the Featured and Controversial articles, there was a qualitative difference in the role norm and rule invocation played. In Controversial discussions, social norms and rules were most likely to be invoked against the behaviour of an editor who was of a different view (group?) while in Featured sites, norms and rules were somewhat more often used by the editor as a reflection on their own contribution – i.e. involved a level of self-check. This might take the form of a statement such as 'I know this is not NPOV but…..'.

Registered vs Non-Registered Users

There was no statistically significant difference in the likelihood for either registered or non-registered users to invoke norms or rules. There was a statistically significant difference between registered and non-registered editors (p=.000) when it came to validation. Registered editors were more likely than non-registered to be explicitly accepted (18.7% of utterances compared to 13.9%), less likely to be rejected (9.9% compared to 13.7%), considerably less likely to be ignored (18.3% compared to 34.7%) or unquestioned (53.1% compared to 37.6%). Qualitatively, however, it was much more common that un-registered users would make suggestions before undertaking edits, particularly in the Features articles, so their behaviour was less likely to attract action or comment.

Non-registered editors were more likely to make negative style utterances (24.3% compared to 18.5%) and less likely to make positive utterances (9.5% compared to 17.4%). This difference was significant (p=.000).

Influence Through Illocutionary Force

The theory of speech acts distinguishes between the meaning of an utterance and its pragmatic intent. With the VRM coding frame used in this research each utterance is coded twice, once to capture the semantic form and again to capture the use of language to exert (illocutionary) force (Searle, 1969). A typical utterance may have a *form* which differs from the *intent*. The utterance 'could you close the door?', for example, has the form of a *question* but the intent of *advisement:* the speaker intends the listener to close the door. In VRM, the relationship of form to intent is expressed, using the statement "in service of" (Stiles, 1992). In this example the question 'could you close the door' is 'in service of' the advisement 'close the door'. In standard presentation this is recorded as (QA).

Edification in service of Edification (EE) is the most frequent form of utterance in the Wikipedia sample – 37% of all utterances were of this mode. The Edification mode is defined as deriving from the speaker's frame of reference, making no presumption about the listener and using a neutral (objective) frame of reference shared by both speaker and listener. This mode is informative, unassuming and acquiescent. As a strategy for influencing others it reflects attempts to convince by neutral objective argument.

The second most common mode is that of Disclosure in service of Disclosure (DD). Disclosure is defined as being from the speaker's experience, making no presumption, but being framed using the speaker's frame of reference. This is summarised as informative, unassuming but directive. Unlike EE mode, DD mode represents an attempt by the speaker to impose or have the listener accept the speaker's frame. Twelve percent of all utterances adopted this form.

The third most common mode is Disclosure in service of Edification (DE). The DE mode represents an utterance which is from the speaker's frame of reference but as if it is neutral or from a shared frame. Eight percent of all utterances used this mode. This is a somewhat neutral mode where the speaker offers clearly labelled personal knowledge as information.

The fourth most common mode is Advisement in service of Advisement (AA). AA mode represents speech from the speaker's experience, which makes presumptions about the listener and adopts the speaker's frame of reference. It can be summarised as informative, presumptuous and directive. It commonly takes the form of 'you should….' Approximately 7% of utterances were in this mode. A further 12% of utterances have the directive pragmatic intent of advisement masked by using a less presumptuous form – that of Edification or Disclosure.

Significantly, utterances associated with politeness (such as acknowledgements 5%) and with discourse which aims at mutual understanding, such as confirmation (1.5%) and reflection (1%), were very rare in the Wikipedia sample.

Discussion of Findings

What is significant about the utterance strategies is that they typically involve an exchange of assertions delivered with a neutral – i.e. non-emotive style. There are very few explicit praises, or put downs, and few niceties like explicit acknowledgements of one another. Seldom do contributors refer to one another by name – the exchanges are rather impersonal. This does not tally with what one would expect if the Wikipedia etiquette (http://en.wikipedia.org/wiki/Wikipedia:Etiquette) had been institutionalised. The Featured articles conform a little more closely with what one would expect than do the Controversial, but if we assume that the etiquette captures the community's ideal, the emerged patterns do not conform to that 'ideal' to the extent that might be expected in either case. Similarly we see low levels of questioning or of reflection (i.e. feeding back the words of the speaker to check understanding or to come to better understand the other's intentions). This is arguably inconsistent with the task needs – to reach consensus on controversial topics. The frequency with which utterances were ignored also suggested low engagement by participants in the discussion. All of this would seem to need some explanation.

The absence of any expression of acknowledgement of emotions and/or similarity of attitude (homophilly) among many contributors suggests that Wikipedia lacks many of the qualities of verbal exchange that would identify it as strong community. It is more consistent with being a place to share coordination of a task. This could suggest that the goal is the primary orientating point. However, the lack of quality of discourse needed to achieve consensus is more indicative of a brief encounter between different and established milieux which struggle to find common understanding rather than of a community committed to a common goal (Becker & Mark, 1997). This might suggest that the shared goal may be subordinate to more personal goals by a considerable proportion of contributors. Or it may be that the technology and environment will support no more than this.

The Wikipedia environment supports saboteurs who can use the opportunity afforded by the open and anonymous platform to use identity deception i.e. to mimic the language and style of an 'expert' or to present as a genuine editor while trying to pursue a personal or political agenda hostile to the aims or interests of the Wikipedia. We found no direct evidence of this behaviour in the pages we sampled even though the discussions about controversial articles provide particularly fertile ground for such sabotage. Nevertheless the threat of it could have an overall influence on the type of communication conventions which arise. Editors may, for example, display reserve and suspicion, withholding trust and taking conventional signals of authority and identity (Donath, 1998) as unreliable. The first principle in the Wikipedia etiquette is 'assume good faith'. To do so would, however, leave the process more vulnerable to 'troll' activity.

Utterance strategies between registered and unregistered editors did not vary greatly, although unregistered editors were more likely to use disclosure intent and more likely to ask questions (possibly associated with the increased likelihood that they are relatively new to Wikipedia). They are also more likely to be negative – reflecting their potentially lower commitment to the article or the community.

Qualitatively there was considerable evidence of mind reading (theory of mind) – i.e. editors appeared to form judgements about the intent of others on relatively little information. There was, however, little evidence of the use of utterance strategies to better understand or check these theories of mind. Some editors, particularly in the Controversial discussions appeared quick to judge and then follow response patterns consistent with those judgements (e.g. ignoring or accepting utterances of others). There were also few instances of renegotiated patterns of communication style. Positions and styles stayed relatively constant over the period of the interaction. Only occasionally would an editor modify his/her style significantly if challenged. Of the rule invocations 26% were accepted, a similar proportion were rejected or ignored and the remainder went unquestioned (but generally had no affect on behaviour). This is consistent with norms being triggered by a limited range of cues which allow individuals to locate themselves and select identities appropriate to a context and which then remain essentially stable. The invocation of rules and norms appears to have little to no immediate effect on behaviour although it is not clear if it has an effect in subsequent behaviour as this cannot be ascertained from the available data.

CONCLUSION AND FUTURE WORK

In this study we set out to identify mechanisms which underpin the emergence of systemic self-organisation in a volunteer on-line global institution. The aim was to specify the mechanisms involved in order to support the design of a simulation architecture suitable for the wider study of normative mechanisms. The findings have challenged some of our assumptions and expectations, in particular:

- The more detailed and specific behavioural etiquette seems to have little influence on the overall character and style of interaction.
- The overall quality of interaction of editors falls short of the range and quality of communicative style characteristic of a community and that would be consistent with what one would expect, given the nature of the task.
- Most regulation is achieved without the need for frequent explicit invocation of rules or norms. Rather, behaviour seems to accord to a convention which editors quickly recognise and conform to (or bring to the Wikipedia)

and which minimally accommodates what needs to be done to satisfy the task in a context of potentially heterogeneous personal goals.

- There was a lack of evidence of active negotiation of expectations and standards and convergence of behaviour towards a norm. Within the discussion pages there appeared to be little obvious norm innovation, evolution, adaptation or extension. This suggests that on first encounter with Wikipedia, editors read a set of cues as to what constitutes appropriate or acceptable behaviour and then accommodate it. Alternatively the order observed may be largely attributable to the prior socialisation of participants with local norms and rules playing a very minor part in supporting task regulation.
- While there is a difference between controversial and featured sites this is minimal and the quality of the interaction cannot explain the difference in status. Similarly there appeared to be little in the subject matter of the two groups of articles which would explain the difference – both contained subject matter which was contestable and subject to significantly diverse opinion.

Wikipedia is not a market as there is no tradable product or price, either in a conventional sense or in the form of tradable reputation. Nor is Wikipedia a command hierarchy: the openness of the wiki platform and the low cost of joining and leaving precludes formal control as a primary means for governance. Neither is Wikipedia well described by the network theory of governance as there is no obligation to maintain involvement. While it might be expected that the Bazaar Governance would apply, the absence of a reputation mechanism suggests that it may be better considered through the more general lens of stewardship theory. Even here, there is no role for moral leadership but rather a diffused willingness to comply with certain minimum standards on the part of a sufficient majority.

There is no clear basis to argue that the apparent order is a direct result of the use of deontic commands associated with social norms and environment specific rules. Despite the fact that the community has been a prolific rule generator, they appear to play a minor role. Contributors demonstrate a style which is broadly inconsistent with these rules and not a good fit with the task.

Overall though there is order and it appears to be emergent. The mechanisms which underpin this emergence have not been revealed by the analysis undertaken to date although some hypotheses can be tentatively suggested. The neutral-objective style may be a consequence of the anonymity and open nature of the environment – leading to a suspension of trust. It may propagate as new comers copy the pattern through a process of behavioural cueing. It is possible also that the order is due to pro-social behaviour internalized and brought to the task. The volunteer nature of Wikipedia, and the level of commitment required, is likely to mean that long term editors reflect a pro-social disposition (Penner, Dovidio, Piliavin, & Schroeder, 2005). In this context a little norm/rule invocation may go a long way if not by influencing immediate behaviour then by encouraging future compliance and/or by giving incentive for non-compliers to leave. The relatively small difference in overall style apparent in relation to the diverse range of articles may have little to do with the specific communicative behaviours adopted in communication about that article but rather due to the chance association of individuals at a given point of time and how this subtle process of encouragement and dissuasion plays out over time. Such a view is quite different from that modelled in past attempts to simulate social norms.

A review of past approaches to the simulation of norms undertaken by EMIL partners at the University of Bayreuth concluded that the past research drew on the traditions of game theory and artificial intelligence. The latter were exclusively in the first generation AI tradition. Significantly, data drawn from real social situations was seldom used and there was a strong tendency to build on prior work with little questioning of assumptions about the nature of normative behaviour. Seldom was any mainstream theory of social behaviour employed as a part of the research program. The EMIL project is notable, therefore, for its insistence on the need to adopt an empirical orientation: for models to be designed in the light of and tested against observations drawn from real world cases of normative behaviour as well as in its avoidance of pre-commitment to particular simulation models or traditions.

While the findings of the research to date are far from conclusive they do challenge many of the assumptions incorporated into past simulations and suggest a range of alternative hypotheses. Some of these will be able to be critically examined by further analysis of the current data and/or by data currently being collected through a controlled wiki experiment as well as data proposed to be collected in a case study in Second Life. The EMIL simulator is being designed to support a range of alternative assumptions and so should allow us to test alternative hypotheses and contribute to our understanding of this increasingly significant phenomena.

ACKNOWLEDGMENT

The work on which this article is based has been supported by EMIL a three-year EU funded project (Sixth Framework Programme - Information Society and Technologies - Citizens and Governance in the Knowledge Based Society).EMIL comprises six Partner institutions: Institute of Cognitive Science and Technology, National Research Council, Italy; University of Bayreuth, Dept. of Philosophy, Germany; University of Surrey, Centre for Research on Social Simulation, Guildford, United Kingdom; Universität Koblenz – Landau, Germany; Manchester Metropolitan University, Centre for Policy Modelling, Manchester, United Kingdom; and AITIA International Informatics Inc. Budapest, Hungary.

I thank the partners for their contributions to the research.

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This work was previously published in International Journal of Agent Technologies and Systems, Vol. 1, Issue 1, edited by G. Trajkovski, pp. 19-33, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 7.20
Social Network Structures for Explicit, Tacit and Potential Knowledge

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ABSTRACT

The purpose of this conceptual article is to develop argumentation of the knowledge assets of a firm as consisting of three constructs, to extend the conventional explicit, tacit dichotomy by including potential knowledge. The article highlights the role of knowledge, which has so far not been utilized in value creation. The underlying assumption in the article is that knowledge assets can be thought of as embedded in the relationships between individuals in the firm, rather than possessed by single actors. The concept of potential knowledge is explained with selected social network and knowledge management literature. The findings suggest that the ideal social network structure for explicit knowledge is centralized, for tacit knowledge it is distributed, and for potential knowledge decentralized. Practically, the article provides a framework for understanding the connection between knowledge assets and social network structures, thus helping managers of firms in designing suitable social network structures for different types of knowledge.

INTRODUCTION

This article starts from the notion that knowledge is an asset for the firm in value creation (e.g., Spender, 1996). According to research in social networks and in the theory of the firm, value creation with knowledge can be considered as something that is embedded in the relationships between individuals, thus making the research on firms' social network structures important (Nelson & Winter, 1982; Granovetter, 1985; Winter, 1987; Kogut & Zander, 1992; Uzzi, 1996). A common saying in the social networks literature is "it's not what you know, it's who you know" (e.g., Cohen & Prusak, 2001).

The main message of this article is that there are fundamentally different types of knowledge assets that produce value with fundamentally different types of social network structures. Based on a short overview of knowledge management literature, an idea is proposed that there are three types of knowledge assets in a firm: explicit, tacit and potential, as well as corresponding three ideal types of social network structures: centralized, distributed and decentralized. The general purpose of this article is to develop convincing arguments to show that knowledge should be described with three constructs, to extend the conventional dichotomous view of knowledge. This line of thought makes it possible to start thinking of unrealized, not yet implemented, knowledge as a strategic asset, in addition to the knowledge assets already utilized by the firm.

The dichotomous view of knowledge as either explicit or tacit has been dominant in the theory of knowledge management after Nonaka and Takeuchi (1995) introduced their model of knowledge creation, the so-called SECI model. It has been claimed, however, that although the SECI model is excellent in describing a process after the initial idea has been developed for a new innovation, it does not necessarily explain the time before clarifying the idea (Engeström, 1999). One possible explanation for this is that the constructs of explicit and tacit knowledge alone are not sufficient to explain the varying nature of knowledge, and how knowledge should be utilized in the very early phases of innovation processes.

This article elaborates arguments about a third knowledge construct, potential knowledge. Potential knowledge is first explained through theory, and illustrated with social network structures. Potential knowledge is defined as a *knowledge asset either in codified or experience-based form that has not yet been utilized in value creation*.

A so-called Coleman-Burt debate on ideal social network structure appears in the social networks literature. This debate is about whether the most optimal network should be structurally sparse and decentralized (Burt, 1992; 2004) or dense and distributed (Coleman, 1988; Uzzi, 1996). There are empirical suggestions towards solving this debate, arguing that the optimal network structure is a combination of sparseness and density, including network ties among the actors that enable both closure and reach simultaneously (Uzzi & Spiro, 2005; Baum, van Liere, & Rowley, 2007; Schilling & Phelps, 2007).

As a result of this theoretical article, it is suggested that the type of knowledge asset—explicit, tacit or potential—is a contingency for the social network structure. It is suggested that there is no one ideal social network structure. Instead, the social network structure of a firm includes a centralized structure for explicit knowledge, a distributed structure for tacit knowledge, and a decentralized structure for potential knowledge. All the types of knowledge and the corresponding social network structures are needed, and individuals can belong to many types of networks simultaneously.

Besides categories of knowledge, another approach to the concept is to consider knowledge as a continuum. There, knowledge is never purely either tacit or explicit, but a combination of both (e.g., Jasimuddin, Klein, & Connell, 2005). Following this line of thought, knowledge that is utilized in the creation of value can be thought to include all three types, with the weighting of the different types changing from one situation to another. The role of potential knowledge is essential in the early phases of the innovation process, whereas tacit knowledge is important in the development phases, and explicit knowledge in the commercialization phases (c.f., Nonaka & Takeuchi, 1995). Based on the knowledge continuum insight, it is proposed in the discussion section that the weights of the different knowledge types, and also the social network structures are different in the idea, development and commercialization phases of the innovation process. Implications for managers are presented and further research issues suggested in the concluding section.

EXPLICIT, TACIT AND POTENTIAL KNOWLEDGE OF A FIRM

An epistemological definition suitable of describing the nature of potential knowledge is "knowing about the thought origins for doing things" (Scharmer, 2001, p. 6). Potential knowledge is knowledge whose value for the organization has not been discovered yet. To borrow from physics, potential energy is stored and available to call on when needed, while kinetic energy is in use, in motion. In the context of an expert's work at the individual level, potential knowledge has been defined as the total amount of knowledge the person has, in contrast to the "actual" knowledge that the individual uses in his or her work (Hollnagel, Hoc, & Cacciabue, 1995).

In the categorical approach to knowledge, knowledge is usually seen as either explicit or tacit. Explicit knowledge is knowledge that is codified, in the form of books, documents and written procedures, "knowledge about things." Tacit knowledge, on the other hand, can be defined as "knowledge about how to do things" (Scharmer, 2001, p. 6), and it is located in the routines of individuals and the organization, as well as in the ways of working between the individuals in the firm (Nelson & Winter, 1982).

Tacit knowledge, according to Polanyi's (1966) original definition, cannot be made explicit, but in the knowledge management theory, a fundamental insight of Nonaka's SECI model (1995) includes the transformation of tacit knowledge into explicit and back during the innovation process in a firm, as highlighted in the cases presented in Nonaka and Takeuchi's (1995) book.

Definitions for tacit knowledge vary in the literature. Hansen (1999) sees tacit knowledge in the firm as corresponding to knowledge that has a low level of codification, that is complex and hard, but not impossible to articulate, or can be acquired only through experience. According to Teece (1986), knowledge in the tacit form is transferable, but it has to be transferred by those who posses the knowledge, due to difficulties in the articulation of tacit knowledge.

The discussion on the definitions and types of knowledge has been guiding the knowledge management literature since the birth of the field. Snowden (2002) states that knowledge management as a discipline has gone through three phases since the early 1990s. The first phase considered the efficient use and storing of codified knowledge, the second phase was started by Nonaka and Takeuchi's (1995) book, and the attention was directed towards learning and conversion between tacit and explicit knowledge. The third phase deals with innovation, complexity and self-emergence of knowledge.

A shortcoming that Nonaka and Takeuchi's SECI model has, despite of its undisputed explanation power on the knowledge creation process, is that it does not take into account the emergence of knowledge in the very early phases of the innovation process (Engeström, 1999; Scharmer, 2001). Scharmer illustrates this with the well- known home bakery example of Nonaka and Takeuchi (1995, p. 100) by arguing that certain kinds of information about bread, such as weight, price and ingredients are explicit knowledge. The activities of baking and producing the bread are examples of tacit knowledge. Finally, the knowledge that enables a baker to create the baking process in the first place is self-transcending, emergent type of knowledge. This is the type of knowledge that could be labeled as potential, and that is what the SECI model lacks. Potential knowledge is the starting point for the knowledge spiral in the SECI model of Nonaka and Takeuchi (1995).

To position the concept of potential knowledge in conjunction with the value creation of the firm, it can be reflected through the explicit-tacit dichotomy (Table 1). Firm-level explicit knowledge, knowledge about things, is knowledge in a codified form that can be stored, managed and used electronically with data mining and document mining techniques in the organization. Firm-level tacit

Table 1. Potential knowledge defined through explicit and tacit types of knowledge

Tacit	Experience-based knowledge	Experience-based or codified knowledge that has not yet been utilized in value creation.
Explicit	Codified knowledge	
	Realized knowledge assets	**Potential knowledge assets**

knowledge, respectively, is knowledge that exists in the skills and perceptions of the employees or groups of employees in a given area, is stored in organizational routines (Nelson & Winter, 1982), and cannot be handled electronically. Potential knowledge is a knowledge asset either in a codified or experience-based form that has not yet been utilized in value creation.

Table 1 describes potential knowledge as an unrealized form of tacit or explicit knowledge. The three knowledge assets pose a challenge in the management of social network structures—what kinds of social network structures are needed, and what managerial action should be taken to create these structures?

SOCIAL NETWORK STRUCTURES FOR EXPLICIT, TACIT AND POTENTIAL KNOWLEDGE IN A FIRM

In this section, the ideal social network structures for explicit, tacit and potential knowledge are presented. By leveraging social network structures, a firm can produce most value with its knowledge assets. It has been argued that decentralized, distributed and centralized social network structures (see Barabási, 2002) are ideal for potential, tacit and explicit knowledge. These networks make it possible not only to search for new, non-redundant sources of potential knowledge, but also to transfer experience-based, tacit knowledge, and to implement explicit knowledge in the firm.

The management of potential knowledge requires scanning the firm's environment through social network ties and seizing the value creation potential in that network. Therefore, the management challenges related to building a social network structure for potential knowledge are twofold: 1) how to increase the span of the network in order to increase the knowledge potential, and 2) how to transform potential, unrealized knowledge into realized knowledge.

In the case of tacit knowledge, which is hard to transfer due to its experience-based, un-codified and complex nature, the management challenge is how to arrange the social network structure to allow close, personal and reciprocal social network relationships for the transfer of tacit knowledge across the organization.

Explicit knowledge, which is exact, codified knowledge about things, poses the challenge of how to implement that knowledge in practice. The main topic of interest in the implementation of explicit knowledge is creating a structure of accuracy and discipline to ensure flawless flow of explicit knowledge. Table 2 summarizes the three classifications of knowledge and the management challenges related to the social network structure in each type of knowledge.

From the point of view of the contingency theory (e.g., Burns & Stalker, 1961), it has been stated that environmental conditions affect the structures of networks. For example, Podolny and Baron (1994; 1997) argue that under uncertainty, and when facing authoritative power, social network ties are formed more likely with similar others, which leads to the formation of strong ties. Also, cultural traditions and institutions have been found to influence the social network structures in a way that in the environment with highly profound institutions, such as the lifetime

Table 2. Three classifications of knowledge and social network structure-related management challenges

Type of knowledge	Definition	Social network management challenge
Potential knowledge	Codified or experience-based knowledge that has not yet been utilized in value creation	How to build an extensive social network and how to scan and seize knowledge from this structure?
Tacit knowledge	Experience-based knowledge	How to transfer experience-based knowledge in the social network structure?
Explicit knowledge	Codified knowledge	How to implement codified knowledge in value creation with the social network structure?

employment and seniority-based promotion in Japan, taller hierarchies and greater formal centralization can be found (Lincoln, Hanada, & McBride, 1986).

The type of knowledge is a contingency for the social network structure. The explicit knowledge of a firm is used to reach efficiency in producing already designed products or services, because it includes well-codified rules, documents and procedures. This knowledge is, for example, knowledge related to stock levels or blueprints of products. Therefore, an ideal social network structure for explicit knowledge is the centralized structure (see Barabási, 2002), in the sense of the mechanic management system presented by Burns and Stalker (1961).

Tacit knowledge is a knowledge asset that has accumulated through past experiences in the firm. It is mainly used for gradual improvement of existing products, services or production methods and processes. Tacit knowledge can be, for example, the know-how of the employees, or past customer experiences. It is experiences that are difficult to transfer and require reciprocal and close relationships with the individuals. The distributed social network structure (see Barabási, 2002) is the most suitable one for tacit knowledge. In the traditional contingency theory, Burns and Stalker's (1961) organic management system resembles the distributed social network structure.

Potential knowledge is either codified or experience-based, an unrealized knowledge asset that has future value creation potential. It is used to initiate the innovation of something totally new in the very early phases of the innovation process. Potential knowledge is characterized with connections to many non-redundant sources of knowledge, which makes the ideal network structure for potential knowledge decentralized (see Barabási, 2002). There are no equivalent structures of decentralized networks in the contingency theory. Table 3 summarizes this chapter by presenting the social network structures for explicit, tacit and potential knowledge.

Decentralized, distributed and centralized social network structures have notable differences in their functioning mechanisms. The decentralized social network is built on individuals as hubs of knowledge who gather and broker knowledge from different sources. The distributed social network structure does not have brokers, because there the relationships are distributed evenly, and individuals are connected with a few links to a couple of others. In the centralized social network, the functioning mechanism is based on a focal individual who manages the flows of knowledge with disconnected others. In the next section, the types of knowledge and social network structures are connected to different tasks in the firm.

DISCUSSION

Based on a common presupposition in the theory of the firm, and in the social network literature, knowledge can be thought of as embedded in the interactions between individuals in the firm (i.e., Nelson & Winter, 1982; Kogut & Zander, 1992; Uzzi, 1996). Therefore, each of the three knowledge constructs poses different challenges for the management of social network relationships in a firm. In order to produce value with potential knowledge, the firm must be able to grow the reach of its network to include non-redundant, new sources of knowledge. In explicit knowledge, the social network should allow quick and flawless implementation, and in tacit knowledge comprehensive and reciprocal transfer.

There has been a debate among knowledge management scholars about whether the concept of knowledge should be treated as a categorical construct (e.g., Nonaka & Takeuchi, 1995), or as a continuum (e.g., Jasimuddin, Klein, & Connell, 2005). The starting point of this article has been the categorical perspective to knowledge, although the continuum perspective that sees knowledge as existing along a continuum of tacitness and explicitness is usable also in the context of the theory of the firm. The suggestion towards knowledge consisting of both tacit and explicit components at the same time is plausible for example in the context of absorptive capacity (Cohen & Levinthal, 1990). There, a firm must posses a certain knowledge base before it is able to learn anything new.

Figure 1 integrates the categorical and continuum perspectives of knowledge in the value creation of a firm. Here, a firm creates value basically in three ways: 1) invention, 2) development, and 3) commercialization. These three ways of value creation are present in the innovation process of product innovation. In the invention phase, the role of potential knowledge is emphasized, and the management of the firm should concentrate on building a decentralized social network structure to support free and fast flow of ideas from distant and non-redundant sources. However, based on the insight of absorptive capacity and the knowledge continuum view, the invention phase needs also

Table 3. Social network structures for explicit, tacit and potential knowledge in a firm

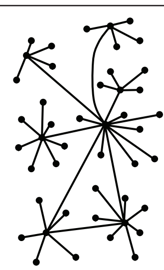
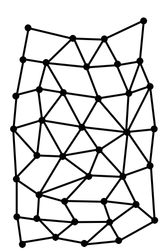
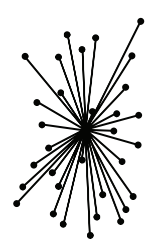
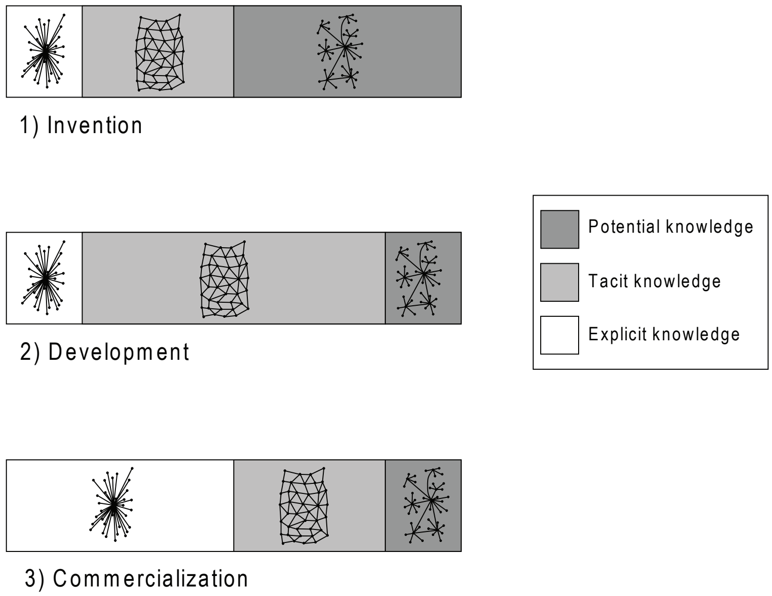
	Potential knowledge	Tacit knowledge	Explicit knowledge
Illustration			
Network structure	Decentralized	Distributed	Centralized
Functioning mechanism	There are hubs in the knowledge network that control the flows of knowledge and intermediate between different groups. Some of the actors are more connected than the others.	There is no specific actor who manages the knowledge flows. The knowledge flows horizontally from one actor to another. Every actor has knowledge links to a couple of other actors.	The focal node in the network manages the knowledge flows. The knowledge flows hierarchically from the top down and from the bottom to the top. There are no knowledge exchange links between the subordinates.

Figure 1. Potential, tacit and explicit knowledge in different phases of the innovation process



tacit knowledge and explicit knowledge, but to a lesser extent. This is because without certain explicit procedures and methods, or without some kind of individual's past experiences in ideation work, new invention is not possible.

Similarly with the invention phase, also the development and commercialization phases include all three types of knowledge, but with different weights (see Figure 1). In the development phase, an idea is gradually developed, based on the expertise of the individuals, with the reciprocal and distributed social network structure. Finally, in the commercialization phase, the developed product is produced as efficiently as possible along the unambiguous rules and procedures in the centralized social network structure.

Jasimuddin et al. (2005) present the paradoxes and difficulties related to the concept of knowledge convincingly in their literature review. There is confusion in the field of knowledge management about the concept, not only because different scholars have their own theoretical backgrounds, but also because it is not always clear whether knowledge is discussed from the point of view of the individual or the organization, from the epistemological or managerial standpoint.

Connecting potential, tacit and explicit knowledge constructs to the different phases in the innovation process makes it possible to see knowledge as both a categorical and a continual concept. Categorizations are needed to distinguish different aspects of knowledge assets that create value for the firm, and the knowledge continuum is needed when the categories are applied into practice in the value creation process.

CONCLUSIONS AND FURTHER RESEARCH

The cycles of the economy are becoming shorter, and firms are expected to bring new products and services to the market at an increasing pace. Rapid, centralized implementation of explicit knowledge is essential, because firms must be able to transform their product definitions, processes and production methods rapidly across a possibly globally distributed hierarchical demand-supply chain. Besides efficient production, firms must be capable of improving their products or services gradually to meet the needs of the customers. Gradual development can be achieved by allowing reciprocal and thorough transfer of tacit knowledge in a distributed social network. Last but not least, firms face a challenge of innovativeness, scanning and seizing their environment for new possible trends and ideas. There, the decentralized social network structure for potential knowledge comes into place.

It is clear that there is no one optimal social network structure for a firm but many, and each social network type requires unique management initiatives. Potential knowledge can be harnessed with managerial actions that aim to create a decentralized social network structure, for example, by investing in search capabilities or by increasing the pool of different types of talent in the firm, and emphasizing creativity and sharing of ideas in the leadership style. In order to create decentralized structures, individuals with knowledge broker capabilities (c.f., Burt, 2004) should be encouraged to improve the sharing, gathering and flow of ideas across the firm.

Tacit knowledge can be leveraged with managerial actions that aim for distributed social network structures. This can be achieved by emphasizing learning and trust building in the leadership style of managers. Investments in team building, team cohesion, and building of cross-functional teams with members from different parts of the organization should be made to ensure a timely transfer of tacit knowledge.

Finally, the management of explicit knowledge should focus on efficiency and a time-to-market mindset. There, a centralized social network structure can be achieved by investing in efficient, hierarchical management systems and systems engineering with industrial organization logic.

The divisions according to the type of knowledge presented in this article offer one theoretical framework for managing the complex whole of the social network ties in a firm. Decentralized, distributed and centralized social network structures all exist in the firm, and the same individuals can be a part of a social network for potential, tacit and explicit knowledge at the same time. The plethora of types of relationships between individuals in an organization is vast. The fundamental question for future research is which kinds of layers of relationships should be investigated more thoroughly, and how the social networks that the different types of relationships uncover should be operationalized. More work should be done in terms of defining the potential knowledge construct to find answers to why some firms are essentially better in sensing new opportunities in the market than others.

By influencing the social network structures in the firm with managerial action, the use of knowledge assets in value creation can be encouraged. The aim of further research based on this article is to connect different types of knowledge assets to different value-creating tasks in the firm, and to study empirically the inter-firm and intra-firm management initiatives suitable for each of the social network types. From the intra-firm social network perspective, possible interesting research questions would be related to the ideal structures in, for example, transferring ideas across the firm, business development, or in efficient production. Also individual-level research questions on, for example, the social network characteristics of highly innovative individuals should be studied from the knowledge management perspective.

In many cases, innovation occurs in the relationships between different firms (Powell, Kogut, & Smith-Doerr, 1996), and also development and production functions are increasingly operated across firm and industry borders. The three types of knowledge and the corresponding three social network types should be investigated from the point of view on how the three knowledge types can be separated from each other in inter-firm relationships. Creating awareness of different types of knowledge assets in the collaboration relationships between many firms, and different types of social networks to support them, would allow more efficient management of globally distributed innovation, development and production activities.

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This work was previously published in International Journal of Knowledge Management, Vol. 5, Issue 1, edited by M. Jennex, pp. 78-87, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 7.21
Motif Analysis and the Periodic Structural Changes in an Organizational Email-Based Social Network

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ABSTRACT

Network motifs are small subgraphs that reflect local network topology and were shown to be useful for creating profiles that reveal several properties of the network. In this work the motif analysis of the e-mail network of the Wroclaw University of Technology, consisting of over 4000 nodes was conducted. Temporal changes in the network structure during the period of 20 months were analysed and the correlations between global structural parameters of the network and motif distribution were found. These results are to be used in the development of methods dedicated for fast estimating of the properties of complex internet-based social networks

INTRODUCTION

Communication technologies enabled the emergence of complex, evolving social networks built on various services like e–mail, P2P and community portals. In general they are similar to the traditional social networks based on relations between humans, but there are also some significant differences. First, the information about the users in virtual communities and their activities is stored in electronic form which allows precise inference of the network structure and parameters. On the other hand, the networks created by means of communication technologies show incomparable size and dynamics (for more differences between regular social networks and virtual ones see Sec.3).

When investigating the topological properties and structure of complex networks we must face a number of complexity–related problems. In large social networks, tasks like evaluating the centrality measurements, finding cliques, etc. require significant computing overhead. In this context the methods, which proved to be useful for small and medium sized networks fail when applied to the huge structures. Moreover, our knowledge about the actual network structure may be incomplete especially due to its size and dynamics.

In this work we present the results of the analysis of local topology structure of large e–mail based organizational social network. The investigated e–mail network of the Wroclaw University of Technology (WUT), consisting of over 4000 nodes (e–mail addresses of the users) was generated basing on server logs from the period of February 2006 – September 2007, analyzed with standard methods – clustering and centrality assessment. Periodic changes in the network structure, connected with the business profile of the organization (university) were discovered and analyzed. In the series of experiments the global features of the network (clustering coefficients, centrality as well as the number of edges and nodes) were checked for correlations with the distribution of small network subgraphs, called network motifs. The existence of relations between motif profile of the network and its global structural properties may allow their fast estimation.

Dependencies between global network characteristics and the distribution of local topology features may have numerous applications. They can help to estimate the measures like centrality and clustering without the complete knowledge of the network structure. This feature appears very appealing especially when we deal with evolving networks consisting of millions of nodes (like social networks of mobile phone users, Web communities and so on) and the distribution of motifs may be determined by various sampling techniques which do not assume the exhausting processing of the entire structure of the network.

In the following sections we briefly introduce the networks motifs concept as well as the basics of online social networks. Furthermore, the process of social network extraction from WUT e–mail logs is presented. Finally, the results of motif detection and temporal changes in the structure of this network are discussed.

NETWORK MOTIFS

Complex networks, both biological and engineered, were analyzed with respect to so–called network motifs (Milo, 2002). They are small (usually 3 up to 7 nodes in size) subgraphs which occur in the given network far more (or less) often then in the equivalent random (in terms of the number of nodes and edges) networks. Despite all known structural and statistical similarities, networks from different fields have very different local topological structure. It was recently shown that concentration of network motifs may help to distinguish and classify complex biological, technical and social networks (Milo et al.,2004). We can define so–called superfamilies of networks, which correspond to the specific significance profiles (SPs). To create SP for the motifs in a given network, the concentration of individual motifs is measured and compared to their concentration in a number of random networks. The statistical significance of motif M is defined by its Z–score Z_M:

$$Z_M = \frac{n_M - \left\langle n_M^{rand} \right\rangle}{\sigma_M^{rand}} \qquad (1)$$

where

n_M – the frequency of motif M in the given network,

$\left\langle n_M^{rand} \right\rangle$ and σ_M^{rand} – the mean and standard deviation of M's occurrences in the set of random networks, respectively (Itzkowitz, 2003).

Most algorithms for detecting network motifs assume exhaust enumeration of all subgraphs with a given number of nodes in the network. Their computational cost dramatically increases with the network size. However, it was recently shown that it is possible to use random sampling to effectively estimate concentrations of network motifs. The algorithm presented in (Kashtan, 2004) is asymptotically independent of the network size and enables fast detection of motifs in very large networks with hundreds of thousands of nodes and larger. In result we do not have to process the entire network and the prohibitive computational cost may be avoided.

The existence of network motifs affects not only topological but also functional properties of the network. For biological networks, it was suggested that network motifs play key information processing roles (Shen-Orr, 2002). For example, so–called FFL motif – has been shown both theoretically and experimentally to perform tasks like sign–sensitive filtering, response acceleration and pulse–generation (Mangan, 2003). Such results reveal that, in general, we may conclude about function and properties of very large networks from their basic building blocks (Mangan, Zaslaver & Alon 2003).

In another work, motif analysis was proved to have ability of fast detection of the small–world and clustering properties of the large artificial Watts–Strogatz network (Chung-Yuan, 2007). This result open promising but still unexplored possibilities of reasoning about network's global properties with sampling of local topological structures.

Very little research has been done on motifs in computer science and sociology. SPs for small social networks (<100 nodes) were studied in (Milo, 2004). A web network counting $3.5x10^5$ nodes (Barabasi, 1999) was used to show the usability of sampling algorithm (Kashtan, 2004).

The motif analysis of Internet–based social networks is also hardly represented in recent works. It was recently shown that the email–based social networks appear to have the SP very similar to traditional social networks, but there are also some distinctive features which define their unique SP (Juszczyszyn, 2008).

VIRTUAL SOCIAL NETWORKS

People who interact with one another, share common activities or even posses similar demographic profiles can form a social network. Overall, the concept of a social network is quite simple and can be described as a finite set of individuals, by sociologists called actors, who are the nodes of the network, and relationships that are the linkages between them (Adamic, 2003; Ehrlich, 2006; Garton, 1997; Hanneman, 2005; Weng, 2005). In other words, social network concept is utilized to describe the relationships between friends, co–workers, members of the particular society, relatives in the family, etc. Not only can the character of the relationships be analyzed, but also their strength and direction. Although social network analysis (SNA) emphasizes the connections between people, the results of SNA provide also much information about individuals themselves.

The concept of social network, first coined in 1954 by J. A. Barnes (1954), have been in a field of study of modern sociology, anthropology, geography, social psychology and organizational studies for last few decades. The regular social networks are based on the in person contact. However, new trends in social network have emerged with development of the Internet where there is no in person contact. The online social networks can be extracted from the data about users and their behaviors that are gathered in various types of services that are available in the computer network.

The social networks that can be identified in the real world such as network of co–workers, friends or family members differs from social networks existing in the Internet

The main features that distinguish social networks on the Internet from regular ones are as follows:

1. Lack of physical, in person contact – only by distance, even very long distances.
2. Usually the lack of unambiguous and reliable correlation between member's identity in the virtual community – internet identity and their identity in the real world.
3. The possibility of multimodal communication; simultaneously with many members but also the possibility of easy switches between different communication channels, especially online and offline, e.g. online VoIP and offline text communication.
4. The simplicity of a break up and suspension of contacts or relationships.
5. The relatively high ease of gathering the data about communication or common activities and its further processing.
6. The lower reliability of the data about users and their activities available on the Internet. Users of Internet services relatively frequently provide fake personal data due to privacy concerns.

Although social networks in the Internet have already been studied in many contexts and many definitions were created, they are not consistent. Also, different researchers name these networks differently. In consequence, these networks are called: computer–supported social networks, CSSNs (Wellman, 1996), online social networks (Garton, 1997), web–based social networks (Goldbeck, 2005), web communities (Gibson, 1998; Flake, 2000), or virtual communities (Adamic, 2003).

In the literature, the name web communities was firstly used to describe the set of web pages that deal with the same topic (Gibson, 1998; Flake, 2000). Adamic and Adar (2003) argue that a web page must be related to the physical individual in order to be treated as a node in the online social network. Thus, they analyze the links between users' homepages and form a virtual community based on this data. Additionally, the equivalent social network can also be created from an email communication system. On the other hand, a computer–supported social network introduced in (Wellman, 1996) appears when a computer network connects people or organizations. Finally, Golbeck (2005) affirms that a web–based social network must fulfill the following criteria: users must explicitly establish their relationships with others, the system must have explicit support for making connections, and relationships must be visible and browsable.

Based on the kind of service people use, many examples of the social networks in the Internet can be enumerated. To the most commonly known belong: a set of people who date using an online dating system (Boyd, 2004), a group of people who are linked to one another by hyperlinks on their homepages (Adamic, 2003), customers who buy similar stuffs in the same e–commerce (Weng, 2005), the company staff that communicates with one another via email (Adamic, 2005;, Kazienko, 2007; Shetty, 2005; Culotta, 2004; Zhu, 2006), people who share information by utilizing shared bookmarking systems (Zhu, 2006) such as del.icio.us.

E–mails that was mentioned above are bidirectional and asynchronous way of communication. They posses limited social presence but on the other hand enable to exchange the information between people who are in different places and on different schedules (Wellman, 1996; Musiał, 2008). The email service is an example of social network in the computer network where the users communicate with one another by exchanging messages. The relationship in such a network can be derived both from the communication between two users as well as from the address books available in the given email system. The email addresses can be derived from different domains, e.g. Gmail, Yahoo, etc. Note that during analysis of such networks the cleansing process is a very complex issue, e.g. the junk mail should be excluded or two email addresses can belong to one social entity.

EMAIL–BASED SOCIAL NETWORK OF WUT

The experiments were carried out on the logs from the Wroclaw University of Technology (WUT) mail server, which contained only the emails incoming to the staff members as well as organizational units registered at the university. The communication with the external addresses was not considered – only organizational social network was investigated in our experiments. Motif detection was performed with FANMOD tool (Wernicke, 2006; Wernicke & Rasche, 2006) dedicated for motif detection in large networks.

First, the data cleansing process was executed. The bad email addresses was removed from the analysis and the duplicates were unified. WUT social network consists of nodes and relations between these nodes. The email addresses are the nodes of this network and the relationship between two nodes exists if and only if there is any email communication between them. In order to tract the temporal changes in the considered network the information from the logs was extracted for every month in the period of February 2006 – September 2007 separately. This allowed us to create 20 networks reflecting the structure of organizational communication between the WUT employees. This network was used for motifs detection in order to check how the motif SP changes when different periods of time are considered. The size of the networks varied from 3 257 to 4465 nodes, reflecting fact that various numbers of employees were active in different months.

Figure 1 shows that the changes in network size are periodic – this effect is connected with the general business profile of the WUT employees' activities. Obviously – August (months nr 7 – 3257 nodes and 19 – 2905 nodes on Figure1), as a peak of summer holiday season, may be associated with minimal communication activity of the university personnel. This is reflected in

Figure 1. Temporal changes in the size of WUT email network [16]

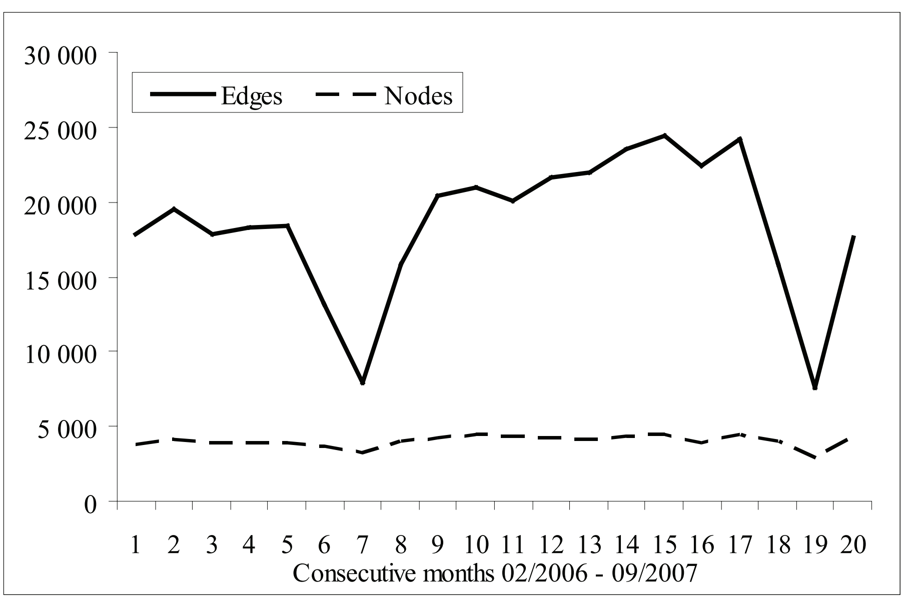
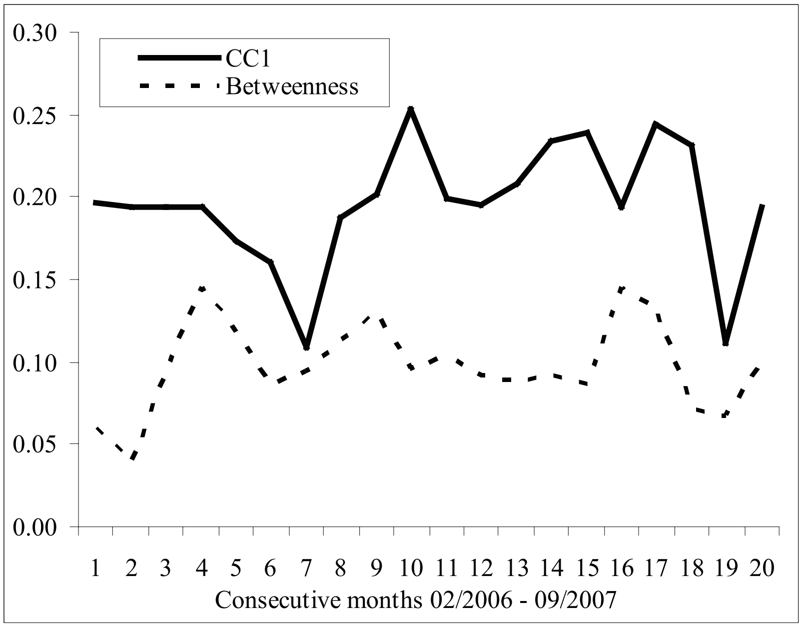


Figure 2. Average clustering coefficient CC1 and Betweenness centrality



small decrease in the number of active e–mail users (network nodes) and rapid drop in the number of network edges – 7941 edges in August 2006 and 7555 edges in August 2007 (which stand for incoming/outcoming messages). Similar effect (although less in size) is typical also for July and September, when the holidays respectively start and end. The short winter university holidays (two weeks in the middle of February) are not so clearly visible but, as we will see below, detectable with the motif analysis.

Along with the size of the network (measured as the number of nodes and edges), three more structural measures were computed: two clustering coefficients (*CC1*, *CC2*) and the betweenness centrality. The clustering coefficients were defined in the following way:

$$CC1 = \frac{2\left|E\left(G1\left(n\right)\right)\right|}{\deg\left(n\right)\left(\deg\left(n\right)-1\right)} \qquad (2)$$

$$CC2 = \frac{\left|E\left(G1\left(n\right)\right)\right|}{\left|E\left(G2\left(n\right)\right)\right|} \qquad (3)$$

where:

deg(n) – denotes degree of node *n*,
|E(G1(n))| – number of lines among nodes in 1–neighborhood of node *n*,
|E(G2(n))| – number of lines among nodes in 1 and 2–neighborhood of node *v*.

The two coefficients considering 1– and 2–neighborhood are given by Eq. 2 and 3. We also assume that for a node *n* such that *deg(n)* ≤1 all clustering coefficients are 0.

Betweenness centrality was defined in standard way (according to [18]) as a measure which returns for given node *n* the medium mediating between all pairs of nodes. Figure 2 presents the changes in the values of *CC1* and the network betweenness centrality. We may note that two moments of the most significant changes in the network structure (months no 7 and 19) are visible in the values of *CC1*, while fluctuations of betweenness are random–like and their interpretation is not straightforward.

Figure 3. Average clustering coefficient CC2

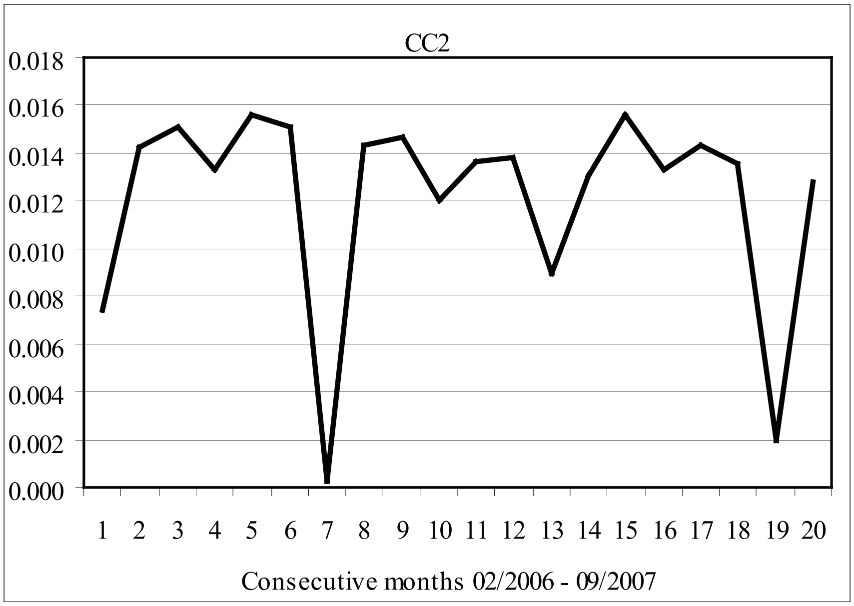
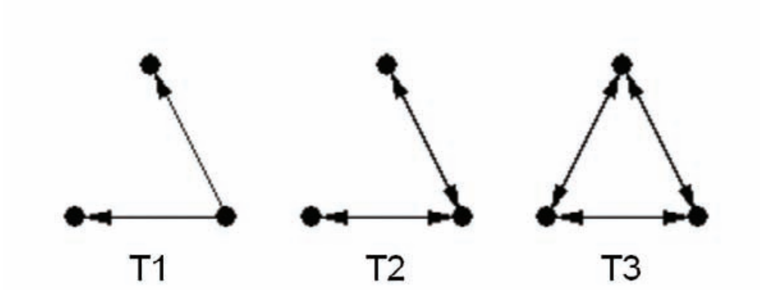


Figure 4. Network motifs sensitive to structural changes in an e-mail network (Juszczyszyn, 2008)

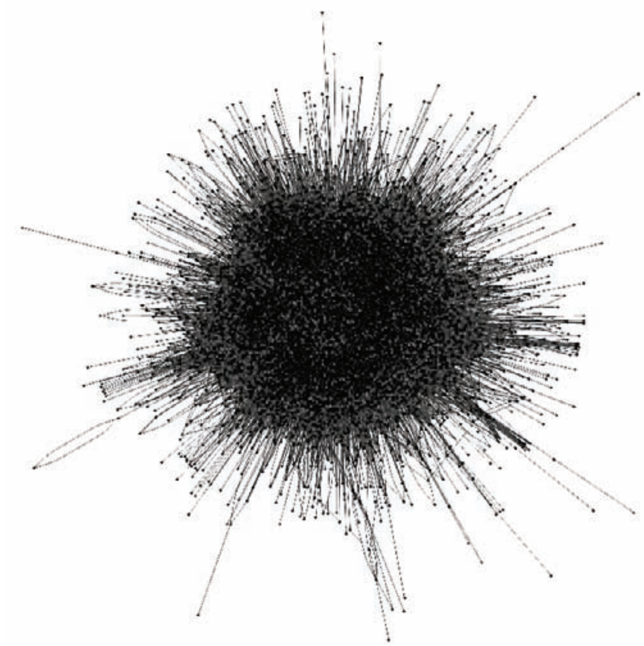


The temporal characteristic of *CC2* (which takes into account the density of the 2–neighbourhood of given node) is shown on the Figure 3. We can see that the two minima clearly denote August – the peak of summer holidays, associated with rapidly fading communication between the employees of WUT. Moreover, the next two smallest values (for February'2006 and February'2007) point to the two–week winter holidays (also: the end of winter semester on the university).

CC1, *CC2* and the betweenness centrality will be used in Sec. 5 to check for possible correlations with the motif distribution in the network.

Investigation of the local network topology with motif analysis, presented recently in (Juszczyszyn, 2008) have shown that the abovementioned periodic activity changes affect not only the scale but also the structure of communication. The distribution of motifs detected in (Juszczyszyn, 2008) (triads consisting of three network nodes and up to six directed edges) proved that holiday seasons are associated with the lack of the broadcast–type

Figure 5. Social network discovered from the email communication between employees of WUT (Juszczyszyn, Kazienko & Musiał, 2008)



communication. Also, the users forming densely connected cliques tend to sustain their communication during holidays which was reflected by the large number of occurrences of fully connected triads in the investigated network.

In particular – three triads (motifs) were identified as good candidates for tracking changes in large, evolving networks. They are presented on the Figure 4.

The Z–scores of these three motifs were visibly changing (with the highest variance) according to periodic structural changes in the network. In result, for the further experiments, we chose to investigate the behaviour of fully connected subgraphs (like T3 on Figure2) along with those reflecting broadcast type communication directed towards targets which are not connected (like T1 and T2. Note that they may be also associated with the existence of weak links and connections between cliques). Also, in order to follow the conclusions from these first experiments we assumed that the distribution of the four–node subgraphs (quadruples) will be investigated, because they better reflect the nature of dense cliques and connections between then (this will be discussed in detail in the next section).

On the Figure 5 a visualization of the network created on the basis of e–mail communication in entire 20–months period is shown (Juszczyszyn, Kazienko & Musiał, 2008). All 20 networks created for our experiments described below were similar in size and complexity.

MOTIF DETECTION AND ANALYSIS

The motif analysis was performed in this paper based on four–node motifs. Six possible four–node connected subgraphs (a.k.a. quadruples) exist. As defined in Sec. 2 if their occurrence in the given network differs significantly from that of a random network that consists of the same number of nodes and edges as the investigated network, they become

Figure 6. Four-node network motifs (quadruples)

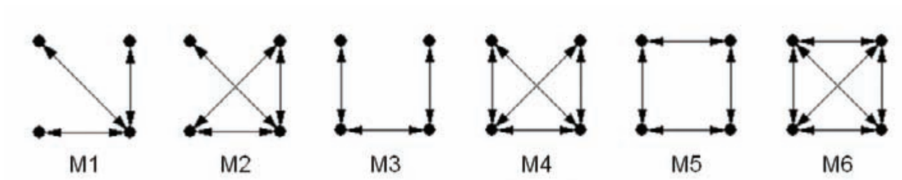
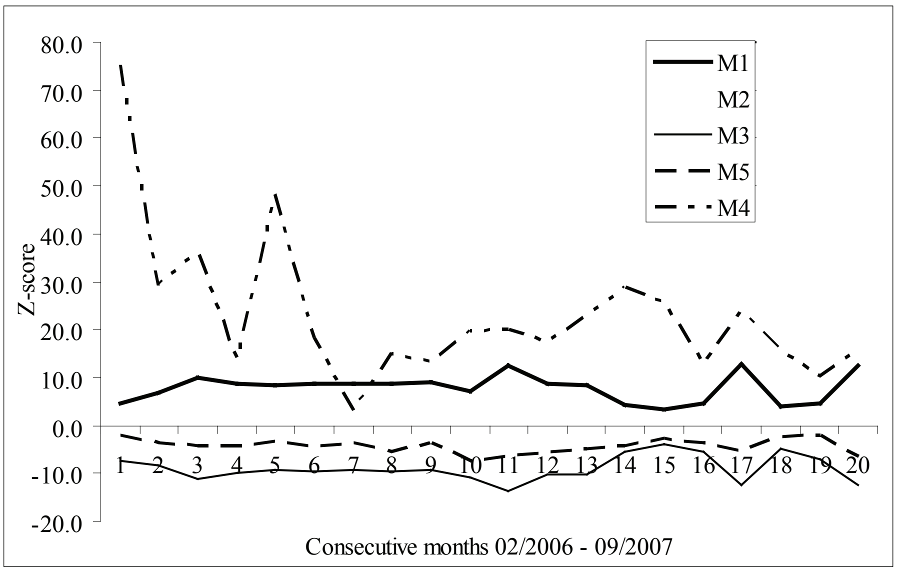


Figure 7. Temporal significance profile for motifs M1-M5



network motifs. Figure 6 introduces the subgraphs we used in our experiments. Note, that all arrows on the picture are bi–directional, in motif detection we chose to disregard the direction or the relations in the network – analysing over one hundred of possible directed quadruples would impose inevitable interpretation problems.

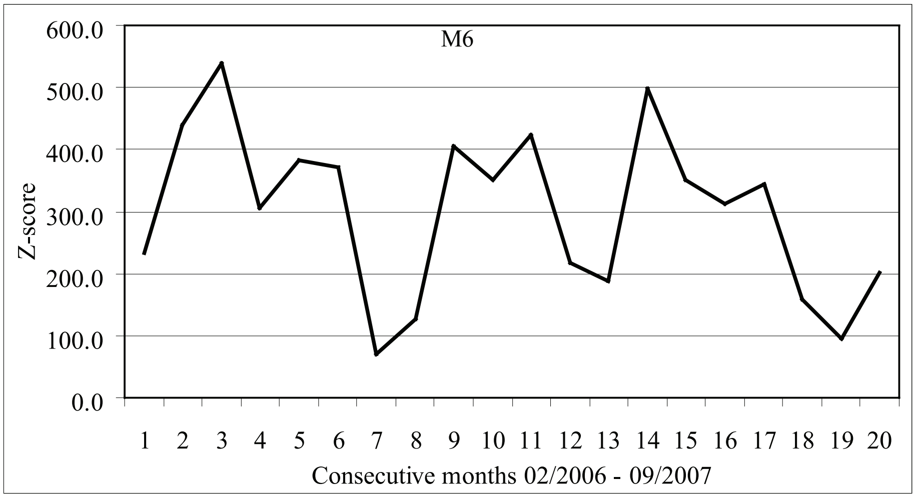
Detection of the above six subgraphs was carried in all 20 networks derived from e–mail communication. Figure 7 shows the temporal significance profiles for motifs M1 to M5 and their changes during 20 months.

Conducted analysis have shown no visible correlation between the Z–scores of motifs M1–M5 and the changes of the network connectivity illustrated on Figure1. The same result was obtained for centrality and clustering measures. For example, the Pearson correlation coefficients computed for M1–M5 and all the measures introduced in Sec. 3 do not exceed 0.25, showing that there is no linear relationship between them. Moreover, the Z–scores of M1–M5 (with the exception of M4, which may be explained but its close edit distance to M6 discussed below) are close to zero, in terms of motif analysis it means that their distribution is similar to the one met in random networks. They also do not change sign that sometimes may suggest a structural change in the network.

However, the situation with M6 is dif**ferent (Figure 8). First of all, its Z–score is** bigger by the order of magnitude, taking values from 69 to 539. It also shows the biggest variance in the set of 20 considered months.

The analysis of correlations between the

Figure 8. Temporal significance profile for motif M6



Z–score of M6 and the values of *CC1*, *CC2* and betweennes centrality have shown dependencies between them. The Pearson coefficient computed for Z–score of M6 equals:

- 0,5618 for number of edges in the network,
- 0,4993 for number of nodes in the network,
- 0,4503 for *CC1,*
- 0,6538 for *CC2,*
- 0,1231 for betweenness centrality.

According to discussion presented by Cohen (2007) the values obtained for *CC1* and *CC2* should be treated (when dealing with social networks) as significant. There is positive linear relationship between the frequency of M6 occurrences and *CC1* and *CC2*. Correlation with betweenness centrality was not confirmed – it will be the addressed during further experiments.

CONCLUSION

The authors investigated the local topology and its dynamics in the email based social network by utilizing the concept of network motifs. Additionally, we analyzed some characteristics of the global structure (such as centrality, clustering coefficient, number of nodes or edges) and presented how the values of these measures change over time. Finally, we uncovered the correlation between the network characteristics and some of the investigated four-nodes motifs.

We demonstrated that there is a relationship between the Z–score of M6 motif (fully connected quadruple) and the values of chosen structural network measures. Temporal changes in local connection patterns of the social network are correlated with changes in the intensity of communication and clustering coefficients and are detectable by means of motifs analysis (which, along with fast network sampling techniques, gives us a possibility to insight into the structure of large social network without significant computational overhead). The further investigations will aim to develop methods of estimating the values of global network characteristics by subgraph sampling techniques. We intend to use these methods for analysis of large, changing network structures (like internet communities, evolving networks of mobile phone users etc.) which require a new ways of detecting their properties with low computational overhead and minimal cost.

An interesting possibility of future temporal motif analysis will be also addressing relationship strengths in detail. Complementarities between results of (Juszczyszyn, Kazienko & Musiał, 2008) and the temporal TSP changes suggest that further experiments may bring interesting results.

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This work was previously published in International Journal of Virtual Communities and Social Networking, Vol. 1, Issue 2, edited by S. Dasgupta, pp. 22-35, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 7.22
"Social Potential" Models for Modeling Traffic and Transportation

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ABSTRACT

The "Social Potential", which the authors will refer to as the SP, is the name given to a technique of implementing multi-agent movement in simulations by representing behaviors, goals, and motivations as artificial social forces. These forces then determine the movement of the individual agents. Several SP models, including the Flocking, Helbing-Molnar–Farkas-Visek (HMFV), and Lakoba-Kaup-Finkelstein (LKF) models, are commonly used to describe pedestrian movement. A systematic procedure is described here, whereby one can construct and use these and other SP models. The theories behind these models are discussed along with the application of the procedure. Through the use of these techniques, it has been possible to represent schools of fish swimming, flocks of birds flying, crowds exiting rooms, crowds walking through hallways, and individuals wandering in open fields. Once one has an understanding of these models, more complex

and specific scenarios could be constructed by applying additional constraints and parameters. The models along with the procedure give a guideline for understanding and implementing simulations using SP techniques.

INTRODUCTION

Modeling traffic and transportation requires consideration of how individuals move in a given environment. There are three general aspects to consider when looking at movement: reactive behaviors, cognitive behaviors and constraints due to environmental factors. Individual drivers and pedestrians have a general way of dealing with certain situations, some of which comes from experience and some from personality. In this situation, there is generally only one specific response for any given agent. In other situations, one needs to allow an individual to choose from a set of various possible decisions based on how they affect movement and path planning. A final consideration is how the environment will constrain the general movement of the individual.

Much of an individual's movement, especially when driving a vehicle, is reactive. This is due to the fact that most actions are reactions to the conditions of the road and events which are occurring nearby. This is similar to pedestrian movement since walking becomes routine for people. Individuals do not think about every step that they are going to make and every possible outcome, they simply step forward and know the general outcomes they expect. When things deviate from the expected, then their movements are adjusted. Individuals transporting cargo, have a defined origin and destination which requires some decision making such as route planning. There is a goal they are trying to reach, and decisions are made along the way to achieve this goal. We will refer to these as cognitive behaviors, due to the fact that they take some conscious thought to achieve the goal. Techniques of path planning, seeking or organization can be used to represent these choices. The final aspect of movement is the definition of the environment. The individuals need to know where obstacles are and how they interact with them in order to avoid collisions and other unwanted contact.

In multi-agent systems there are numerous techniques which can be used to describe how each agent makes decisions and moves, such as Genetic Programming, Reinforced Learning, Case Based Reasoning, Rules Based Reasoning, Game Theory, Neural Network, Context Based Reasoning, Cellular Automata, and SP. The two primary techniques which are used to represent the decisions of individuals in pedestrian simulations are Cellular Automata and SP.

This chapter will focus on SP techniques for modeling and how to use it to represent individuals' desires and movements during a simulation. A description of the technique is given along with a detailed example of constructing a model from scratch. This will give some insight into the elements of the technique and the process which must be taken to use it effectively. There are a few commonly used models which represent pedestrian movement: Flocking (Reynolds, 1987), HMFV (Helbing, 2002), and LKF (Lakoba, 2005). A brief description of these models will be given along with the forces which are used in the model. Then cognitive behaviors will be discussed which can be added to any of the existing models to create specific desired movements in the individuals. Next, a description of different techniques used to interact with the environment is given. We then conclude by looking at how to apply this technique to more than individuals' movements.

BACKGROUND

Individuals tend to move in predictable manners due to the fact that walking in an environment becomes an automatic process where decisions are made instinctively (Helbing, 2005). People are familiar with walking and the paths they tend to follow. This fact allows for the construction of models which should represent the movement of individuals in reasonably simple terms. The same could be said for traffic and transportation movements, except that the possible movements for these are constrained more than for individuals. Nonetheless, the same techniques can be used for both systems.

One manner of looking at how an object moves is to relate it to the physical forces acting on the object, referred to as Newtonian Mechanics. The SP technique represents the movement of sentient beings by artificial forces between an individual and the environment in the same way Newtonian Mechanics represents movements via physical forces. The SP technique was originally developed as a way of modeling individuals’ decisions. One of the earliest uses was in modeling flocks of birds and schools of fish (Reynolds, 1993). Then the techniques were applied to robotic movement and path planning (Herbert, 1998; Lee, 2003; Reif, 1999). The technique is set up to allow the behavior of an individual to be defined through a collection of simple force-like rules. These artificial forces sometimes relate the social interaction between individuals and therefore the name “Social Potential” was given to describe the modeling technique (Reif, 1999). The SP technique originally used potentials to calculate forces and then used these forces to determine the movement of the individuals. Research in the field has shown that forces other then potential based forces might be required (Helbing, 2002) to simulate the movement of some individuals. Therefore we will refer to any model which uses forces to determine the direction of movement as an SP model.

In order to use this technique, the causes of the movements must be identified and then artificial forces representing their effects must be designed. The appropriately designed forces will then define how the individual reacts to each of these causes. The final movement of an individual is then taken to be a superposition of all influencing forces. This separation into an individual force for each cause allows for a simple definition of the individual forces whose sum creates the specific movements in the individuals.

The SP technique treats each individual like a particle; these particles are attracted or repelled from points, obstacles, other individuals, and areas of interest. This technique creates interactions on a microscopic level by simulating the movement of each individual. Treating each individual as a particle allows the creator of the model to focus on what influences a given individual and how to define the reaction of the individual to these influences. This allows for simple definitions and relates these influences to a commonly used technique, Newtonian Mechanics. Groups of individuals can then be simulated by placing numerous individuals into a common area and allowing these individuals to interact. The sum total of all the individual movements then gives rise to the emergent behaviors which is referred to as macroscopic “Crowd Dynamics.”

Simple Example

Consider searching for a place to eat when visiting a new location. This would have to be a place where you have never been before therefore you have no previous knowledge of the location of possible places to eat. Now assume that you intend to find a place by wandering around; in this way you will also get to know the area. What factors are going to be important to you?

1. Desire to stay close to the hotel, or where you are staying.
2. Attraction to visible restaurants.
3. Slight repulsion from other individuals.
4. Repulsion from crowded restaurants.

These four factors are identified as the causes for the movements of the individual. Assuming that there are no constraints on where you can walk (no walls or buildings) then there is a simple set of rules governing the movement. These rules are built as a set of forces representing the previously defined factors.

Since you want to stay near the hotel, the further you get away from the hotel, the larger the attraction to the hotel should be. The force keeping you near the hotel should have a form which increases as you get further away, like $f = -a \cdot r_{hotel}$ or $f = -a \cdot e^{b \cdot r_{hotel}}$ where r_{hotel} is the distance from the individual to the hotel and *a and b* are parameters. As you approach an eating establishment your attraction to the establishment should grow in the opposite manner, so the force should have something like the form

$$f = \frac{-c}{r_{\text{restaurant}}} \quad \text{or} \quad f = -c \cdot e^{-d \cdot r_{\text{restaurant}}}$$

where *c and d* are parameters with $r_{\text{restaurant}}$ being the distance from the individual to the restaurant. Everyone has a certain amount of personal space they attempt to maintain, so they are generally repelled from nearby individuals by something like $f = \frac{g}{r_{individual}}$ or $f = g \cdot e^{-h \cdot r_{\text{restaurant}}}$. If you are currently hungry, you know that any crowd at a restaurant generally means a long wait time, so you should be repelled from crowded restaurants. You could represent this by using a force of the form $f = j \cdot (\#of\_individuals_{\text{restaurant}})$.

In general it is easiest to start out with the simpler polynomial type forces then try the exponential forces second. However these different forms could produce distinctly different behaviors. Choosing the simple polynomial functions to represent the forces will give a general idea of the movement, so we would take

$$f_1 = -a \cdot r_{hotel}$$
$$f_2 = \frac{-c}{r_{\text{restaurant}}}$$
$$f_3 = \frac{g}{r_{individual}}$$
$$f_4 = j \cdot (\#of\_individuals_{\text{restaurant}}).$$

The above illustrates the four general forces which one would use to begin simulating the above scenario. There are other forces which should be present, such as a small random force to start the individual looking for a restaurant, and to keep them from moving in perfectly straight lines. There could also be other interactions between individuals as well as interactions to prevent the individual from walking into buildings or other obstacles.

Generally, the approach taken in constructing an SP model involves the three broad steps discussed above. These are:

1. Define the important aspects which need to be modeled.
2. Decide on the types of forces and their functional form which would represent their causes.
3. Determine the appropriate values for the free parameters in the forces which would best represent the system you are trying to model.

If there is no driving reason for choosing a certain functional form for the forces then start as simple as you can. Begin with a simple polynomial and test the application to see if the individuals move in the general manner that you require. Get close approximations of the parameters then see if you need to adjust the types of forces, or possibly even add new forces. These three steps will be iterated numerous times before completing the construction of a model. Since this process can be very time consuming it can be helpful to start from an existing model.

CURRENT SP MODELS

There are only a few standard SP models being used to describe pedestrian movement. There are also models which have been developed for robotic movement (Khatib, 1985; Reif, 1999) which can also be used, but since each model for robotic movement is constructed for a specific goal, we will focus on the general models which are currently used for pedestrian movement. Each model has particular strengths as well as disadvantages, but they can be used as a starting point on which to build your model. These models already have the forces defined for basic movement and certain parameters have been set or bounded. This allows for a simple starting point and reduces the number of free parameter values which one would need to set (or determine) to represent a specific simulation.

Flocking/Herding

Flocking was one of the first recognized models using the SP technique. Craig Reynolds in the 1980s was trying to find a new way of defining movement of computer simulated individuals (Reynolds, 1987). Up to that time the movement of each individual was constructed by hand; this made simulating large numbers of individuals difficult and labor intensive. Reynolds found that he could represent these movements by four simple forces: cohesion, avoidance, flock centering, and a small random force. This simulation was called Boids and did an amazing job of representing both bird flocking and fish schooling

Of the social forces used in this model, cohesion is the force which causes the individuals to stick together; it is a mild attractive force toward other individuals within a local neighborhood of the individual. Avoidance is a repulsive force which balances the cohesive force so as to keep the individuals from running into one another. Flock centering is a force used to bring the individuals into a unified entity. The force representing the flock centering causes each individual to try to get into the center of the individuals it can see. This would give the individual the most protection from the surrounding elements and enemies. A small random force is necessary to prevent an individual from walking in a straight line. This randomness makes the simulation more accurate in portraying the life-like pattern of humans walking.

Flock centering is very noticeable in schools of fish. Since the fish on the edge of the school are most likely to be eaten, these fish constantly push themselves toward the center, thereby pushing the other fish out to the edges (Seghers, 1974). The constant pushing toward the center creates the shape of the school and causes the location of any individual in it to be constantly changing, not only in regard to its surroundings but also with regard to the school itself. Flock centering behavior is not as recognizable in flocks of birds, so in this case, this force is less important and can be given less influence. However, an exception to this is found in penguins. The emperor penguins guard their eggs over the long cold winter; the birds on the edge constantly move in towards the center causing the same cycle-type motion as mentioned above in fish. In this way the penguins keep the entire collection of birds at a reasonable temperature instead of leaving the edge to freeze (Gilbert, 2006).

Current implementations for pedestrian movement generally contain various forms of the above three types of social forces, excluding the random force. Since people do not generally have the need for protection whereby they would struggle to get toward the center, a centering concept as in flocking is not needed. In place of flocking a “consistency force” is added, keeping each individual moving in the direction he/she was generally moving.

A distinction in this model is that velocities are fixed and the forces are only used to determine the *direction* which the individuals will move. The collection of these forces is sometimes called a herding model, since the individuals loosely clump together and thereby act as a single collection, or herd. These forces would typically be of the form:

$$\vec{f}_{consistency} = c \cdot \vec{v}$$

$$\vec{f}_{avoidance} = \frac{\vec{r} \cdot a}{r^3}$$

$$\vec{f}_{cohesion} = -s \cdot \vec{r}$$

$$\vec{F} = \vec{f}_{consistency} + \vec{f}_{avoidance} + \vec{f}_{cohesion}$$

$$\Delta\vec{X} = \vec{F} \cdot \frac{v \cdot \Delta t}{\|F\|}$$

HMFV Model

Helbing, Molnar, Farkas and Vicsek realized that the representation of an individual’s movements in a physical environment must consider standard physical forces because contact can occur with other pedestrians or objects (Helbing, 2002). In this model, an individual generally has both types of forces acting on him/her: the physical forces and the social forces. The physical forces are actual forces, like frictional and pushing forces, which occur when two individuals run into or otherwise contact each other, or when an individual collides with an obstacle. The social forces are those which represent how a self-determined individual would want to move. Both classes of forces are necessary in order to obtain realistic movement of individuals and realistic interaction between an individual and obstacles in the environment.

The HMFV model uses three primary forces: social, frictional, and pushing. The social force represents the personal space an individual wishes to keep open around them; it is modeled using exponential decay. The force of friction occurs when the individual contacts another individual or an obstacle. The frictional force on a pedestrian is tangential and opposite to the relative motion between them and the object or other individual. The pushing force occurs due to the fact that in a crowd, packed individuals are slightly compressible and therefore spring, or push back, when pressing on another individual or obstacle. The normal, pushing force is modeled by Hooke’s law. The forms for these forces in the HMFV model are given below:

$$\vec{f}_{social} = \vec{r} \cdot a \cdot e^{-r/b}$$

$$\vec{f}_{friction} = \kappa \cdot \vec{N} \times \left[\vec{N} \times \vec{v}\right].$$

$$\vec{f}_{pushing} = \vec{N} \cdot c \cdot \delta r$$

LKF Model

Lakoba, Kaup, and Finkelstein modified the HMFV model by including more physically realistic parameter values in the physical forces (Lakoba, 2005). However when this was done, new issues arose, especially when dealing with different densities of individuals in the simulations. New social forces had to be included in order to create more physically realistic simulations for all densities. The new social forces dealt with the directionality of interactions between individuals as well as the “excitation level” of an individual. The physical forces kept the same basic form as in the original HMFV model (Lakoba, 2005), which are the first two equations listed below.

A description of the other forces introduced by LKF is in order. There are two different forms for the social forces: one for the social force acting on an individual (ind) due to any obstacle (obs) and another for the social force acting on an individual due to the presence of another individual. For the former, the force is a repulsive force along the line from the individual to the center of the obstacle. Its magnitude is given by $wF1(obs) \cdot \max faceToBack \cdot e^{\frac{-r}{B}}$, with the coefficient $wF1$ as an orientation factor. If the obstacle can be seen then $wF1$ is unity, otherwise as the angle increases from $\pi/2$, the value of the

Table 1. Variables for Flocking model

$\vec{r}$	The distance between two individuals, directed to the individual on which the force acts
r	The magnitude of the distance between two individuals
$\vec{v}$	The velocity of the individual of interest
v	The magnitude of the velocity
$\Delta\vec{X}$	The change in position of an individual
Δt	The time step used for the simulation
c, a, s	Free parameters to adjust strength of the individual forces

$wF1$ decreases to the value of b, which is defined below. The value of b is reached when the angle is π. The quantity max *faceToBack* represents the maximum value of this force when the individual is facing the back of an obstacle. For the social force between individuals, the form is the same except that the additional factor $wF3$ is included and has the effect of replacing max *faceToBack* with max *faceToFace* when the individual can see the other. The velocity of an individual is defined by the excitation of the individual, their current speed, and the average speed of nearby individuals. The excitation of the individual is also allowed to change over time, and this is based on the current excitation and the ability of the individual to move at their initial velocity. The function $wF3$ is defined as max *faceToBack*, or max *faceToFace* depending on if the entity in question can be seen. This notation given here is a change from the notation in Lakoba (2005), but without changing the value of any force they used. This only simplifies the definition of the social force acting on an individual, and causes $wF3$ to be nothing more than a switch from max *faceToFace* to max *faceToBack*.

$$\vec{f}_{friction} = \kappa \cdot \vec{N} \times \left[\vec{N} \times \vec{v}\right]$$

$$\vec{f}_{pushing} = \vec{N} \cdot c \cdot \delta r$$

$$\vec{f}_{social\_obs}(obs) = \vec{N} \cdot wF1(obs) \cdot \max faceToBack \cdot e^{\frac{-r}{B}}$$

$$\vec{f}_{social\_ind}(ind) = \vec{N} \cdot wF1(ind) \cdot wF3(ind) \cdot \left[\frac{e^{\frac{-r}{B}}}{m}\right]$$

where

Table 2. Variables for HMFV model

$\vec{N}$	The outward normal vector from the object or other individual, located at the point of contact
δr	The magnitude of overlap between an individual on the object of interest
a, b, c, k	Free parameters to adjust the strengths or ranges of the various forces

$$wF1(entity) = \begin{cases} 1 & canSee(entity) \\ 1 - \frac{2}{\pi}\left[\theta - \frac{\pi}{2}\right][1-b] & else \end{cases}$$

$$wF3(entity) = \begin{cases} \max\ faceToFace & canSee(entity) \\ \max\ faceToBack & else \end{cases}$$

$$\max\ faceToFace = F\left[1 + \frac{1}{e_{\max}}\right]\left[[1-\tilde{\rho}] + k2 \cdot \tilde{\rho}\right]$$

$$\max\ faceToBack = w_0 \cdot m \cdot [1 + e_{\max}] \cdot e^{\frac{-1}{B}\left[D - \frac{1}{\rho_{\max}}\right]}\left[k_0[1-\tilde{\rho}] + k1 \cdot \tilde{\rho}\right]\frac{1}{\tau[1-b]}$$

$$\vec{v}_0(t) = \vec{\theta}_g [1 + E(t)] v_{preferred} [1-p] + p \cdot \vec{v}_{local}$$

$$E(t) = E(t-\Delta t) - \Delta t \cdot \left[\frac{E(t-\Delta t)}{T} + \frac{e_{\max}}{T}\frac{1 - \|\vec{v}\|}{v_{preferred}}\right]$$

Some of these symbols have already been defined above. The new symbols introduced are given in Table 3 just below along with the values of the parameters used in the original LKF model.

COGNITIVE BEHAVIORS

Cognitive behavior forces are forces that can be added to the individual to create specific directional choices. These are things like wandering, seeking, following a path, or following a wall. They are considered cognitive behavioral forces due to the fact that the individual is making a decision using these forces; they are not purely reactive style forces.

Wander

Wander is sometimes referred to as a random walk. This type of force is generally needed in order to keep an individual from walking in a perfectly straight line. Basically it creates small deviations from the path the individual would otherwise take (Reynolds, 1999).

One method of applying this technique is to choose a small maximum angle (θ max) of deviation inside of which one would place an artificial attraction point and then add the force from the attraction point to the other forces acting on the individual (Figure 1). The strength of the force can be adjusted by choosing the distance (d) the artificial attraction point is placed from the center of the individual. For example:

$$\theta = (random * 2\theta \max) - \theta \max$$
$$f = (d * \cos\theta, d * \sin\theta)$$

where *random* is a randomly selected number between 0 and 1.

This force should never be so large that the individual will not follow the path at all; this is supposed to be small deviations in the movement of the individual as they follow the main path. The main path should still be selected by other forces.

The previous example is capable of creating a jittery movement in the individual. For a smoother movement, one could pick θ such that it would have a pattern instead of being purely random (Hebert, 1998). For example: $\theta(t) = \theta \max * \cos(t)$, would create a smooth, wave-like motion around the path instead of the jitter due to a random selection (Ueyama, 1993). The trigonometric function can be adjusted to modify the frequency of the wander.

Seek (Flee)/Pursue (Evade)

Seek (Flee)/Pursue (Evade) occurs when an individual either tries to head toward an individual of interest or away from an individual of interest. This is different from the standard attraction and repulsion between individuals in that it is a *selected* attraction or repulsion. If a man saw someone selling fruits when he was looking for an apple, then he would be attracted to that particular vendor, hence seeking or pursuing the vendor. If someone was being followed and was trying to not be caught, then they would be evading or fleeing. This is a technique used in predator/prey style simulations (Isaacs, 1999). The key feature to these behaviors is to predict where the individual (either following or being followed) will be at some point of time in the future. The point of attraction will actually be to the projected position and not the current position. If the pursuer goes to the point where the evader is currently at, then no matter how fast he is traveling he will never reach the evader. This is because the evader will have moved a little bit, and therefore will be just outside of the reach of the pursuer. This is why the pursuer must move to the projected location of the evader. For the evader, the force would be structured like

$$\vec{f} = \frac{a \cdot \vec{r}}{\|\vec{r}\|^{b}}$$

where

$$\vec{r} = \vec{X}_{evader(t)} - \vec{X}_{pursuer(t+\Delta t)}.$$

Similarly, for the pursuer the force would be

$$\vec{f} = \frac{-a \cdot \vec{r}}{\|\vec{r}\|^{b}}$$

where

$$\vec{r} = \vec{X}_{evader(t)} - \vec{X}_{pursuer(t+\Delta t)}.$$

Path Following

Path following is also sometimes referred to as "way-point based path planning". This is the ability to set up distinct way points to define a path that an individual will follow as he/she progresses to a destination point. In some ways, this goes against the idea of SP technique movement models in that the path is *not* determined by the forces. This technique can be very useful in planning out available routes that an individual can choose or to give an individual an idea of where movement should occur in an environment. The individual following the path must know the waypoints and the order in which to follow them. At the start, the individual gets an attraction force to the first waypoint. Once the individual gets close to the waypoint, the first attraction force is turned off and the attraction to the next waypoint in the list is turned on. This progression continues until the individual has passed all of the waypoints in the path. This is a way to create queues or lines in a simulation.

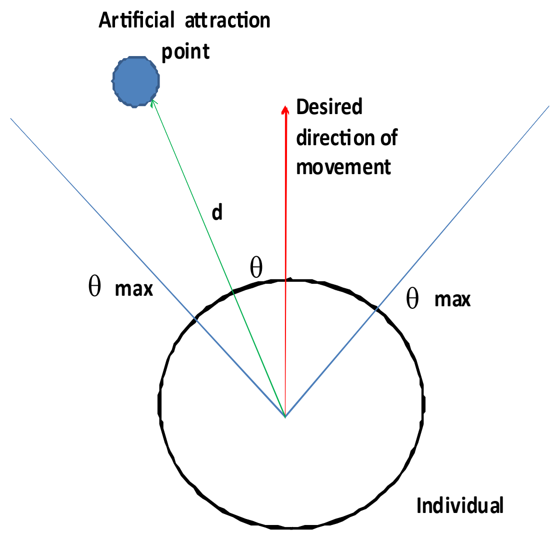
Wall Following

Wall following is a method which has been used for years to get out of mazes. Upon entering a maze, place a hand on one of the walls that touches the entry way, and continue to follow that wall. If you had started from the beginning of the maze then you are guaranteed to find the exit. On the other hand, if you were dropped into the middle of the maze, you could still use this principle. First, you would have to place a hand on a wall and mark where you are. Then follow that wall and if you found that you returned to the exact same spot, then you would move to the other wall and repeat the scenario. If you found that you returned once again to the exact same spot then both walls are interior walls and the technique fails because you are basically stuck inside a room with no doors. Otherwise, you will eventually find your way out.

Table 3. Variables for LKF model

$b = 0.3$	Back-to-front ratio of perception
$B = 0.5m$	Approximate fall off length (personal space) for the social forces
$D \approx 0.7m$	The diameter of the individual
E	The excitation state of the individual
$e_{\max} = \frac{v_i}{w_0} \approx 1$	The maximum value allowed for the excitement parameter (E)
$m \approx 80kg$	The average mass of an individual
$p \in (0,1)$	The parameter representing the independence of an individual (does not change through the simulation)
ρ	The number of individuals inside a circle of radius B around the individual of interest, divided by the area πB^2
$\tilde{\rho} = \rho \cdot \frac{\pi D^2}{4}$	The non-dimensionalized density of individuals
$\rho_{\max} = 5.4\, people / m^2$	Maximum allowable density of people per square meter (Weidmann, 1992)
$T = 2s$	The lag time for excitement to return to initial state when unaffected
$\tau = 0.2s$	The average reaction time of a person
θ	The angle between θ_g and r
$\vec{\theta}_g$	The vector representing the direction the individual is looking
$\vec{v}$	The velocity of the individual
$v_{preferred}$	The individual's preferred speed. The values used in LKF were 1.5, 3.0, and 4.5 m/s.
$\vec{v}_0$	The preferred velocity of the individual
$\vec{v}_{local}$	The average velocity of individuals in the local neighborhood
$w_0 = 1.34m/s$	Average walking speed of a non-panicked individual
$k_0 = 0.3$ $k_1 \in [1.2, 2.4]$ $k_2 = 1.5$	Parameters to adjust high density corrections for face-to-back orientation
c, F, κ	Free parameters to adjust strength of the individual forces

Figure 1. Wander example



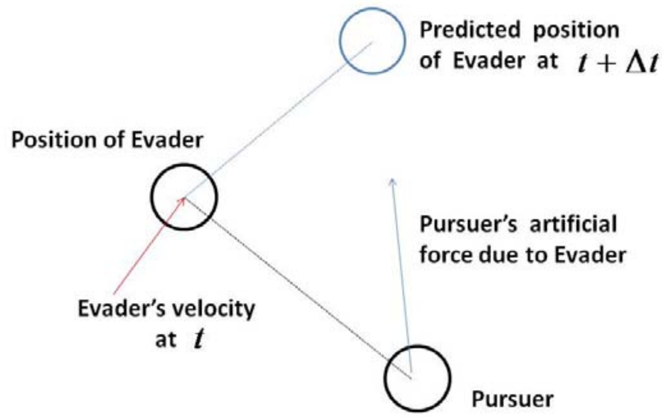
In simulations, wall following becomes useful because when one is using social forces to represent the movement, an individual can become stuck in closed areas and at corners. The individuals have to get out of these areas before they can reach their goal (e.g. there could be an obstacle between the individual and their goal that they would have to go around before they could reach their goal). Wall following can create the necessary break-out condition to move the individual out of these trapped situations and allow them to continue toward the intended goal.

One way to do this in a simulation is to set up an artificial attraction point which is parallel to the obstacle and in the direction of the individual's movement (Figure 4). This new point is there to pull the individual along the wall. This force should become active only when the individual is within a given distance of a wall and then should flip to repulsive once he/she gets too close to the wall. This will allow the individual to keep a given distance from the obstacle that the individual is walking along.

The second option (Figure 5) for applying wall following does not use an artificial point of attraction, but rather just modifies the calculated forces to cause the desired movement. First, the movement is calculated as originally defined to get a direction and magnitude; this is the calculated force vector. Next, the line is found which goes through the center of the individual of interest and is parallel to the obstacle of interest. Finally, the calculated force vector is projected onto the parallel line. This forces all movements to be parallel to the obstacle of interest. Using this approach, the individual will not follow the wall at all times, but will only follow a wall when the wall is impeding the individual's movements toward a given goal.

Both of these techniques can be very useful when trying to manuever around obstacles and explore environments. Some decisional logic must sometimes be included when two obstacles touch each other so that the individual will interact with the correct obstacle.

Figure 2. Seek Flee example



ENVIRONMENTAL FEATURES

The environment is a collection of geometric objects the individual must interact with, usually by avoiding them. The following are obstacles found in the simulation that define the environment in which individuals must maneuver.

Obstacles

An obstacle should have an external shape described in some manner such that the distance to points on it can be found. Also, obstacles should have a center. It is best to keep the definition of the obstacles to simple structures like rectangles and circles. Using pixilation principles defined for computer graphics, it is reasonably easy to represent all possible shapes by these two primitive structures (Pineda, 1988).

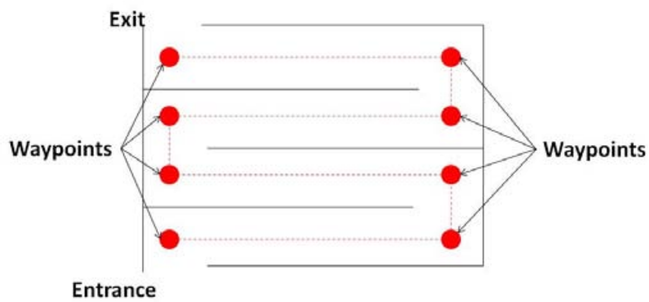
Walls

Walls are simply rectangular obstacles placed where a wall should occur in the simulation. There are some key points to consider though, primarily, what happens at the intersection of two walls. You do not want individuals walking between two connected walls, so make sure that there is no gap whatsoever between the two walls. Even a gap of a few centimeters could possibly be recognized and the individuals could attempt to squeeze between the two walls. This scenario can cause many problems in the simulation, and is sometimes very difficult to recognize. A simple solution to this is to always have the walls overlap slightly. This removes all possibility of an individual squeezing in between the walls.

Paths

Paths were described previously as a collection of waypoints the individual follows. Paths can be constructed as part of the environment and then handed to individuals when they need to use them. Consider an amusement park with five different rides. Each ride has a waiting line, and therefore each ride would have a path associated with it. These paths could reside as part of the environment. Once an individual decides to go on a given ride, a copy of the ride's associated path gets assigned to the individual. In this manner, the paths are part of the environment and the individuals only use these paths when they become of interest or are needed by the individuals being simulated (Lee, 2003).

Figure 3. Path following example



Moving Obstacles

There is nothing that restricts an obstacle from moving. It is possible to define a simulation where the obstacles move regularly, like a train at a train station, or with a more complicated description, like vehicles at an intersection. As long as the descriptions for the movement are defined on the same time step (Δt) as the SP models, the two different entities can interact simultaneously. Also, if any obstacles need to move, they could be defined as a different type of entity having a given movement pattern with all other obstacles being stationary. Either approach is valid; it depends on what is being modeled and which approach fits the scenario the best.

Regions

Sometimes there are areas, or regions, in an environment where certain events should happen or where certain effects occur on an individual. These can be constructed in a manner similar to the technique used in video games where a region of effect is created and all individuals within that region are affected. To do this, define a region as an obstacle in the environment which has no attraction or repulsion. Associate a given effect with this obstacle. This effect could be a speed reducer to represent tough terrain, or it could be a more mild repulsive force to represent an area where an individual would not like to enter. These regions could be associated with given individuals or all individuals to allow for a large variation in simulation scenarios.

Interactions

How an individual recognizes other entities and obstacles in the environment is a very important aspect to the simulation. There are a few different techniques used: centroidal, subdivision, force field, axial, and centroid with axial.

Centroidal

Traditionally the obstacles are treated as point masses (Reynolds, 1987) and are usually located at the center of the obstacle. This is similar to the way an introductory course in physics simplifies the features of Newtonian Mechanics. In progressing through the levels of physics, one learns that dealing with everything as only point masses is a drastic over-simplification to the system. This simplification can cause erroneous results or leave out important dynamics of the system.

Subdivision

Here, the environment is subdivided into small cells. Once the grid is developed, the obstacles are intersected with the grid and any cell of the grid intersecting with an obstacle is considered to be an obstacle. The grid divisions need to be

Figure 4. Wall following option 1

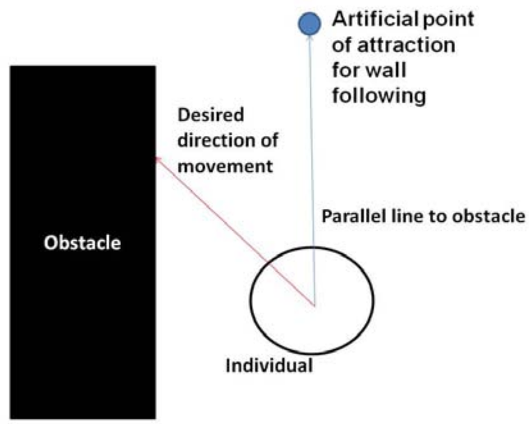
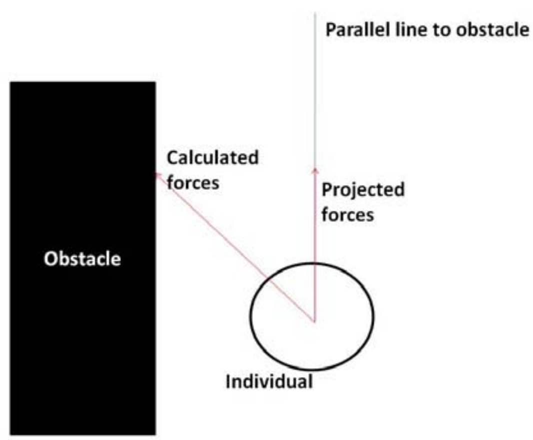


Figure 5. Wall following option 2



chosen according to the size of the obstacles and their general shapes. SP models are computationally dependent on the number of entities in the simulation since forces are calculated for each obstacle and for each individual. Because of these two factors, this grid-type division of the environment makes the calculations of movement for an individual in the simulation much more time consuming.

Force Field

If the environment is static, a force field can be generated from the environment definition. This technique can combine the information on strength of attraction/repulsion and overall shape of all obstacles in the environment (Gazi, 2005; Khatib, 1985). A map of the obstacles and their forces can then be used to determine the social forces on an individual due to the static environment. Once the map is generated, it can be referenced by the location of the individual, and the values for the social forces would be retrieved. The disadvantage here is that it takes a lot of work to define the environment and then to pre-calculate the necessary force fields to represent that environment.

Axial

This technique is based upon ray tracing concepts in computer graphics, but only a discrete number of rays are shot. This technique was used by Craig Reynolds who would shoot a single ray in the direction that the individual was moving and then check to see if it intersected any obstacles in the environment (Reynolds, 1993). The point of contact with the ray and the obstacle is the point used to calculate the interactions. Checking in the four axial directions gives a better idea of what was happening around an individual, instead of just what was occurring in front of the individual. The ray in the direction of movement could still be included but was not found to be that useful. This technique works reasonably well, but can miss a large number of obstacles which should be "seen" by an individual.

Centroid with Axial

Since all objects in a given vicinity of the individual are important, only checking in the axial directions is insufficient. The centroid with axial technique starts with gathering a collection of all obstacles in the known vicinity of the individual. The centroidal distance to the first obstacle is calculated. Next, one checks the four axial directions and calculates the distance to that obstacle. Then, one takes the minimum of the centroidal and axial distances and uses the point associated with that distance to calculate the social forces. Repeat this process for all obstacles in the vicinity of the individual. In this way, one is guaranteed to locate at least one point of interest for any obstacle near the individual.

Interacting with Various Models

A given SP model can be used simultaneously with a different SP model or even a different type of model altogether. SP models are continuous models discretized in time. The key point in ensuring that two continuous models work reasonably well together is they must have the same time step (Δt). In contrast, if the other model is a discrete model, like a Cellular Automata, the time step for the discrete model should be a multiple of the time step being used for the continuous models. If that is not possible, have the discrete model execute the first time step occurring after its execution should have occurred. Take care to make sure that the speeds and sizes of the individuals are in agreement between the models and then they can work reasonably well together.

CONCLUSION

SP techniques are very useful in describing the movements of individuals. The procedures described have been used to implement various models and to look at how individuals might be expected to react to given environments. However, it can easily be expanded and applied to individuals driving a car, riding a bicycle, etc. Recently Majid Ali Khan, Damla Turgut and Ladislau Bölöni (Khan 2008) have demonstrated the use of the SP technique for simulating trucks driving in highway convoys.

The mathematics of the models presented has been condensed, where needed, to allow for simpler implementations and easier understanding of the process of the SP techniques. These simplifications allowed relationships between interactions with obstacles and with other individuals to be apparent and quickly defined. Anytime individuals are in control of their movement and need to make decisions while simultaneously being constrained by the environment, SP models can be constructed to represent how individuals would tend to move.

Environments representing exiting rooms, walking in hallways, exiting gated areas, and wandering in a room have been visualized and simulated using this technique. By adding new parameters to existing models, ages and certain social characteristics were represented (Jaganthan, 2007; Kaup, 2006; Kaup, 2007). This has allowed the exploration of how environmental changes can affect different types of individuals. Differing exit strategies have been studied to see if environmental factors can be used to increase the efficiency of an exit. All of these results demonstrate the usefulness and applicability of the procedures described for the SP technique.

It also provides the possibility of eventually testing and validating social interaction theories. Given any theory, one could directly model that theory by programming a simulation so that the agents would respond per that theory. Then by running the simulation, one could observe what social structure(s) would arise.

FUTURE RESEARCH

Plans exist to continue to study additional parameters which can be included in current models to allow the design of better simulations for describing cultural and social differences. To do this correctly, one needs to have some reasonable measure by which one could determine whether or not two different simulations were sufficiently similar, as well as how close any one given simulation would compare to a real world event. Such methods need to be designed as quantitatively as possible.

As a first approach in this direction, videos have been created and gathered of various pedestrian movements in various venues, with the intention of gathering data from these videos which could be used for comparing simulations of these venues to real world videos of the same venue. A technique for doing this has been developed which is still in the testing phase. Preliminary results are encouraging.

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This work was previously published in Multi-Agent Systems for Traffic and Transportation Engineering, edited by A.L.C. Bazzan; F. Klügl, pp. 155-175, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.23
Increasing Capital Revenue in Social Networking Communities:
Building Social and Economic Relationships through Avatars and Characters

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ABSTRACT

The rise of online communities in Internet environments has set in motion an unprecedented shift in power from vendors of goods and services to the customers who buy them, with those vendors who understand this transfer of power and choose to capitalize on it by organizing online communities and being richly rewarded with both peerless customer loyalty and impressive economic returns. A type of online community, the virtual world, could radically alter the way people work, learn, grow consume, and entertain. Understanding the exchange of social and economic capital in online communities could involve looking at what causes actors to spend their resources on improving someone else's reputation. Actors' reputations may affect others' willingness to trade with them or give them gifts. Investigating online communities reveals a large number of different characters and associated avatars. When an actor looks at another's avatar they will evaluate them and make decisions that are crucial to creating interaction between customers and vendors in virtual worlds based on the exchange of goods and services. This chapter utilizes the ecological cognition framework to understand transactions, characters and avatars in virtual worlds and investigates the exchange of capital in a bulletin board and virtual. The chapter finds strong evidence for the existence of characters and stereotypes based on the ecological cognition framework and empirical evidence that actors using avatars with antisocial connotations are more likely to have a lower return on investment and be rated less positively than those with more sophisticated appearing avatars.

INTRODUCTION

The rise of online communities has set in motion an unprecedented power shift from goods and services vendors to customers according to Armstrong and Hagel (1997). Vendors who understand this power transfer and choose to capitalize on it are richly rewarded with both peerless customer loyalty and impressive economic returns they argue. In contemporary business discourse, online community is no longer seen as an impediment to online commerce, nor is it considered just a useful Web site add-on or a synonym for interactive marketing strategies. Rather, online communities are frequently central to the commercial development of the Internet, and to the imagined future of narrowcasting and mass customization in the wider world of marketing and advertising (Werry, 2001). According to Bressler and Grantham (2000), online communities offer vendors an unparalleled opportunity to really get to know their customers and to offer customized goods and services in a cost executive way and it is this recognition of an individual's needs that creates lasting customer loyalty. However, if as argued by Bishop (2007a) that needs, which he defines as pre-existing goals, are not the only cognitive element that affects an actor's behavior, then vendors that want to use online communities to reach their customers will benefit from taking account of the knowledge, skills and social networks of their customers as well.

According to Bishop (2003) it is possible to effectively create an online community at a click of a button as tools such as Yahoo! Groups and MSN Communities allow the casual Internet user to create a space on the Net for people to talk about a specific topic or Interest. Authors such as Bishop have defined online communities based on the forms they take. These forms range from special interest discussion Web sites to instant messaging groups. A social definition could include the requirement that an information system's users go through the membership lifecycle identified by Kim (2000). Kim's lifecycle proposed that individual online community members would enter each community as visitors, or "Lurkers." After breaking through a barrier they would become "Novices," and settle in to community life. If they regularly post content, they become "Regulars." Next, they become "Leaders," and if they serve in the community for a considerable amount of time, they become "Elders." Primary online community genres based on this definition are easily identified by the technology platforms on which they are based. Using this definition, it is possible to see the personal homepage as an online community since users must go through the membership lifecycle in order to post messages to a 'guestbook' or join a 'Circle of Friends'. The Circle of Friends method of networking, developed as part of the VECC Project (see Bishop, 2002) has been embedded in social networking sites, some of which meet the above definition of an online community. One of the most popular genres of online community is the bulletin board, also known as a message board. According to Kim (2000), a message board is one of the most familiar genres of online gathering place, which is asynchronous, meaning people do not have to be in the same place at the same time to have a conversation. An alternative to the message board is the e-mail list, which is the easiest kind of online gathering place to create, maintain and in which to participate (ibid). Another genre of online community that facilitates discussion is the Chat Group, where people can chat synchronously, communicating in the same place at the same time (Figallo, 1998). Two relatively new types of online community are the Weblog and the Wiki. Weblogs, or blogs are Web sites that comprise hyperlinks to articles, news releases, discussions and comments that vary in length and are presented in chronological order (Lindahl & Blount, 2003). The community element of this technology commences when the owner, referred to as a 'blogger', invites others to comment on what he/she has written. A Wiki, which is so named through taking the first letters from the axiom, 'what I know is', is a collaborative page-editing tool with which users may add or edit content directly through their Web browser (Feller, 2005). Despite their newness, Wikis could be augmented with older models of

Table 1. Advantages and disadvantages of specific online community genres

Genre	Advantages/Disadvantages
Personal Homepage	Advantages: Regularly updated, allows people to re-connect by leaving messages and joining circle of friends Disadvantage: Members often need to re-register for each site and cannot usually take their 'Circle of Friends' with them.
Message Boards	Advantages: Posts can be accessed at any time. Easy to ignore undesirable content. Disadvantages: Threads can be very long and reading them time consuming
E-mail Lists and News-letters	Advantages: Allows a user to receive a message as soon as it is sent Disadvantages: Message archives not always accessible.
Chat Groups	Advantages: Synchronous. Users can communicate in real time. Disadvantages: Posts can be sent simultaneously and the user can become lost in the conversation.
Virtual Worlds and Simulations	Advantages: 3-D metaphors enable heightened community involvement Disadvantages: Requires certain hardware and software that not all users have
Weblogs and Direc-tories	Advantages: Easily updated, regular content Disadvantages: Members cannot start topics, only respond to them
Wikis and Hypertext Fiction	Advantages: Can allow for collaborative work on literary projects Disadvantages: Can bring out the worst in people, for example, their destructive natures

hypertext system. A genre of online community that has existed for a long time, but is also becoming increasingly popular is the Virtual World, which may be a multi-user dungeon (MUD), a massively multiplayer online role-playing game (MMORG) or some other 3-D virtual environment. through taking the first letters from the axiom, 'what I know is', is a collaborative page-editing tool with which users may add or edit content directly through their Web browser (Feller, 2005). Despite their newness, Wikis could be augmented with older models of hypertext system. A genre of online community that has existed for a long time, but is also becoming increasingly popular is the Virtual World, which may be a multi-user dungeon (MUD), a massively multiplayer online role-playing game (MMORG) or some other 3-D virtual environment.

Encouraging Social and Economic Transactions in Online Communities

According to Shen et al. (2002), virtual worlds could radically alter the way people work, learn, grow, consume and entertain. Online communities such as virtual worlds are functional systems that exist in an environment. They contain actors, artifacts, structures and other external representations that provide stimuli to actors who respond (Bishop, 2007a; 2007b; 2007c). The transfer of a response into stimuli from one actor to another is social intercourse and the unit of this exchange is the transaction (Berne, 1961; 1964). A transaction is also the unit for the exchange of artifacts between actors and is observed and measured in currency (Vogel, 1999). Transactions can be observed in online communities, most obviously in virtual worlds, where actors communicate with words and trade goods and services. Research into how consumers trade with each other has considered online reputation, focusing on how a trader's reputation influences trading partner's trust formation, reputation scores' impact on transactional prices, reputation-related feedback's effect on online service adoption and the performance of existing online reputation systems (Li et al., 2007). According to Bishop (2007a), encouraging participation is one of the greatest challenges for any online community provider. There is a large amount of literature demonstrating ways in which online communities can be effectively built (Figallo, 1998; Kim, 2000; Levine-Young & Levine, 2000;

Preece, 2000). However, a virtual community can have the right tools, the right chat platform and the right ethos, but if community members are not participating the community will not flourish and encouraging members to change from lurkers into elders is proving to be a challenge for community providers. Traditional methods of behavior modification are unsuitable for virtual environments, as methodologies such as operant conditioning would suggest that the way to turn lurkers into elders is to reward them for taking participatory actions. The ecological cognition framework proposed Bishop (2007a; 2007c) proposes that in order for individuals to carry out a participatory action, such as posting a message, there needs to be a desire to do so, the desire needs to be consistent with the individual's goals, plans, values and beliefs, and they need to have to abilities and tools to do so. Some individuals such as lurkers, may have the desire and the capabilities, but hold beliefs that prevent them from making participatory actions in virtual communities. In order for them to do so, they need to have the desire to do so and their beliefs need to be changed. Traditional methods, such as operant conditioning may be able to change the belief of a lurker that they are not being helpful by posting a message, but it is unlikely that they will be effective at changing other beliefs, such as the belief they do not need to post. In order to change beliefs, it is necessary to make an actor's beliefs dissonant, something that could be uncomfortable for the individual. While changing an actor's beliefs is one way of encouraging them to participate in a virtual community, another potential way of increasing their involvement is to engage them in a state of flow which might mean that they are more likely to act out their desires to be social, but there is also the possibility that through losing a degree of self-consciousness they are also more likely to flame others (Orengo Castellá et al., 2000).

A CHARACTER THEORY FOR ONLINE COMMUNITIES

Kim's membership lifecycle provides a possible basis for analyzing the character roles that actors take on in online communities. Existing character theories could be utilized to explore specific types of online community (e.g., Propp, 1969) or explain to dominance of specific actors in online communities (e.g., Goffman, 1959). Propp suggested the following formula to explain characters in media texts:

$\alpha a^5 D^1 E^1 MF^1 Ta^5 BKNToQW$

Propp's character theory suggests that in media texts eight characters can be identified; the villain who struggles against the hero; the donor who prepares the hero or gives the hero an artifact of some sort; the helper who helps the hero in their expedition; the princess who the hero fights to protect or seeks to marry; her father the dispatcher; and the false hero who takes credit for the hero's actions or tries to marry the princess. While Propp's theory might be acceptable for analyzing multi-user dungeons or fantasy adventure games, it may not be wholly appropriate for bulletin board-based online communities. Goffman's character theory according to Beaty et al. (1998) suggests that there are four main types of characters in a media text: the protagonists who are the leading characters; the deuteragonists who are the secondary characters; the bit players who are minor characters whose specific background the audience are not aware of; and the fool who is a character that uses humor to convey messages. Goffman's model could be useful in explaining the dominance of specific types of online community members, but does not explain the different characteristics of those that participate online, what it is that drives them, or what it is that leads them to contribute in the way they do.

Bishop's (2007a; 2007c) ecological cognition framework (ECF) provides a theoretical model for developing a character theory for online communities based on bulletin board and chat room models. One of the most talked about types of online community participant is the troll. According to Levine-Young and Levine (2000), a troll postsprovocative messages intended to start a flame war. The ECF would suggest that chaos drives these trolls, as they attempt to provoke other members into responding. This would also suggest there is a troll opposite, driven by order, which seeks to maintain control or rebuke obnoxious comments. Campbell et al. (2002) found evidence for such a character, namely the big man, existing in online communities. Salisbury (1965) suggests big men in tribes such as the Siane form a de facto council that confirms social policy and practices. Campbell et al. (2002) point out that big men are pivotal in the community as, according to Breton (1999), they support group order and stability by personally absorbing many conflicts. Actors susceptible to social stimuli activate one of two forces, either social forces or anti-social forces. Actors who are plainly obnoxious and offend other actors through posting flames, according to Jansen (2002) are known as snerts. According to Campbell, these anti-social characters are apparent in most online communities and often do not support or recognize any of the big men unless there is an immediate personal benefit in doing so. Campbell et al. (2002) also point out that the posts of these snerts, which they call sorcerers and trolls, which they call tricksters, could possibly look similar. Differentiating between when someone is being a troll and when they are being a snert although clear using the ECF, may require interviewing the poster to fully determine. Someone whose intent is to provoke a reaction, such as through playing ‘devil's advocate' could be seen theoretically to be a troll, even if what they post is a flame. An actor who posts a flame after they were provoked into responding after interacting with another, could be seen theoretically to be a snert, as their intention is to be offensive. Another actor presented with the same social stimuli may respond differently. Indeed, Rheingold (1999) identified that members of online communities like to flirt. According to Smith (2001), some online community members banned from the community will return with new identities to disrupt the community. These actors could be labeled as e-venegers, as like Orczy's (1904) character the scarlet pimpernel, they hide their true identities. Driven by their emotions, they seek a form of personal justice. A character that has more constructive responses to their emotions exists in many empathetic online communities according to Preece (1998), and may say things such as “MHBFY,” which according to Jansen (2002) means “My heart bleeds for you,” so perhaps this character type could be known as a MHBFY Jenny. Using the ecological cognition framework there should be also those actors that are driven by gross stimuli, with either existential or thanatotic forces acting upon them. Jansen (2002) identified a term for a member of an online community that is driven by existential forces, known to many as the chat room Bob, who is the actor in an online community that seeks out members who will share nude pictures or engage in sexual relations with them. While first believed to be theoretical by Bishop (2006), there is evidence of members of online communities being driven by thanatotic forces, as reported by the BBC (Anon., 2003). Brandon Vedas, who was a 21-year-old computer expert, killed himself in January 2003. This tragic death suggests strongly that those in online communities should take the behavior of people in online communities that may want to cause harm to themselves seriously. The existence of this type of actor is evidence for the type of online community member who could be called a Ripper, in memory of the pseudonym used by Mr Vedas.

There are two more characters in online communities, driven by action stimuli that results in them experiencing creative or destructive forces. Surveying the literature reveals a type of actor that uses the Internet that are prime targets for “sophisticated technical information, beta test software,

Table 2. A character theory for online communities based on the ecological cognition framework

Label	Typical characteristics
Lurker	The lurker may experience a force, such as social, but will not act on it, resulting in them not fully taking part in the community.
Troll	Driven by chaos forces as a result of mental stimuli, would post provocative comments to incite a reaction.
Big Man	Driven by order forces as a result of mental stimuli, will seek to take control of conflict, correcting inaccuracies and keeping discussions on topic.
Flirt	Driven by social forces as a result of social stimuli, will seek to keep discussions going and post constructive comments.
Snert	Driven by anti-social forces as a result of social stimuli, will seek to offend their target because of something they said.
E-venger	Driven by vengeance forces as a result of emotional stimuli, will seek to get personal justice for the actions of others that wronged them.
MHBFY Jenny	Driven by forgiveness forces, as a result of experiencing emotional stimuli. As managers they will seek harmony among other members.
Chat Room Bob	Driven by existential forces as a result of experiencing gross stimuli, will seek more intimate encounters with other actors.
Ripper	Driven by thanatotic forces as a result of experiencing gross stimuli, seeks advice and confidence to cause self-harm.
Wizard	Driven by creative forces as a result of experiencing action stimuli, will seek to use online tools and artifacts to produce creative works.
Iconoclast	Driven by destructive forces as a result of experiencing action stiumli, will seek to destroy content that others have produced.

authoring tools [that] like software with lots of options and enjoy climbing a learning curve if it leads to interesting new abilities” (Mena, 1999), who are referred to as wizards. There is also the opposite of the wizard who according to Bishop (2006) seeks to destroy content in online communities, which could be called the iconoclast, which according to Bernstein and Wagner (1976) can mean to destroy and also has modern usage in Internet culture according to Jansen (2002) as a person on the Internet that attacks the traditional way of doing things, supporting Mitchell’s (2005) definition of an iconoclast being someone that constructs an image of others as worshippers of artifacts and sets out to punish them by destroying such artifacts.

These eleven character types, summarized in Table 2, should be evident in most online communities, be they virtual worlds, bulletin boards, or wiki-based communities.to be explored and frameworks to be developed which can be used by both practitioners and researchers and also means that researchers can deal with real situations instead of having to contrive artificial situations for the purpose of quasi-experimental investigations (Harvey & Myers, 1995). While Yang (2003) argues that it is not feasible to spend a year or two investigating one online community as part of an ethnography, this is exactly the type of approach that was taken to evaluate the proposed character theory, partially due to the author receiving formal training in this method. Yang’s approach, while allowing the gathering of diverse and varied information, would not allow the research to experience the completeness of Kim’s (2000) membership lifecycle, or be able to fully evaluate the character theory and whether the characters in it can be identified.

Location and Participants

An online community was selected for study, this one serving Wales and those with an interest in the geographical locations of Pontypridd and the Rhondda and Cynon Valleys in South Wales. Its members consist of workers, business owners, elected members, and expatriates of the area the online community serves. This online community, known to its members as 'Ponty Town', with 'Ponty' being the shortened term for Pontypridd, was chosen by the author due to his cognitive interest in the Pontypridd constituency and his belief that he would be a representative member of the community and fit in due to holding similar personal interests to the members. This is in line with Figallo (1998), who argues that similar interests is what convinces some members of online communities to form and maintain an Internet presence. The members of the community each had their own user ID and username that they used to either portray or mask their identity. They ranged from actual names, such as 'Mike Powell' and 'Karen Roberts' that were used by elected representatives, names from popular culture, such as 'Pussy Galore', to location-based and gendered names, such as 'Ponty Girl', 'Bonty Boy' and 'Kigali Ken'.

Equipment and Materials

A Web browser was used to view and engage with the online community, and a word processor used to record data from the community.

Procedure

The author joined the online community under investigation and interacted with the other members. The community members did not know the author personally, however, he utilized his real name. Even though the author could have posted under a pseudonym it would have made the study less ecologically valid and more difficult for the author to assess the reaction of the participants. The author carried out activities in the online community by following the membership life-cycle stages, which manifested in not posting any responses, posting a few responses on specific topics to regularly posting as an active member of the community. Additionally, data collected by Livingstone and Bober (2006) was used to understand the results.

Results

Undertaking the ethnography proved to be time consuming, though revealing about the nature of online communities and the characteristics of the actors that use them. Of the eleven characters identified in the proposed character theory, eight were found in the investigated online community.

Lurkers could be identified by looking at the member list, where it was possible to find that 45 of the 369 members were lurkers in that they did not post any messages.

The Troll

The troll was easily identified as an actor that went by the pseudonym Pussy Galore, who even managed to provoke the author.

This Bishop baiting is so good I'm sure there will soon be a debate in the Commons that will advocate abolishing it. – Pussy Galore, Female, Pontypridd

Some of the troll's comments may be flames, but their intention is not to cause offence, but to present an alternative and sometimes intentionally provocative viewpoint, often taking on the role of devil's advocate by presenting a position that goes against the grain of the community.

There is some evidence of the troll existing in the data collected by Livingstone and Bober (2006), as out of a total of 996 responses, 10.9% (164) of those interviewed agreed that it is 'fun to be rude or silly on the internet'.

The Big Man

Evidence of actors being driven by order forces was also apparent, as demonstrated by the following comment from a big man.

I don't think so. Why should the actions of (elected member) attacking me unprovoked, and making remarks about my disability lead to ME getting banned? I am the victim of a hate crime here. – The Victim, Male, Trefforest

The example above clearly demonstrates the role of the big man as absorbing the conflicts of the community and having to take responsibility for the actions of others. While the big man may appear similar to the snert by challenging the actions of others, their intention is to promote their own worldview, rather than to flame and offend another person. The big man may resemble the troll by continually presenting alternative viewpoints, but their intention is not to provoke a flame war based on a viewpoint they do not have, but to justify a position they do have.

The importance of the big man to the community was confirmed approximately a year after the ethnography was completed when during additional observations, a particular actor, ValleyBoy, appeared to take over the role from the big man that was banned, and another member, Stinky, called for banned members to be allowed to return, suggesting the community was lacking strong and persistent characters, such as the big man.

The Flirt

In the studied online community, there was one remarkable member who posted mostly constructive posts in response to others' messages, known by her pseudonym Ponty Girl who was clearly identifiable as a flirt. Her comments as a whole appear to promote sociability as she responds constructively to others' posts. The flirt's approach to dealing with others appears to differ from the big man who absorbs conflict as it seems to resonate with the constructive sides of actors leading them to be less antagonistic towards the flirt than they would be the big man.

Yes, I've seen him at the train station on quite a few occasions," "A friend of mine in work was really upset when she had results from a feedback request from our team - I'd refused to reply on the principle that she is my friend and I would not judge her, but a lot of the comments said that she was rude, unsympathetic and aloof. She came to me to ask why people thought so badly of her. – Ponty Girl, Female, Graig

The Snert

There were a significant number of members of the community that responded to posts in an anti-social manner, characteristic of snerts. While members like Stinkybolthole frequently posted flames, the online community studied had one very noticeable snert, who went by the name of JH, whom from a sample of ten of his posts, posted six flames, meaning 60% of his posts were flames.

Nobody gives a shit what you want to talk to yourself about. Get a life," "I'm getting the picture. 'Fruitcake Becomes Councilor' is such an overused newspaper headline these days," "Sounds like you've won the lottery and haven't told us. Either that or your husband is a lawyer, accountant or drug dealer,, "The sooner we start to re-colonize ooga-booga land the better, then we'll see Britains (sic) prosperity grow. Bloody pc wimps, they need to get laid. – JH, Male, Trallwn

The existence of the snert is evident. The data collected by Livingstone and Bober (2006) reveals that from a sample of 1,511, 8.5% (128) of individuals have received nasty comments by e-mail and 7% (105) have received nasty comments in a chat room. Of the 406 that had received nasty comments across different media, 156 (38.42%) deleted them straight away. A total of 124 (30.54%) tried to block messages from the snert, 84 (20.69%) told a relative, 107 (26.35%) told a friend, 74 (18.23%) replied to ask the snert to stop their comments, and 113 (27.83%) engaged in a flame war with the snert.

The e-Venger

Evident in the online community investigated was the masked e-venger, who in the case of this particular community was an actor who signed up with the pseudonym elected member, claiming to be an elected representative on the local council, who the members quickly identified to be someone who had been banned from the community in the past. This user appeared to have similar ways of posting to the snert, posting flames and harassing other members. The difference between the e-venger and the snert is that the former is driven by wanting to get even for mistreatment in the past whereas the latter responds unconstructive to the present situation.

Poor sad boy, have you met him? He's so incompitent (sic). His dissabilty (sic) is not medical it's laughable. The lad has no idea about public perception," "Don't give me this sh#t, she and they cost a fortune to the taxpayer, you and I pay her huge salary. This is an ex-education Cabinet Member who was thrown out by the party, unelected at the next election and you STILL pay her wages!", "I'll see you at the Standards meeting [Mellow Pike]. 'Sponsor me to put forward a motion'! Bring it on. – Elected Member

The member appeared to be driven by emotional stimuli activating vengeance forces, seeking to disrupt the community and even making personal attacks on the members including the author. As outlined above, the data collected by Livingstone and Bober (2006) reveals that 27.83% of people that are flamed will seek revenge by posting a flame back.

The MHBFY Jenny

Sometimes the remarks of members such as flirts and big men are accepted, which can lead other actors to experience emotional stimuli activating forgiveness forces as was the case with Dave, the investigated online community's MHBFY Jenny.

Mind you it was funny getting you to sign up again as 'The Victim'. – Dave, Male, Pontypridd

While many of the MHBFY Jenny's comments are constructive like the flirt, they differ because the former responds to their internal dialogue as was the case with Dave above, whereas the flirt responds to external dialogue from other actors, as Ponty Girl clearly does.

The Chat Room Bob

The online community investigated, like many, had its own chat room Bob. The actor taking on this role in the investigated online community went by the name of Kigali Ken, and his contributions make one wonder whether he would say the same things in a real-world community.

Any smart women in Ponty these days? Or any on this message board? I've been out of the country for a while but now I'm back am looking for some uncomplicated sex. Needless to say I am absolutely lovely and have a massive... personality. Any women with an attitude need not apply. – Kigali Ken, Male, Pontypridd

While their action of seeking out others may appear to be flirting using the vernacular definition, the intention of the chat room Bob differs from the flirt who based on Heskell's (2001) definition is someone who feels great about themselves and resonates this to the world to make others feel good, as they will make pro-social comments about others and in response to others. The chat room Bob on the other hand, appears to be only after their own gratification, responding to their physical wants.

The existence of the chat room Bob is evident. The data collected by Livingstone and Bober (2006) reveals that 394 people from a sample of 1,511 have reported that they have received sexual comments from other users. Of these 238 (60.4%) deleted the comment straight away, 170 (43.14%) attempted to block the other person, 49 (12.44%) told a relative, 77 (19.54%) told a friend, and 75 (19.04%) responded to the message. This suggests that the chat room Bob is an unwanted character in online communities whose contributions people will want to delete and whom they may try to block.

The Ripper, Wizard, and Iconoclast

Despite studying the online community for over a year, there was no evidence of there being a ripper, a wizard or an iconoclast in the community, beyond the administrators of the site posting and deleting content and adding new features, such as polls. The closest an actor came to being a ripper was an actor called choppy, who faked a suicide and then claimed a friend had hijacked their account. Fortunately, it might be argued that a true ripper who was seeking to cause self-harm was not present, but the existence of this type of online community member should lead online community managers to show concern for them, and members should not reply with comments such as "murder/suicide" when they ask for advice, as happens in some online communities.

While visual representations are often absent from bulletin board communities, actors will often make their first interpretations of others in virtual worlds when they book at another's avatar and evaluates them based on their worldview, which may provoke a relation leading to the actor developing an interest in the other actor. In the context of online communities, an avatar is a digital representative of an actor in a virtual environment that can be an icon of some kind or an animated object (Stevens, 2004). According to Aizpurua et al. (2004), the effective modeling of the appearance of an avatar is essential to catch a consumer's attention and making them believe that they are someone, with avatars being crucial to creating interaction between customers and vendors. According to Puccinelli (2006), many vendors understand that customers' decisions to engage in economic transactions are often influenced by their reactions to the person who sells or promotes it, which seems to suggest that the appearance of an avatar will affect the number of transactions other actors will have with it.

A STEREOTYPE THEORY FOR INTERPRETING AVATARS IN ONLINE COMMUNITIES

Technology-enhanced businesses led by business leaders of a black ethnicity have been some of the most innovative in the world, with companies like Golden State Mutual ending the 1950s with electronic data processing systems in place, $133 million of insurance in force and $16 million in assets (Ingham & Feldman, 1994). Representations of black actors have also been some of the most studied, with potential applications for studying avatars in online communities. Alvarado et al. (1987) argue that black actors fit into four social classifications: the exotic, the humourous, the dangerous and the pitied. Furthermore, Malik (2002) suggests that male black actors are stereotyped as patriarchal, timid, assiduous, and orthodox. Evidence for these can easily be found in contemporary print media, such as Arena magazine (Croghton, 2007) where an advertisement for an electronic gaming system displays a black individual as pitied. In the same publication Murray and Mobasser (2007) argue that the Internet is damaging relationships, where images of women are of those in 'perfect' bodies, and although they do not define what a perfect body is, it would be safe to assume they mean those depicted in the publication, such as Abigail Clancy and Lily Cole, the later of which described herself as 'hot stuff', and perhaps depictions of this sort could be iconographic of an exotic avatar. Alvarado et al. (1987) supported by Malik (2002) have argued that these stereotypes have been effective in generating revenue for advertisers and not-for-profit organizations. While these stereotypes may be useful for developing an understanding of avatars and how they can generate both social and economic capital for individuals, they need to be put into the context of a psychological understanding of how actors behave and interact with others.

Utilizing the ecological cognition framework (Bishop, 2007a; 2007c); it can be seen that the visual appearance of an actor's avatar could be based on the five binary-opposition forces, with some of the stereotypes identified earlier mapping on to these forces. The image of actors as orthodox and pariahs can be seen to map onto the forces occupied by the flirts and snerts, respectively; the assiduous and vanguard stereotypes appear to be in harmony with the forces occupied by the wizard and iconoclast, respectively, the dangerous and timid stereotypes are consistent with the forces connected with the e-venger and MHBFY Jenny, the exotic and pitied stereotypes can be seen to map on to the forces used by the chat room Bob and ripper, respectively, and the patriarchal and humourous stereotypes appear to be consistent with the forces, respectively, used by the big man and troll. The stereotype theory provides a useful basis for investigating the role of avatars in online communities and the effect they have on social and economic transactions.

Location and Participants

A study was carried out in the second life virtual world and involved analyzing the avatars used to create a visual representation of the actor and profile pages displaying their personal details and avatar of 189 users, known as residents, of the community who met the criteria of having given at least one rating to another actor, a feature that has since been discontinued in the system despite it showing how popular a particular actor was.

Equipment and Materials

The Second Life application was used to view and engage with the online community, and a word processor and spreadsheet was used to record data from the community in the form of the number of times a person had received a gift or response from another.

Procedure

The author became a member of the online community under investigation and interacted with the other members over a period of three months. The members of the community did not know the author, especially as a pseudonym was adopted, as is the norm with Second Life. The author carried out activities in the online community by following the membership lifecycle stages that each individual member of an online community goes through as discussed earlier in the chapter. A search was done for actors and possible locations and groups of specific avatars identified. After an avatar was categorized, data from their profile was recorded and the return on investment (ROI) calculated. According to Stoehr (2002), calculating the ROI is a way of expressing the benefit-cost ratio of a set of transactions, and can be used to justify an e-commerce proposal.

Table 2. Mean (M) dollars ($) given and received by actors of specific avatars and their ROI (%)

Stereotype	Character	N	M Given $	M Received $	M ROI %
Exotic	Chat Room Bob	30	1171.67	1731.67	237.26
Pitied	Ripper	11	1743.18	2534.09	141.19
Humourous	Troll	48	362.5	446.35	120.69
Patriarchal	Big Man	17	4500	4588.24	428.43
Orthodox	Flirt	16	4393.75	4575	49.48
Pariah	Snert	26	149.04	107.69	-1.24
Assiduous	Wizard	16	267.19	159.38	-12.63
Vanguard	Iconoclast	4	75	162.5	233.33
Dangerous	E-venger	6	2587.5	2095.83	0.62
Timid	MHBFY Jenny	15	6150	4395	101.82

Results

The results, as summarized in Table 2, reveal that the avatar with greatest return on investment was the patriarchal stereotype with a 428.43% return and the one with the least ROI was the assiduous with a 12.63% loss. The most common avatar was the humorous, followed by exotic and pariah. The least common avatar was the vanguard, followed by the dangerous and pitied.

An independent samples test using the Mann-Whitey method was carried out on one of the highest ROI avatars, the patriarchal, with one of the lowest, the pariah. It revealed, as expected, a significant difference in the return on investment ($Z=-3.21$, $p<0.002$). Also interesting was the difference between the specific attributes rated. The mean appearance rating for the patriarchal stereotype was 29.24 compared to 17.27 for the pariah ($Z=-3.10$, $p<0.003$), the mean building rating for the patriarchal was 29.03 compared to 17.40 for the pariah ($Z=-3.06$, $p<0.003$), and the mean behavior rating was 30.62 for the patriarchal stereotype and 16.37 for the pariah ($Z=-3.68$, $p<0.001$). This would seem to suggest that as well as not getting as high a return on investment, other actors will not judge the more antisocial-looking pariah as well as they judge the more sophisticated-looking patriarchal avatar. Examples of the avatars are presented in Figure 3. Studies such as those by Zajonc (1962) and Goldstein (1964) have demonstrated that actors will seek to avoid the uncovering of beliefs and other thoughts thatcome about when an actor experiences threatening behavior from others or uncomfortable emotions. This being the case, it could be that when an actor is presented with an avatar that causes them discomfort or 'dissonance', then they will seek to resolve the conflict created by avoiding that particular avatar. This would explain why the pariah stereotype produces a limited number of economic transactions and has the one of the worst returns on investment, which would seem to support the findings of Eagly et al. (1991) that people that appear less discomforting are more popular with peers and receive preferential treatment from others.

THE FUTURE OF SOCIAL NETWORKING COMMUNITIES

In science fiction, the future is often portrayed as utopian or dystopian, where possible future outcomes of social trends or changes that are the result of scientific discoveries are depicted and the implications of them assessed (Csicsery-Ronay, 2003). In the cyberpunk genre of science fiction,

Figure 1. Examples of avatars in order top-bottom, left-right as Table 2

the dystopian future is often made up of corporations, who ruthlessly corrupt, corrode, exploit and destroy (Braidotti, 2003). Social networking communities are quickly being subsumed into corporate structures. In July 2005, News Corporation bought Myspace.com, which is a social networking service that integrates message boards with personal homepages and utilizes the Circle of Friends social networking technique, and in December of that year, the British broadcaster ITV bought the old school tie-based Friends Reunited social networking service (BBC, 2005; Scott-Joynt, 2005).

The ecological cognition framework has the potential to radically transform minor Web sites into highly persuasive and engaging communities where relationships between vendors and customers can be enhanced and the goals of each can be met. While there is also the possibility that a corporation that understands online communities can manipulate its members in such a way that it can easily exploit them, the model could be used by vendors with more of an interest in helping customers meet their goals to market their products and services effectively. Vendors that understand the stage of Kim's (2000) lifecycle they are at and the stage the consumer is at can more effectively target their messages in such a way that they are persuasive. Using the model, vendors can design avatars that provoke the particular responses they want from customers and continue that initial appeal by adopting the appropriate character type. This works well in some media texts where according to Kress (2004) media producers can use the appearance of their characters to convey that character's personality and build on that throughout the text.

DISCUSSION

The rise of online communities in Internet environments has set in motion an unprecedented shift in power from vendors of goods and services to the customers who buy them, with those vendors who understand this transfer of power and choose to capitalize on it by organizing online communities and being richly rewarded with both peerless customer loyalty and impressive economic returns. A type of online community, the virtual world, could radically alter the way people work, learn, grow consume, and entertain. Understanding the exchange of social and economic capital in virtual worlds could involve looking at what causes actors to spend their scarce resources on improving someone else's reputation. Actors' reputations may affect how willing others are to trade with them or even give them gifts, and their reputation is in part influenced by their appearance and how they interact with other actors and often feedback from other actors are displayed on their profile.

The ecological cognition framework provides a theoretical model for developing a character theory for online communities based on bulletin board and chat room models. The five forces and their opposites can be used to develop the types, and the judgments of ignorance and temperance can be used to explain the behavior of those that do not participate, namely lurkers, which were accounted for in the investigated online community where it was possible to find that 45 of the 369 members were lurkers for the reason that they did not post any messages. The ECF would suggest that chaos forces drive trolls, as they attempt to provoke other members into responding as a result of experiencing mental stimuli. The troll was easily identified in the investigated online community as an actor that went by the pseudonym Pussy Galore, who even managed to provoke the author. Order forces can be seen to drive the big man and was represented in the investigated online community by the victim. Those actors who are plainly obnoxious and offend or harass other actors through posting flames are known as snerts, who were most obviously represented in the investigated online community by a user called JH. Flirts are members that respond to the text posted by other members as social stimuli, and will respond to it after activating their social forces and in the studied online community there was one remarkable member who posted mostly constructive posts in response to others' messages, know by her pseudonym Ponty Girl. There are actors driven by their vengeance forces, which could be labeled as e-venegers, represented in the investigated online community by elected member and those actors driven by forgiveness forces could be called MBHFY Jenny, represented in the studied online community by Dave. An actor in an online community that is driven by existential forces, known to many as the chat room Bob, who seeks out members who will share nude pictures or engage in sexual relations with them, was apparent in the investigated online community using the name Kigali Ken. There is evidence for an online community member driven by thanatotic forces, who could be called a ripper, but this member was not found in the investigated online community beyond an actor called Choppy. There are also theoretically two more characters in online communities, driven by action stimuli that results in them experiencing creative or destructive forces, with the one driven by creative forces being the wizard, and the opposite of iconoclast being the one that seeks to destroy content in online communities.

These character types are particularly evidenced in bulletin board communities, but in the virtual world it is likely that an actor's avatar will have some effect on how others perceive them before they are spoken to. The extent to which an actor is able to sustain an appeal to another could be analyzed as seduction. An actor's avatar forms an important part of the intimacy stage of seduction, as the visual appearance of an actor could possibly have an impact on how others perceivedthem, and an actor may construct an image based on their identity or the image they want to project and the relationship between an actor's avatar and their identity can be understood as elastic as even the best and strongest elastic can break, with there being the possibility that avatars can develop to the point where connection between them and the identities of the actors using them can be stretched so far that they cease to exist. There has been a debate over whether identity is unitary or multiple with psychoanalytic theory playing a complicated role in the debate. If there is a lifecycle to an actor's membership in an online community, then it is likely that they will develop different cognitions, such as beliefs and values at different stages that may become 'joindered'. This would mean that an actor's behavior would be affected by the beliefs and values they developed when joining the community when they are at a more advanced stage in their membership of the community. Utilizing the ecological cognition framework, it can be seen that the visual appearance of an actor's avatar could be based on the five binary-opposition forces, with some of the stereotypes identified earlier mapping on to these forces. The investigation found that the avatar with the greatest return on investment was the patriarchal stereotype with a 428.43% return and the one with the least ROI was the assiduous with a 12.63% loss. The most common avatar was the humorous, followed by exotic and pariah. The least common avatar was the vanguard, followed by the dangerous and pitied. An independent samples test revealed, as expected, a significant differences between the pariah and the patriarchal stereotype with the later having a greater return on investment, and higher ratings on appearance, building and behavior, suggesting that as not getting as high a return on investment, other actors will not judge the more antisocial-looking pariah as well as they judge the more sophisticated-looking patriarchal avatar.

The research methods used in this study were an ethnographical observation and document analysis. These methods seem particularly suited to online communities, where behavior can be observed through participation and further information can be gained through analyzing user profiles and community forums. The study has demonstrated that online communities, in particular virtual worlds, can be viewed as a type of media, and traditional approaches to media, such as investigating stereotypes, can be applied to Internet-based environments.

ACKNOWLEDGMENT

The author would like to acknowledge all the reviewers that provided feedback on earlier drafts of this chapter. In addition the author would like to thank S. Livingstone and M. Bober from the Department of Media and Communications at the London School of Economics and Political Science for collecting some of the data used in this study, which was sponsored by a grant from the Economic and Social Research Council. The Centre for Research into Online Communities and E-Learning Systems is part of Glamorgan Blended Learning Ltd., which is a Knowledge Transfer Initiative, supported by the University of Glamorgan through the GTi Business Network of which it is a member.

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This work was previously published in Social Networking Communities and E-Dating Services: Concepts and Implications, edited by C. Romm-Livermore; K. Setzekorn, pp. 60-77, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 7.24
Providing Mobile Multimodal Social Services Using a Grid Architecture

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ABSTRACT

In this chapter, we describe a grid approach to providing multimodal context-sensitive social services to mobile users. Interaction design is a major issue for mobile information system not only in terms of input-output channels and information presentation, but also in terms of context-awareness. The proposed platform supports the development of multi-channel, multi-modal, mobile context aware applications, and it is described using an example in an emergency management scenario. The platform allows the deployment of services featuring a multimodal (synergic) UI and backed up on the server side by a distributed architecture based on a GRID approach

DOI: 10.4018/978-1-60566-386-9.ch017

to better afford the computing load generated by input channels processing. Since a computational GRID provides access to "resources" (typically computing related ones) we began to apply the same paradigm to the modelling and sharing of other resources as well. This concept is described using a scenario about emergencies and crisis management.

INTRODUCTION

The penetration of mobile device in western countries is high and still increasing. At the same time new generation terminals feature ever increasing computing power, opening new possibilities for innovation, especially in service delivery.

One emerging trend in service evolution is for services to cater not only to individuals but also to communities of users. Communities are a social phenomenon where people with common interests, experiences, and objectives are brought together. They provide a social place where individuals exchange and share information, knowledge, emotions and jointly undertake activities. Managing the creation or deletion of flexible communities improves the user experiences in communities (NEM, 2006).

MoSoSo (Mobile Social Software), is a class of mobile applications that aims to support social interaction among interconnected mobile users (Lugano, G., 2007). While existing Internet-based services have already shown the growing interest in communication support for communities, *MoSoSo* adds additional dimensions to group communication by exploiting contextual data such as the user geographical position (Counts, S., 2006).

When designing MoSoSo applications, three important differences between desktop and mobile environments should be taken into account:

- The physical context of use is no longer static and poses some constraint to user attention;
- The social context is also dynamic: mobile communities member are tied up by common interest and contextual information, like location and time;
- MoSoSo applications are designed not just for communication but for usage in everyday life situations: users are always socially connected.

In our vision the MoSoSo concept could also benefit "public" (e-Government) services leading to innovative, more effective mobile services, able to leverage on dynamic management of *ad-hoc* communities, context-awareness (i.e. time and location), user profile management and multimodal interaction.

One domain where such benefits will matter most will be emergencies and crisis management. In fact, the response to such situations typically implies the coordination of physical resources, (emergency services personnel, often belonging to different organizations, or even possibly volunteers) in hardly predictable environments in situations where ineffective operations can cause the loss of lives.

From an IT standpoint, implementing such a vision requires coordination of services and sharing of resources among different organizations that typically operate heterogeneous hardware and software environments. The Virtual Organizations paradigm address this issue: "VOs enable disparate groups of organizations and/or individuals to share resources in a controlled fashion, so that members may collaborate to achieve a shared goal" (Foster I., 2001). In those circumstances dynamism, flexibility and interoperability become essential requirements.

Interoperability, in particular, is a key issue in the e-Government domain due to the increasing demand for integrated services. We aim to integrate MoSoSo users into a typical Grid resource management model. To this end, we designed an experimental platform to support the development of multimodal MoSoSo application, allowing an easy integration of mobile community users into a Grid based VO.

OGSA (Open Grid Service Architecture (Foster, I., 2006), a refinement of the SOA concept, allows the interoperability of "resources". In fact the OGSA specification allows each resource to be seen as a service with a standard interface. In the WS-Resource framework conceptual model, a Web service is a stateless entity that acts upon, provides access to, or manipulates a set of logical stateful resources (documents) based on the messages it sends and receives (WSRF, 2006) (Foster I, 2004).

Obviously, to evolve from SOA to OGSA, all architectural components must be extended to deal not only with services but also with resources. For example, as far as process execution is concerned, the workflow engine has to be able to compose both services and resources. Similarly a logical enhancement to the UDDI registry is required to store information about WS-Resources too.

Whereas there are interesting technology products (both commercial and open sources) dealing with multimodal client interfaces (EIF, 2004) (Frissen, V)(I.D.A.B.C) (Berners-Lee, Tim, 2001) and grid middleware (Foster, I., 2001) (Foster, I., 2006) (OASIS, 2006)(Mark Little, 2004), the innovative idea proposed in this article is to bring them together to enable innovative social services (multimodal emergency services being an example) and reduce digital divide.

The rest of this chapter is organized as follows. In the next section we will describe the multimodal part of the overall architecture (front-end). Then we will describe the back-end grid based architecture. Final remarks in the last section conclude the chapter.

MULTIMODAL ARCHITECTURE OVERVIEW

The multimodal part of the overall architecture (Figure 1, Figure 3), is composed by the following modules (Frattini G, 2006),(Frattini G, 2008):

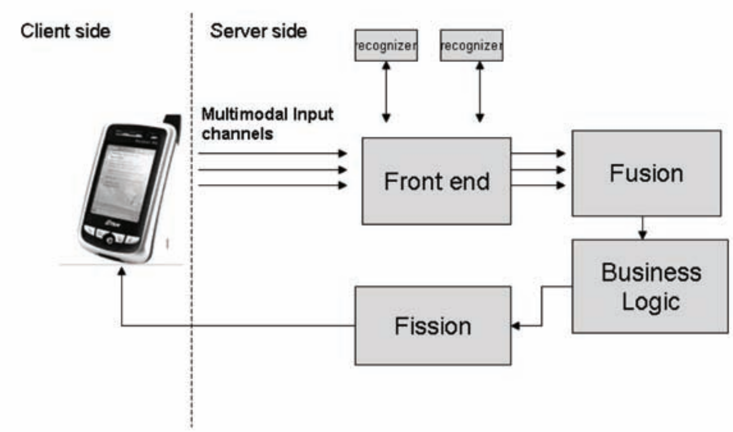
- **Client side application (MMUIManager, MultiModal User Interface Manager):** shows an appealing graphical interface to the user, manages the output channels and collects the inputs from the user and context information.
- **Front end:** collects input from clients and routes it to distributed back-end recognizers (speech, sketch and handwriting recognizers);
- **Fusion:** semantically merges recognized input fragments coming from different channels;
- **Business Logic:** selects appropriate contents;
- **Fission:** sends the selected content to final users.

  Building upon a fairly established conceptual multimodal reference architecture (W3C), we enriched it with Web 2.0 (Frattini, G, 2008), telecommunication & grid technologies, open to community model based interaction. We think the final result is interesting.

In the next sections we will expand on this evaluation. We will first describe our approach to assemble on-the fly mobile multimodal user interfaces using a thin client that exploits resources available on the network. Then, we will present the back-end architecture that deals with the induced computational load.

We focused on using commonly available mobile devices (PDAs or smart phones), and tried to avoid installing specific sw environments. Hence we had to develop a very light software

Figure 1. Architecture overview



framework for building multimodal interfaces. The framework exploits several standard protocols, over commonly available networks, to interact with both local environment and remote servers (Frattini G, 2007).Being multimodal, such interfaces have to be able to:

- Collect multimodal input from different channels: speech, point, sketch, handwrite;
- Render outputs selecting the best possible channels (multimedia output);
- Exploit local resources to create an appropriate context for service fruition.

Since we chose to use light, standard "thin" terminals, all collected input fragments have to be routed to network based modal recognizers . All those functions are grouped in a small footprint application: the MMUIManager. The MMUIManager, operating in a fashion conceptually similar to an Internet browser, receives from servers the information describing the UI contents (images, text, audio/video resources), loading locally just the minimum software layer needed to support the desired user interaction.

Such an approach is similar to what is done fore other languages (XUL).

Implementing this concept was a not trivial task. Suffice it to say that, since a standard markup language to describe synergic mobile multimodal UI had not yet emerged, we had to develop our own: an XML based markup language for aggregating multimodal objects: LIDIM (from the Italian Linguaggio di Definizione Interfacce Multimodali, - language for designing multimodal interfaces).

LIDIM is a tag language that by exploiting alsoresources provided by a general multimodal framework is able to handle any potential combination of input modes and to compose multimodal output objects.

The thin client approach implies that the MMUIManager cannot carry out recognition tasks locally on the user terminal but instead it has to rely on back end recognition server distributed over the

Figure 2. Example of client interface

network, by streaming input fragments to them. To optimize this task, avoiding local buffering of input signals, we adopted the telecommunication protocols SIP/RTP and developed special multimodal objects able to manage streaming protocols in both input and output.

Mobile Interface: The Thin Client Approach

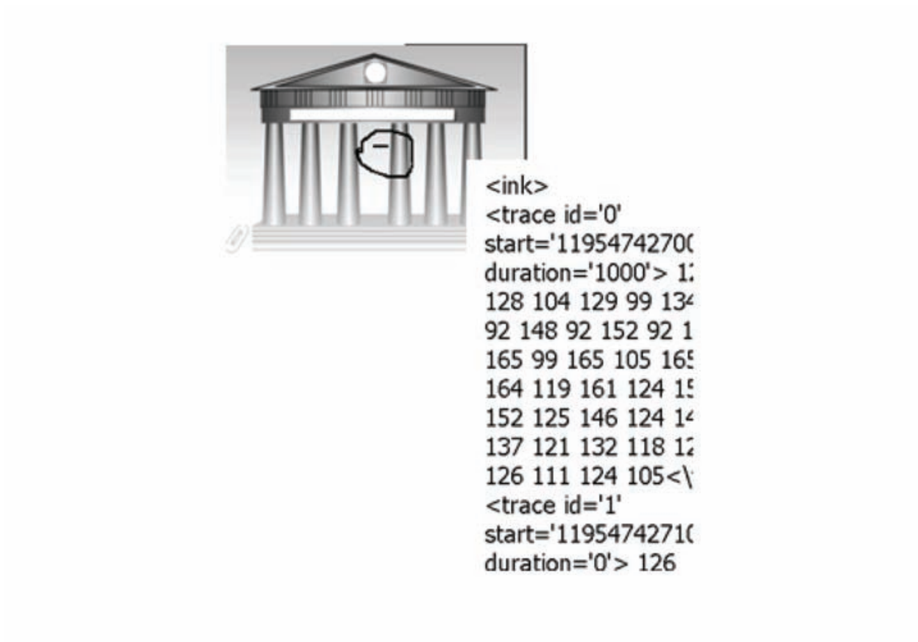
To reach such goals we have followed an XUL like approach. We defined the LIDIM language to describe the multimodal mobile interface built the support for LIDIM in our MMUIManager (MMUIManager acts as a browser for LIDIM building the multimodal interface on the fly and rendering it for user fruition). Such approach enables a very flexible interface design: a specific multimodal applicative frame can be dynamically built adapting to device capabilities, physical context, interaction type, user profile. Not only the graphical aspect, but also content fragments, need not to reside in the device. They reside on optimised content servers and are dynamically selected and streamed to the mobile device .

In short our MMUIManager had to be able to collect multimodal input fragments and send them to back end servers for recognition while at the same time managing multimedia output (text, image, audio, video) composed on the fly.

To be able to handle those tasks, rather than building a monolithic MMUIManager we chose to develop a multimodal framework: a rather comprehensive set of Multimodal elementar objects that can be composed into a coherent multimodal interface. At this moment available alements are buttons, textboxes, html browsers, imageboxes, audio/video panels (able to play audio/video resources) etc.

Those elements can be enriched with specific input modalities, like speech, stylus touch, or draw. For example it is possible to use an "image box" element, and make it sensible to stylus input. In this way the element can allow for an interface in

Figure 3. Sample of draw acquisition



which the user can draw free hand sketches and/or handwriting on top of a picture.

In the specific example ink traces are saved in InkML standard format and sent over the network to appropriate recognition servers, as soon as possible (as soon as a recognition fragment is completed by the user).

Audio acquisition is different: since it is much more difficult to relate a speech fragment a specific interface object "a priori" (i.e. by not considering the semantic content of the speech utterance itself) such input is captured by the MMUIManager itself. This acquisition process is done continuously and the acquired utterances are continuosly streamed over RTP to backend speech recognizers.

As already anticipated we chose to introduce a specific language to describe modular, multimodal/multimedia interfaces: LIDIM.

An alternative choice could have been to extend an existing language to our requirements.

Since we wanted to be able to achieve synergic coordinated multimodal input and multimedia output in a modular interface, the existing technologies/standards proved overly difficult to extend: SMIL conceived for output was too difficult to adapt to input, while X+V and SALT showed the limits inherithed from their design that did not consider synergic multimodal input over simultaneously active input channels.LIDIM manages the following output channels:

- Graphic modular panel interface;
- Audio (pre-recorded sources and TTS);
- Text Messages (Pop up message).

For each resource of the modular interface one or more output media (image, audio, video, text) and input modalities (point, sketch) can be specified. Note that LIDIM just describes the output interface, while the MMUIManager builds the interface and manages the input/output channels. Let us give an example of how it is possible to build an object having point and sketch as input mode and media text, image and audio as possible output.

```
<object id="78678687">
        <output_media>
<text uri="http://...."/>
            <image uri="
http://...."/>
            <audio uri="
http://...."/>
        </output_media>
<input_mode>            <point
isActive="true"/>
            <sketch
isActive="true"/>
        </input_mode>     </ob-
ject>
```

Like HTML, LIDIM does not include the resources (images, text, audio/video resources) which compose the interface; it just contains the addresses where the MMUIManager can get them.

The language is template based, hence leaving to the MMUIManager to dispose the objects on the screen. The current version cannot synchronize different output resources. Future releases are planned to remove such limitation.

We built two MMUIManager prototypes on top of J2ME and .NET Compact Framework software environments.This was motivated by two someway opposite requirements:

- The possibility to run on almost every commercial devices;
- The necessity to exploit all the hardware and OS capabilities of the devices.

The current .NET implementation is more advanced, for its support of streaming for audio input/output. The J2ME lacks this feature (handling only discrete speech utterances via HTTP) since J2ME lacks standard support for RTP protocol. The main MMUIManager tasks are:

- Build the graphic interface using an XML user interface language;
- Manage the input and output channels on the device;

The UI needs to be able to simultaneously collect multimodal input and show multimedia output according to instructions coming from the server.

This approach has a significant advantage: the very same MMUI manager can be used in very different applications contexts content or logic change will be only necessary on server side.

It is a crucial advantage for portable terminals whose users are not, and need not to become, used to installing and configuring local sw applications

According to our goals, the MMUIManager must be based on an engine for interpreting an XML language for creating multimodal/multimedia interface on the fly. Considering this, we have designed and developed a framework for aggregating multimodal objects. A composition of multimodal objects creates a complete multimodal user interface.The interaction modes enabled by our multimodal framework are, at the moment, the following:

- Point on specific buttons (ex. a "Back" button) and point on object;
- Draw/handwrite on the screen;
- speak.
- Output media supported are: image, text, Html, audio, video.

Input channels

To deliver synchronous coordinate synergic multimodality, the client has first to collect simultaneously different input channels, which currently are:.

- Speech
- Pointing
- Sketch
- Handwriting

To overcome the constraints posed by the somewhat limited hardware resources of mobile devices we chose to distribute the recognition process over back end recognisers.

To optimise this distribution we found useful to design an intermediate layer between the MMUIManager and the recognizers. This layer (that we call "Front End module") essentially manages the redirection of input from the MMUIManager toward the recognizers allowing for some location independence,failover and load balancing).

It also takes care of sending recognized input fragments to the fusion module in standard (EMMA) format, and for the TTS channel generate the output.

The Front-End was implemented as a set of cooperating Java servlets deployed on an application server (e.g. Tomcat, JBoss etc.).

The acquisition of the "pointing" modality is the simplest. Every time the user touches a sensible on screen object an HTTP call containing the object identifier is sent to the server to be merged with other concurrent modal fragments.

The acquisition of sketch/handwring is more complex. But still there is no need for a real time process.

The client side framework offers multimodal objects sensible to stylus inputs and traces. Acquired traces are buffered locally and then sent to the front-end server via HTTP using a standard format (InkML). The Front-end server, in turn, routes the acquired input to recognizer and fusion modules.

Speech Recognition is the most complex.

To recognize speech in real time by using distributed Speech Recognizers, an open streaming channel (RTP protocol) between the device and the recognizer (ASR, Automatic Speech Recognizer) has to be established.

This channel allows continuous recognition of the user speech and we chose to have it established through a direct negotiation process between the MMUIManager and the recognizer; such negotiations are made using the MRCP protocol (RFC 4463).

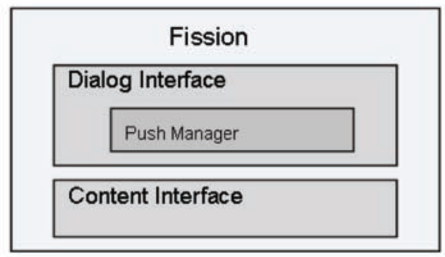
To trigger the recognition process start we introduced a special "start" keyword such as "computer"; so when a user utters "computer,.. do this" the recognition process starts. Obviously any other keyword can be chosen. A recognition fragment isidentified when the user pauses his speech.

Output process

In our architecture, the output process is managed by a business logic layer and by the Fission component. The former provides to thelatter application specific information (also taking into account factors such as user's preferences and behavioural patterns) while the Fission module, takes care of the technical coordination of the output. For example the Fission module guarantees synchronization between the visual presentation and the audio reproduction of the content. To do that the Fission module creates a specific LIDIM output file that is sent to the MMUIManager for rendering.

The Fission was designed to treat asynchronously clients' requests; when the business logic layer has new content for a specific client, it signals this availability to the Fission module by using the HTTP protocol and this may happen independently from client requests (for example because an element in the environment changesornew data becomes available). The Fission module notifies the MMUIManager that updated content issvailable by using the SIP (Session Initiation Protocol)

Figure 4. Fission module internal architecture



protocol. Then the MMUIManager receives from the Fission module the new content through an HTTP request.

SIP is the Internet Engineering Task Force's (IETF's) standard for multimedia conferencing over IP. SIP is an ASCII-based, application-layer control protocol (defined in RFC2543) that can be used to establish, maintain, and terminate calls between two or more end points.

The complete Fission architecture is illustrated in Figure 4.Figure 4 shows the following components:

- The *Dialog Interface* is the module by which the business logic layer talks with the Fission module for the notification of new contents.
- The *Push Manager* is responsible for notifying the MMUIManager about the availability of new content for a specific client.
- The *Content Interface* is the component by which the MMUIManager module communicates with the Fission module for retrieving new contents.

As previously mentioned, contents notification to the MMUIManager, is managed through SIP protocol. The Push Manager, part of the fission module, achieves this notification, after a registration process to the SIP server.

To complete contents notification, the Push-Manager performs a SIP call to the MMUIManager, that in turn hangs up and gets ready to receive the contents.

Figure 5 shows the steps just described.

The SIP server is not part of Fission module, but rather it is a component of the overall system. This component acts in proxy role: it is an intermediate device that receives SIP requests from a client and forwards them on the client's behalf.

The output channels that the MMUIManager can process are depicted in Figure 6.

The voice output channel can play either pre-recorded audio streams or text streams converted to voice by a TTS engine.

The LIDIM file just contains information about resource location (an address). The MMUIManager fetches such content by using HTTP or RTP.

The text Message channel allows popup text

Figure 5. Asynchronous push

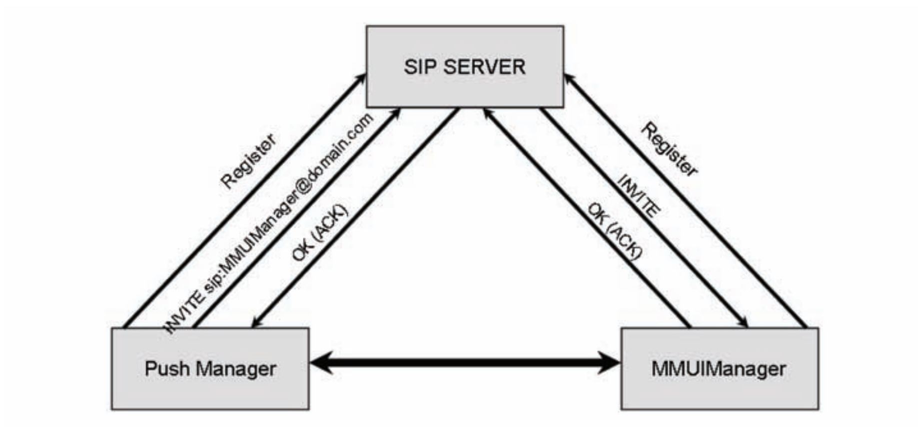
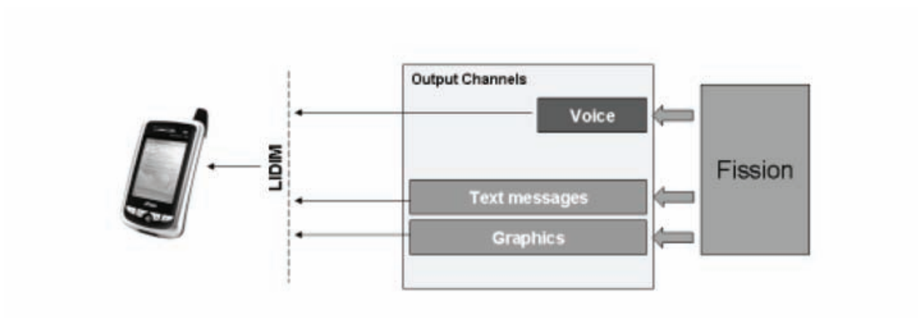


Figure 6. Output channels schema



messages that can also be used for asking user confirmations.

The Graphics channel instructs the MMUIManager about the graphical interface layout to be shown. All the output information are included in a LIDIM page and the Fission module takes care of sending it to the MMUIManager.

It is worth noticing that the fission module is completely asynchronous. This is an important feature: real adaptive services must be able to react by adapting the user interface to context changes, even without an explicit user request, typically to react to usage context changes (noise or lightning conditions).

BACK-END ARCHITECTURAL OVERVIEW

Figure 7 shows the logical view of our back-end architecture (Pierno S, 2008).

The applications, being highly service specific, will not be discussed.

The Workflow Management System (WFMS) takes care of e-Government processes, dealing with process flow design and execution.

The Workflow Engine component belonging to WFMS, has to aggregate both WS and WS-Resources. Our architecture, as well as the functionalities of the components of the Grid oriented workflow system, are based on the model proposed by the Workflow Management Coalition (WfMC) (Yu, Jia, 2005)(Globus Alliance).

To enable processes combining both WS and WS-Resources, we selected, in the J2EE domain, JBOSS Jbpm as the workflow engine and bpel as the script language.

We are hence investigating how to extend them to fully support WSRF-compliant services (PVM) (Dörnemann T, 2004).

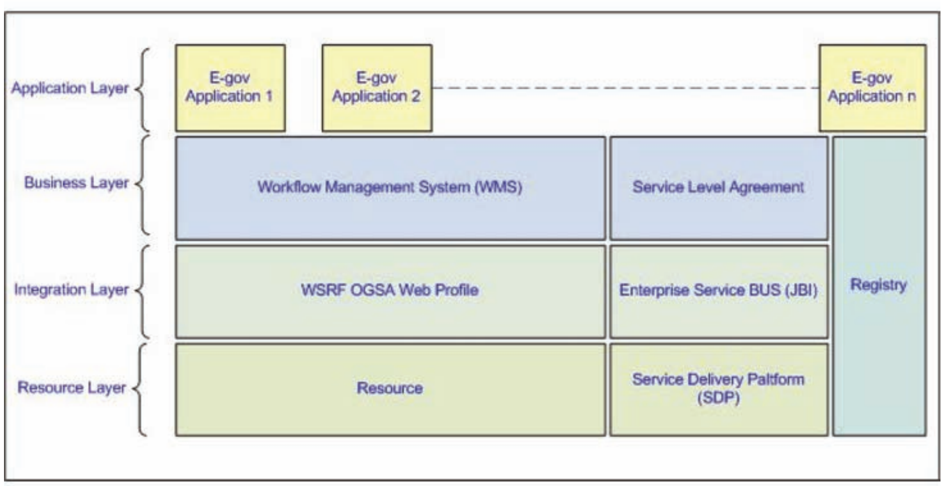
Processes that can be fully defined at design time do not pose significant research challenges, hence we concentrated our research efforts on processes that need to be planned dynamically at execution time. To this aim we are investigating different artificial intelligence techniques that will leverage semantic descriptions of both services and resources. This automatic process planning would either adapt an existing template (stored in a repository) or try to compose it ex novo.

A Service Flow Planner component in the WFMS (Pierno S, 2008) is devoted to this task while a Match-Maker component cooperates with it by finding the best service/resource available (early binding).

In more detail, the Service Flow Planner will be able to automatically plan a process from domain ontology in OWL and service descriptions in OWL-S into Planning Domain Definition Language PDDL.

In choosing the planner, we selected OWLS-Xplan because of its PDDL 2.1 compliance. The language PDDL2.1 is an extension of PDDL for temporal expressions.(Hoffmann, J, 2000)

Figure 7. Back-End (SIEGE) architecture



(Hoffmann, J, 2001) (Hoffmann, J, 2003) (Klusch Matthias). By exploiting this feature, the planner can chose the best service/resource according to QoS parameters.

To integrate the Service Flow Planner with the workflow engine previously described, we are developing a component that will be able to convert PDDL2.1 in both BPEL (OASIS) and JPDL languages.

The Match-Maker component (Pierno,S, 2008) can be used during process execution to find the best service at run time (process planning / re-planning) or, at build time, for discoverying service in the service registry. Our Match-Maker prototype does not depend on either language description, service registry, or matching strategies.

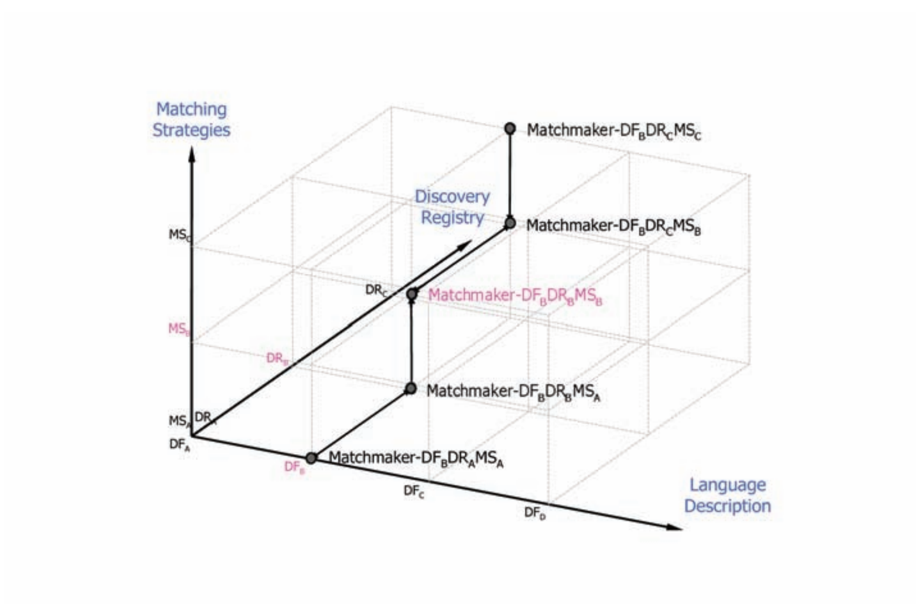
We are building upon the Match-Maker architecture proposed by Paolucci by extending it with the addition of other domain matching strategies such as e-Government QoS matching strategies. These extensions are very important in crisis management scenarios, where processes need to be highly dynamic.

The Service Flow Planner and the Match-Maker have the objective of increasing the capabilities of Workflow Management Systems for the autonomous self-management of composite processes, reducing human intervention to the minimum, primarily in the critical phases of process definition, execution and evolution.

In order to obtain such a result, we are starting from the body of research about Autonomic Web Processes. Autonomic Web Processes research aims to extend the Autonomic Computing model to the execution phase of Web Processes, with the objective of defining a model that extends autonomic self-management to the design, execution and post-execution phases.

In order to achieve such a result (that we define as Autonomic Workflow (Tretola Giancarlo, September 2007) we are proposing autonomic components for supervising a generic process,

Figure 8. Match-Maker



decreasing the need for human intervention, even during the design and supervision phases. (Tretola Giancarlo, April 25-29, 2006) (Tretola Giancarlo, February 7-9, 2007).

We are currently investigating how to integrate the JBOSS Process Virtual Machine (PVM) with Service Flow Planner and Match-Maker to fully support Autonomic Web Processing (Miers Derek (2005) (Tretola Giancarlo, March 26-30, 2007) (Tretola Giancarlo, June 19-20, 2007), (Tretola Giancarlo, July 9-13, 2007). While the Workflow Management System takes care of the high level coordination of services it does not need to concern itself with lower level details.

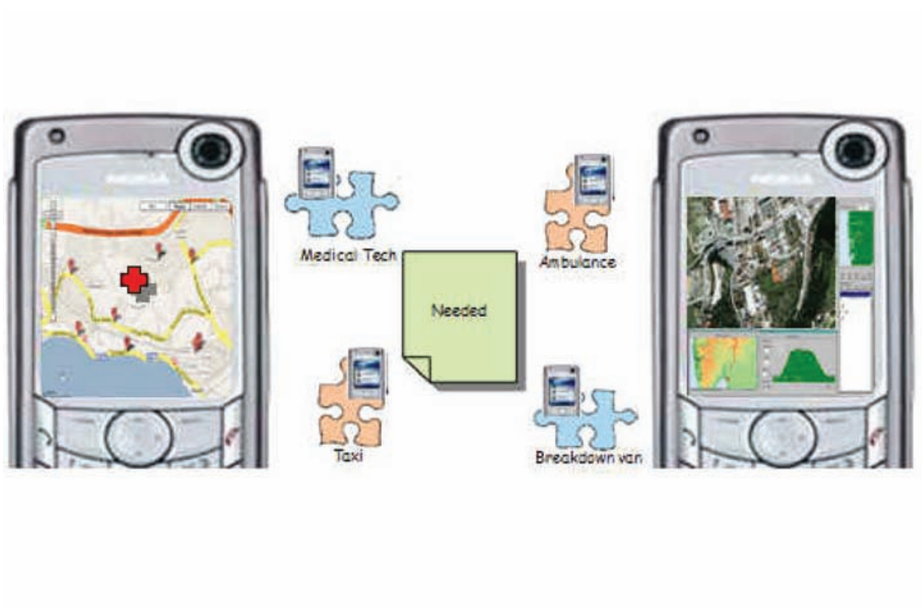
Functions such as data transformation, intelligent routing based on message content, protocol translation, message AAA (authentication, authorization, accounting) management, transaction management are best taken care of by a specialized component: the Enterprise Service Bus. We chose JBoss ESB because it is an ESB compliant with the Java Business Integration (JBI) standard.

WMS can invoke (via ESB) internal or external services and resources. The Service Delivery Platform (SDP), includes a library of loosely coupled services and it is responsible for their management and lifecycle control (Pierno, S, 2008).

The OGSA environment allows the use of resources and their lifecycle management Since the Globus Toolkit 4 (Globus Alliance) is one of OGSA most mature implementations (and one which is being evolved in parallel with OGSA specification), we selected it as a starting point for our investigations.

In distributed heterogeneous systems, mechanisms and technologies able to support a fast and effective services/resources discovery (an effective discovery mechanism has to deal with services/resources capabilities and resources status) are fundamental. In literature the use of semantic description is widely considered as the most promising approach about this. In particu-

Figure 9. Client application: Collecting useful information



lar the Semantic-OGSA (Oscar Corcho, 2006) proposal treats metadata as a first class citizen while defining a set of services suited for metadata management (lifetime management, change notification, etc).

Semantic-OGSA is particularly interesting because it provides for a flexible introduction of semantic data in the architecture: grid resources extended with semantic descriptions may operate together with grid resources that do not receive such an extension. With this approach Semantic-OGSA semantically enables basic OGSA services.

The Registry is another key architectural element. A decentralized hierarchical structure is well suited to the e-Government domain where some kind of hierarchical topology of organizations (national, regional, local) often exists.

We hence started our studies by investigating the UDDI 3.0 registries federation. specification (federation of registries)and developed a framework that allows the navigation of its hierarchical structure. In other words, our framework enables *distributed queries*. It is based on an algorithm that, using configurable parameters, allows the best path for querying the federated registries to be selected.

We foresee future work to further extend our framework to enable *match-making* of services/resources in federated environments.

By so doing our framework will eventually enable *semantic distributed queries*.

Since we intend to use federated UDDI registries to discovery both WS and WS-Resources we need a mechanism to "refresh" resource status across the whole domain: whenever the status of a specific resource changes, the federated registry structure as a whole must be made aware of it.

For this function we are developing the architectural component named SLA (whose main functions are in fact retrieving the state of all services/grid resources and refresh the service registries).

To obtain a registry able to manage all the needed information, it is necessary to extend the registry with metadata annotations. We will follow

Figure 10. Server side: Information management

this approach to add semantic Web capabilities to UDDI registries (Paolucci, M., 2002).

Scenario

In a crisis, several organizations must work together as a virtual organization, sharing resources across organizational boundaries to deal with the complexities of such situations. In those scenarios resources are mainly physical ones: police cars, ambulances, emergency professionals and volunteers. Disaster response VO are hence characterized by resource heterogeneity and must rapidly reconfigure (structural and functional changes) to adapt to the changing communication and control demands which may be needed to handle such events (Sharad Mehrotra, 2008).

All this requires dynamic and adaptive workflows, able to coordinate fixed and mobile resources on the basis of their readiness, availability and capabilities.

In our scenario, local Emergency Operations Centers (ECOs) are in charge of collecting information and coordinating operations. To facilitate communication between VO members (EOC chief, workers and volunteer), our solution provides multimodal interaction support for the mobile devices of the operators involved in the operations, exploiting a "point and sketch" interaction mode, which is particularly useful in on-field mobile operation.

In case of emergency, mobile social community users, are asked by a Resource Planning Support (RPS) service to be involved in the operation and eventually integrated into an *ad-hoc* emergency VO created by the EOC. In this way, we may be able to augment the on-field operator team with additional resources. Furthermore, accessing community member profiles, the RPS service can organize operations considering user's skills and assigning the best task to each VO member.

Let's suppose, for example, that after an earthquake some teams are involved in on-site damage control on the affected area, may be requesting assistance.

Imagine that some team's member with medical skill identifies the symptoms of an heart attack for a citizen asking help. He can use his multimodal mobile device to request intervention of a properly equipped ambulance by indicating the location pointing to a map on the screen (Lugano G, 2007). Through support services, every organization in the VO that can provide ambulance resources, will be asked to return availability, location, capabilities (equipment and crew) and other relevant information.

The available resources will be discovered on the (federated) registry and the best matching one will be called upon to accomplish the task at hand.

CONCLUSION AND FUTURE WORK

So far the research activities already carried out show that the described approach is feasible, although it places high demands (in terms of computing power) to back end systems.

In particular the availability of suitable distributed input processing software for voice recognition on large scale is still elusive.

Future research activities will deal with solving those aspects and improving the processing of context sensitive but user unaware input. For example in case of an unexpected raise in temperature an environment sensor may signal the risk of a fire inception even if no user recognizes visually a fire yet.

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This work was previously published in Multimodal Human Computer Interaction and Pervasive Services, edited by P. Grifoni, pp. 315-330, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Section VIII
Emerging Trends

This section highlights research potential within the field of social computing while exploring uncharted areas of study for the advancement of the discipline. Chapters within this section discuss social bookmarking, the emergence of virtual social networks, and new trends in educational social software. These contributions, which conclude this exhaustive, multi-volume set, provide emerging trends and suggestions for future research within this rapidly expanding discipline.

Chapter 8.1
Pedagogical Mash Up:
Gen Y, Social Media, and Learning in the Digital Age

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ABSTRACT

In this chapter we outline how educators are creating a "mash up" of traditional pedagogy with new media to create a 21st Century pedagogy designed to support the digital learning styles of Gen Y students. The research included in this paper is intended as a directional means to help instructors and course designers identify social and new media resources and other emerging technologies that will enhance the delivery of instruction while meeting the needs of today's digital learning styles. The media-centric Generation Y values its ability to use the web to create self-paced, customized, on-demand learning paths that include using multiple platforms for mobile, interactive, social, and self-publishing experiences. These can include wiki, blogs, podcasts and other developing social platforms like Second Life, Twitter, Yackpack and Facebook. New media provides these hyper-connected students with a medium for understanding, social interaction, idea negotiation, as well as an intrinsic motivation for participation. The active nature of today's digitally connected student culture is one that more resourcefully fosters idea generation and experience-oriented innovation than traditional schooling models. In addition, we describe our approach to utilizing current and emerging social media to support Gen Y learners, facilitate the formation of learning communities, foster student engagement, reflection, and enhance the overall learning experience for students in synchronous and asynchronous virtual learning environments (VLE).

DOI: 10.4018/978-1-60566-120-9.ch004

INTRODUCTION TO WEB 2.0 & GENERATION Y

The basic idea of the Web is that an information space through which people can communicate, but communicate in a special way: communicate by sharing their knowledge in a pool. The idea was not *just that it should be a big browsing medium. The idea was that everybody would be putting their ideas in, as well as taking them out.*

— Tim Berners-Lee

Web 2.0: It's All About Relationships (and Interaction)

In the past social interaction required students and teachers to be tied to a physical space—such as a brick and mortar classroom. But as the Web has evolved, students and teachers have been able to utilize new media technologies to replicate face-to-face social interactions into Web-based learning environments.

This movement of using Web-based platforms for social interaction has been dubbed "Web 2.0." One of the main attributes of Web 2.0 is the transition of the user as passive participant to an active co-participant who creates both the content and context for their experience.

Web 2.0 (social media) is based on three very simple, yet often overlooked principles: 1) humans are inherently social creatures; 2) the continued viability of any social system is rooted in an individual's ability to trust the members of the group and control their level of interaction; and 3) social networking should be used in a situated and engaging context.

A 2005 study by the Pew Internet and American Life Project (Lenhart & Madden, 2005) reported that 48% of teens feel that using the Internet improves their relationships, and 74% report using Instant Messaging (IM) as the technology of choice when it comes to fostering and supporting social relationships with their peers.

In an educational context, social technologies, such as those outlined in the Pew Internet Study, have the potential to engage students in the learning materials and allow them to be included as active participants. Since Gen Y students are drawn to Web 2.0 tools, learning is facilitated by technology as they construct a learning landscape rooted in social interaction, knowledge exchange, and optimum cognitive development with their peers.

Meet Generation Y: Wired, Digital, and Always-On

Raised in the world of interactive, Web-based new media, today's student has different expectations and learning styles than previous generations. A key attribute valued by Gen Y is their ability to use the Web as a platform on which to create a self-paced, customized, interactive, on-demand experience, with plenty of opportunities for social networking with peers, and self-publish content to the Web.

A recent study conducted by the US-based Kaiser Family Foundation (Rideout, Roberts, & Foehr, 2005) found that teens routinely incorporate multiple forms of new and old media into

Table 1. What are the key attributes of Web 2.0?

Foundation Attributes **User-contributed value: Users make substantive contributions to enhance the overall value of a service.** **Network effect: For users, the value of a network substantially increases with the addition of each new user.**
Experience Attributes: **Decentralization:** Users experience learning on their terms, not those of a centralized authority, such as a teacher. **Co-Creation**: Users participate in the creation and delivery of the learning content. **Re-mixability**: Experiences are created and tailored to user needs, learning style, and multiple intelligences by integrating the capabilities of multiple types of social media. **Emergent systems**: Cumulative actions at the lowest levels of the system drive the form and value of the overall system. Users derive value not only from the service itself, but also the overall shape that a service inherits from user behaviors.

(Schauer, 2005)

their daily practice. For example, teens listen to music on their iPod, while simultaneously sending instant messages, watching TV, scouring the Web for information and writing a report for school. The end result is 8.5 hours of media consumption and multitasking squeezed into 6.5 hours a day (Rideout et al., 2005).

Moreover, although 90% of teen online access occurs in the home, the Kaiser Foundation Study (Rideout et al., 2005) found that many students access the Web via mobile devices such as a cell-phone (39%), portable game (55%), or other Web-enabled handheld device (13%).

Everyone involved in education needs to pay attention to these emerging sociological trends and design learning environments that will appeal to the "digital reality" of today's students. While the move from "Mass Media" to "My Media" is a shift in thinking for many, Gen Y views the world of virtual, social and always-on interactivity as their reality.

Understanding Gen Y & Digital Learning Styles

In the 21st Century classroom, the student wants to control the how, what, and when a task is completed. Social media and other Web-based technologies are well suited to provide avenues for students to engage in a social, collaborative, and active dialogue in the online learning environment with their peers and instructor.

A study conducted by the UK-based NESTA FutureLabs (2005) reported that the education "should be reversed to conform to the learner, rather than the learner to the system." Moreover, NESTA found that social media should be used to enable learners to study and be assessed according to their own learning style (BBC, 2005).

Digital learning theory and pedagogical practice also centers on the concept that learning needs to be situated in a social and collaborative context. Discussion among peers can make the often invisible community threads more visible and accessible, and may lead students to find others in the group who share the same interests.

Students are hard wired to look at the variety of available Web 2.0 technologies and then construct their own learning path, and content based on their intrinsic learning needs. As students go through process of choosing, utilizing, integrating and sharing content it provides opportunities for them to be actively engaged, provide and receive feedback, as well as acquire, share, and make use of community knowledge.

More importantly, this emerging digital pedagogy emphasizes providing students with a broad range of technology tools, then providing them with avenues to develop their own understanding and knowledge. As a result, students are highly motivated to discuss and create content, solve problems together, and apply new concepts which relate to their own practice. This approach also provides student's with access to flexible, self-paced, customizable content available on-demand for learning opportunities.

The use of social and new media provides students with an opportunity to self-assess their understanding (or lack of) of the current course topic with their peers. Moreover, as students utilize social technologies to share their thought processes and provide feedback to their learning community, they are able to help each other work through cognitive roadblocks, modify their perceptions, and negotiate their own views while simultaneously building a collaborative peer support system.

In addition, collaborative project-based learning environments help students develop critical thinking and problem solving skills—both essential skills for students to compete in today's global knowledge-based workforce.

Digital Disconnect: Sociological Trends and Implications

As you may expect, traditional academic institutions have generally resisted the influence and in-

Table 2. Gen Y digital learning attributes

Interactive	**Interactive, engaging content and course material that motivates them to learn through challenging pedagogy, conceptual review, and feedback. Students expect to find, use, and "mash up" various types of web-based media: audio, video, multimedia, edutainment and/or educational gaming/simulation.**
Student-Centered	Shifts the learning responsibility to the student, and emphasizes teacher-guided instruction and modeling. Customized, ability to use interactive and social media tools, and ability to self-direct how they learn.
Situated	Reconcile classroom use of social media with how technology is being used outside of the classroom. Use of technology is tied to both authentic (learning) activity and intrinsic motivation.
Collaborative	Learning is a social activity, and students learn best through observation, collaboration, and intrinsic motivation and from self-organizing social systems comprised of peers. This can take place in either a virtual or in-person environment.
On-Demand	Ability to multitask and handle multiple streams of information and juggle both short and long term goals. Access content via different media platforms, including mobile, PC based, or other handheld (portable) computer device.
Authentic	Active and meaningful activities based on real-world learning models. Industry driven problems and situations are the focus and require reflective elements, multiple perspectives and collaborative processes for relevant applicable responses from today's student.

(Baird, 2006)

creasingly pervasive presence of social networking activities in the life of their students, but recently the same institutions have had to look with new eyes at all of the aspects and consequences of these new modes of technological socialization sweeping the younger generations.

— Ruth Reynard

Gen Y students have grown up surrounded by new media and value the ability to choose how, what, where, and when they will learn. According to the 2005 Pew Internet study, teenagers are actively embracing the interactive capabilities of the Internet to create, publish, and share their own content (blogs, podcasts, Web pages, photographs, wiki, and/or video).

In fact, the Pew Internet Study concluded that fully half of all teens who use the internet could be considered c*ontent creators* (Lenhart & Madden, 2005). Students report feeling a sense of growing disconnect between the authentic ways they use technology outside of the classroom and the ways they use it in the classroom (Levin, Arafes, Lenhart, & Rainie, 2002). This growing disconnect has resulted in many students feeling bored and constrained by traditional curriculum and pedagogical theory.

According to the *High School Survey of Student Engagement*, the majority of students interviewed reported they don't feel challenged in their coursework at school. Students also cited that they never or rarely received feedback from their teachers (Sanoff, 2005).

The expectation for highly interactive, flexible, collaborative, and desire to play a more active role in their own learning has already had an impact on the way colleges and even high schools educate students. The Michigan State Board of Education recently mandated that every high school student would have to take at least one online course to receive a diploma (Carnevale, 2005). Among the many reasons cited for adding the online course requirement was the realization that "much learning is going to take place in the 21st Century online."

The combination of social interaction with opportunities for peer support and collaboration creates an interesting, engaging, stimulating, and intuitive learning environment for students (Fisher & Baird, 2005). Effective course design will blend traditional pedagogy with the reality of the new media multitasking learner.

Digital Divide

The infusion of social and new media into the 21st Century pedagogy isn't without challenges. One of the key areas of concern is providing universal access to the Internet and bridging the digital divide between students and/or teachers who have technology and those who don't.

The issues around the digital divide, first raised in the 1990s, continue to be an area of concern. Even in countries where the Internet is widely accessible, there are still regions that remain digitally isolated.

According to 2008 *National Technology Scan*, a report conducted by Parks Associates, nearly 20 million American homes report being without Internet access and/or self-identified as lacking the technological expertise required to create content, search for information, or send an email.

At the 2008 ad:tech Miami Conference, Fabia Juliasz of ibope/NetRatings noted that Internet access in Latin America (Brazil 22%, Mexico 22%, Argentina 26%, and Chile 41%) continues to expand at a steady but slow pace. Since most student consumption of new and social media technologies occurs in the home, lack of at home access makes educational uses of the Internet problematic. This also makes it difficult for the teacher to assign projects or homework to students that require Internet access.

Increasingly there is a trend towards providing professional development online via Web-based platforms (Elluminate, Tapped-In, Facebook, Classroom 2.0, LearnHub etc.) all of which require participants to have Internet access. Teachers without access to the Internet at school or at home will miss out on these valuable opportunities to network with their colleagues and learn emerging and new best practices.

On a positive note, the divide has closed and the rapid adoption of mobile devices and broadband connections will continue to help shrink the divide and provide opportunities for students to participate in mobile learning (mLearning) environments.

NEW MEDIA, SOCIAL NETWORKS, & VIRTUAL LEARNING ENVIRONMENTS (VLE)

Learning requires more than just information, but also the ability to engage in the practice.

— Paul Duguid

The use of new media and social networks in a situated context provides both the structure and building blocks for interaction to take place. The end result is an environment which combines social media, Web-based information resources, and communities to provide a more diverse, active, and engaging learning experience.

Papert (1996) asserts that learning "is grounded in the idea that people learn by actively constructing new knowledge, rather than having information 'poured' into their heads." Moreover, he asserts that people learn with particular effectiveness when they are engaged in constructing personally meaningful artifacts", such as Weblogs, iPod, podcasting/audio blogs, wiki, social bookmarking, and other types of user-generated content (UGC).

How Social Media Supports Digital Learning Styles

The formation of an online learning community allows students to learn in a social context and turn to peers who are subject matter experts for immediate feedback and assistance. This approach also provides opportunities for students to learn through a cognitive apprentice with instructor and/or peers. In addition, opportunities should be provided for students to quantify their knowledge and skills in order to help them identify their place as well as other students with specific expertise. It's important to allow a community the freedom to discover where they fit in the learning community.

The collaborative and interactive aspects of projects undertaken in a course allow students to interact with other members of the class, allow students to identify who has a particular skill or expertise they want to acquire, and then provides opportunities for them to model and scaffold this knowledge from their peers. In addition the virtual learning environment allows students to explore and negotiate their understanding of the course content and find ways for the learner to develop a sense of intellectual identity (Papert, 1999).

When students collaborate they form social ties which motivate them to establish an identity within the group through active participation and contributions to the collective knowledge pool. Through this process learners become motivated on an individual level as well as fostering a sense of accountability to the group to continue to participate.

Anthropologist Lori Kendall, who spent almost two years researching the dynamics of social identity and community, concluded that members of virtual environments have intact social systems, and at times highly charged social relations. But unlike the electronic window of television, Kendall found that members of an online community feel that when they connect to an online forum, they enter a social, if not physical space (Kendall, 1999).

In this new digital age, we need to redefine our concept of what constitutes a legitimate “social system”, “learning community” or “social interaction.” In many ways, the effective use of new media to support instruction provides the same or better quality of socialization than a traditional classroom. If we are truly to expand educational opportunities via virtual learning environments and social networks, we will need to recognize and validate the existence of online communities, relationships, and interaction.

Teaching & Learning in Social Networks

Critics of e-learning often characterize online classrooms as neutral spaces devoid of human connection, emotion, or interaction with instructors or peers. However, effective use of social networking and new media technologies provides educators and students with the ability to interject emotion in the online space, thereby providing opportunities for peers to make emotional connections with classmates, and create a community of practice just as they do in the ‘real time’ world of the brick and mortar classroom. Social networks can also provide an outlet for students who are socially isolated or shy in the traditional classroom, a way connect, share ideas and collaborate with their peers.

Clearly, the key to a successful online user experience is to help students find ways to construct relationships with their peers, while simultaneously meeting their digital learning styles. A digital ethnographic study conducted by Goldman-Segall (1997) at the University of British Columbia pointed out how media tools create a constructivist learning environment which allows people to build interpretations of their data and utilize their individual life experience, multiple intelligences, while still working as part of a collaborative team.

Table 3. Education social networks

Platform	url
LearnHub	http://learnhub.com
Tutor Linker	http://tutorlinker.com/
Apple Learning Interchange	http://edcommunity.apple.com/ali/
Discovery Education Network	http://www.discoveryeducatornetwork.com/
Elgg Spaces	http://elggspaces.com/
Classroom 2.0/Ning	http://classroom20.com

Tosh and Werdmuller (2004) point out that students can use social networking to create their own learning and social communities. These self-directed learning communities could then provide resources, increase engagement in the course content, as well as provide a "network of knowledge transfer."

In the same vein as Vygotsky and other social learning theorist, their "power in the process" hypothesis states that the development of optimum cognitive development is rooted in the social exchange of information on both "the individual and collective levels" resulting in "opportunities to build one's learning instead of just being the recipients of information (Tosh & Werdmuller, 2004)."

Social networking media is an effective and authentic tool that engages the user in the content and allows them to be included as an active participant social interaction, knowledge exchange, and engagement with their peers.

Theory to Practice: Social Media in the Classroom

While teens have become increasingly hyper-connected and mobile, schools have been slow to respond to this cultural shift in the way students learn and communicate with each other. For the most part, educators, parents and school administrators have responded to the new digital reality by filtering, blocking, and restricting the use of digital devices, Web sites, new media and social networking in the classroom.

This growing tension between the digitally wired teens and their schools is reflected in a 2007 study by the US-based National School Board Association which showed that 96% of students use social networking technologies, such as chatting, text messaging, blogging, and participating in online communities such as Facebook, MySpace, and Webkinz, or Moshi Monsters (NSBA, 2007).

Adding to the growing sense of disconnect between wired teens and their schools, nearly 96% of districts participating in the NSBA study report that teachers are assigning homework that requires internet (NSBA, 2007).

Moreover, the NSBA study found that nearly 60% of online students report discussing education-related topics such as college or college planning, learning outside of school, and 50% of students reported that they use social networks to connect with peers to talk specifically about schoolwork. In short, today's Web-savvy students are stuck in text-dominated classrooms.

Preparing Teachers for 21st Century Learning

The other challenge is providing educators with the necessary professional development and training they need in order to effectively integrate new and social media technologies into their curriculum, as well as helping them develop a deeper understanding of the sociological shifts in students' learning styles.

In his book, "*Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*", Harvard University professor Clayton Christensen focuses on how education, technology, and innovation will impact the future of learning.

Among other things, Christensen predicts that by 2019 half of all high school courses will be taught online. If learning moves online as Christensen predicts, what are the implications for educators?

Teaching online with new and social media requires a different pedagogical approach from traditional teaching methods. Which raises an important question: Are educators getting the training and/or professional development required to teach our 21st Century students?

In the immediate future, teachers will need access to the correct pedagogical training for this shift — especially so they can realize the possibility that new and social media technology can truly improve learning.

Student Safety & Social Networks

Many educators face resistance from parents and school administrators about student use of the social Web. As a result, many schools use Web filters that block out large swaths of information. Understandably, the concern is that students will encounter inappropriate information or sexual predators.

However a recent study in the Journal of the American Psychologist (Wolak, Finkelhor, David, Mitchell, and Ybarra, 2008) found that many of the beliefs about sexual predators on the Web are overblown and, in some cases, not true. The study found that *"the stereotype of the Internet 'predator' who uses trickery and violence to assault children is largely inaccurate."*

While there isn't an easy solution when it comes to student Internet use, parents, teachers, and educators--need to take a less hyped, rational, measured approach on using social media in the classroom—and at home.

As a community, educators need to work on educating students to be more aware of the potential hazards and implications of disclosing too much personal information on social networking sites like MySpace and Facebook.

At a time when teens are constantly being reminded about the dangers lurking in social networks, it's always good to remind them that there are still plenty of dangers left in the non-digital world.

PEDAGOGICAL MASH UP: GEN Y & LEARNING IN THE DIGITAL AGE

Perhaps our generation focused on information, but these kids focus on meaning -- how does information take on meaning?

– John Seeley Brown

The variety of Web 2.0 tools are providing students with the opportunity to socialize around the context of the content, in terms of subject matter, production and commentary. These experiences become integrated into today's use of everyday devices in the everyday lives of the students for whom we design. As a result, the learning is embedded in and transferable to other contexts for the student.

Here we provide an overview of the current wave of Web-based tools and outline how social and new media can work together to support learning, and foster community in the frontline and offline classroom.

Social Bookmarking and Social Search

Social bookmarking provides students with a platform to exchange and share information found on the Web. As students search the Web they can save their search results, tag them with keywords, and then depending on whether they have marked the links private or public, share their pool of links and resources with their learning community and classmates.

Members of a community can also search, structure, and self-organize content via tags (keywords). You can then see what resources they are sharing with the community and add the ones you find most relevant to your tag list. And vice-versa. In this way, social bookmarking becomes an organic learning tool, evolving with the interests and needs of the community and the course.

Table 4. Social search/bookmarking resources

Platform	url
del.icio.us	http://del.icio.us
H20 Playlist	http://h2obeta.law.harvard.edu
Rollyo	http://rollyo.com
Blinklist	http://blinklist.com
Diigo	http://diigo.com

Using Social Bookmarking to Support Instruction

A teacher can place links in a community knowledge repository as a jumping off point for students. As students begin to research a topic, they can add content to and search the community pool. In this manner, students are scaffolding their own knowledge and the teacher is working as a facilitator, instead of a "*sage on the stage"*.

Weblogs/Blogs

Weblogs, more commonly known as "blogs", allow students to publish their thoughts and reflections while participating in a collective environment. As students reflect on their own Weblog entries, read their peers posts, receive feedback and network with their community of learners they are creating an environment for knowledge transfer to take place.

The user's ability to connect with members of their learning community via differing types of social media is an important consideration for today's learner. The interactive, collaborative, engaging nature of a blog combined with the ability to instantaneously publish content on the Web, enables students to use technology as a vehicle for presenting their own work as well as providing opportunities for feedback from their peers.

Moreover, blogs give students a chance to read, write, and expand their computing skills. For example, if one student reads another student's blog and sees a video in the blog, they want to learn how to complete that same skill. As a result, they collaborate with their peers to learn how to complete the same task (put video in a blog).

Vlogs or Movlogs are blogs which allow users to put video content on their blog. Platforms such as Flickr, contain mobile blogging tools, titled Moblogs, in which users post photographs or video taken from their camera enabled mobile phone.

Using Blogs to Support Instruction

The key feature of blogs is the author's ability to self-publish in an easy and quick manner on the Web. Students could be required to maintain a Web log (blog) or other Web-based journal throughout the program, as well as individual blogs for each course.

Reflection is a major component in online courses, and provides students with an avenue for expressing their own observed growth, and ability to make multiple connections within a course. Many students today use these types of blogs naturally and almost automatically.

In addition, unlike previous generations, today's digital student doesn't learn or consume information in a linear path. Rather they have

Table 5. Student perspectives on blogging

Source	Comment
• Synchronous Course Discussion	"One 'attitude' that might have changed for me regarding blogs, is that they don't necessarily have to be eloquently written (personal conversation, Mar 1, 2005)"
• Course Blog	"Other than using mandatory course-related academic discussion boards, I have never participated in this particular style of communication medium. It is necessary to become technologically informed and literate so thanks for providing this opportunity (personal conversation, February, 2005)."
• Synchronous Course Discussion	"I think if there is a focus or topic to blog on then the impact on a learning community would be tremendous—a guided blog. This type of journaling would offer a variety of POVs (point of views) and foster a culture of learning (personal conversation, March 1, 2005)."

Table 6. Weblog/blog resources

Platform	url
Blogger	http://www.blogger.com
Vox	http://vox.com
Squidoo	http://www.squidoo.com
Typepad	http://www.typepad.com
Wordpress	http://wordpress.com
Edublogs	http://edu.blogs.com
Gaggle	http://gaggle.net
Vlogs/Movlogs (Video Blog)	
Platform	**url**
Blip.tv	http://www.blip.tv
OurMedia	http://www.ourmedia.org
YouTube	http://youtube.com
Jumpcut	http://jumpcut.com
Vimeo	http://vimeo.com
Moblogs (Mobile Blog)	
Platform	**url**
Flickr	http://flickr.com
Shozu	http://shozu.com
Vox	http://vox.com

an "always-on" learning style that is driven by their intrinsic interests and looking at chunks of materials how and when they want.

By integrating a blog into your course, your class materials are available "on demand" thereby meeting the new digital learning styles of today's Gen Y student. In addition, students are able to utilize the latest in mobile technologies to access a myriad of information—including your course blog, right from their mobile phone.

Podcasts & Audio Tools

The Kaiser Family Foundation Study (Rideout et al., 2005) found that 65% of teens have a portable mp3 device. The ubiquitous use of these types of portable devices provides educators with a unique opportunity to use podcasts as a mobile content delivery tool. Not only will students and teachers will be able to use podcasting technology to locate and then download audio content, but it will also provide them with the software and tools to be able to create and share their own content in a podcast.

Teachers who incorporate podcasting into their curriculum cite many benefits, including an increased sense of student motivation stemming from community feedback, authentic and situated use of social technology in an instructional context, and the freedom to download the podcast content "on-demand."

Using Podcasts to Support Instruction

Podcasting will allow teachers to easily publish (or *podcast*) lectures, photos (perfect for the art history or architecture student), or foreign language accents pronunciations and drills, along with a myriad of other course content. Students

Table 7. Podcasting/audio resources

Platform	url
Kidcast	http://www.ftcpublishing.com/kidcast.html
Odeo	http://odeo.com
Education Podcast Network	http://epnweb.org
Yahoo! Podcasts	http://podcast.yahoo.com
iTunes U	http://www.apple.com/education/itunesu/
BBC MP3	http://www.bbc.co.uk/radio4/history/inourtime/mp3.shtml
Yahoo! Audio Search	http://audio.search.yahoo.com/audio/learnmore

will be able to subscribe to a course content feed and then automatically receive the content on their mp3 device.

YackPack

Developed by researchers at the Persuasive Technology Lab at Stanford University, YackPack is a social audio platform that allows users to record and send audio messages to friends inside privately formed groups. While there are other products that provide avenues for collaboration over the Web—most notably message boards, email, and instant messaging—YackPack is among the first social media tools to allow users to share both live and asynchronous voice messages.

The ability to interject voice into an online space is important because it provides opportunities for members of a community to convey the expression, emotion, and intimacy embedded in human speech. The ability to integrate human speech into the curriculum becomes even more important in pure online learning context where students and teachers only meet in a virtual environment.

Table 8. Yackpack resources

Yackpack	http://yackpack.com
StorytellingU	http://storytellingu.com
Yacklearning	http://yacklearning.net
Yackpack + PBWiki	http://www.blip.tv/file/196824

Using Audio Messaging to Support Instruction

An EFL (English Foreign Language) teacher (or Spanish, German, etc.) can post audio messages (verb conjugation, dialogue, etc) to an entire class. In turn, the students can respond to the teacher via a YackPack audio message. Instructors can also use YackPack as a tool to provide narrative feedback, assessment, and student support. In addition, you can also post Yackpack audio in PBWiki.

Wiki

A wiki is a collaborative Website where members can add, delete and change the content as needed. Wiki's can be used to brainstorm on ideas, create "work-in-progress" drafts, organize content, and provide participants with opportunities for interaction. Wikipedia is one of the most extensive and popular wiki's on the Web.

Many wiki clients allow you to create a mash up of rich media such as video, audio, PowerPoint, RSS feeds, widgets and other social media into your wiki. Not only does this make your wiki more interactive, but it also allows you to offer a variety of media that supports the multiple learning styles of students.

The WikiMedia Foundation is a non-profit organization that maintains several wiki's including one of the most well known, Wikipedia, a Web-based collaborative encyclopedia project.

Table 9. Wiki resources

Platform	url
PBWiki	http://pbwiki.com
Swicki	http://hnu.ida.liu.se/scwiki/Wiki.jsp
Wikimedia/Wikipedia	http://www.wikimedia.org
Zoho	http://wiki.zoho.com
Wetpaint	http://wetpaint.com
Social Text	http://www.socialtext.net/medialiteracy/index.cgi?wiki_resources
Miki (mobile wiki)	http://www.socialtext.com/node/75

Since WikiMedia is an open-source technology, students take can actively contribute to any of the WikiMedia projects.

Using a Wiki to Support Instruction

An instructor can have students form groups, conduct research on a topic of their choice, and then add their findings to the corresponding entry in Wikipedia. Or teachers could start a wiki to share teaching resources, curriculum ideas, or a forum for community support and interaction.

Wiki's are well suited to facilitate collaboration, communication and extend learning between peers. Most wiki clients provide privacy controls allowing you to choose which wiki pages you want to be public. Most importantly, wiki's provide a platform where everyone can contribute their ideas and extend the virtual boundaries of classrooms.

RSS

Really Simple Syndication (RSS) technology is an XML based format that provides the backbone for the distribution of Weblog, podcasting, and other content. RSS allows users to easily syndicate or publish their content for use by others.

There are several free RSS aggregators or news readers available, including *Bloglines*, *Feedburner*, *My Yahoo!*, *Google Reader* and *Yahoo! Pipes*. After a user subscribes to a RSS feed, the content (blogs, Websites, online community groups) automatically updates and is displayed in the feed reader. RSS readers also allow students to self-publish and share their content feed with members of their learning community.

Using RSS to Support Instruction

A key benefit is the user's ability to pick and choose (subscribe) to a particular RSS feed and then have the content updated in real time. In this manner, RSS is an important educational media tool to facilitate and support the "always on" learning styles of Gen Y.

RSS readers allow students to self-publish and share their content feed with members of their learning community. The use of RSS further supports multiple learning styles by allowing the user to select which content is relevant and then have it delivered directly to them for "*on demand*" viewing at their convenience.

As an assessment tool, RSS feeds provide teachers with several benefits. For example, instructors can subscribe to each students RSS feed and have their homework delivered directly into their aggregator, saving them the time consuming task of entering each student's URL in order to view their e-portfolio or blog.

Flickr

Sharing photos is an inherently social activity and Flickr, a Yahoo! company, was the first Web-based photo hosting service to successfully translate this experience into the online space. The key element that makes Flickr so unique is that active exploration and community are interwoven as main components of the design.

Flickr is important because its ease-of-use allows students to keep their focus on acquiring new skills, building on existing knowledge while at the same time developing writing, software, and strengthening social ties within their learning circle. This is especially important in geographically dispersed learning communities, where students may have limited face-to-face time to build a support network with their peers.

Using Flickr to Support Instruction

One of the unique features of Flickr is the ability of users to use their camera phones to take and upload pictures directly to their photoblog. Since most students already have access to a camera enabled cell phone, students can integrate Flickr into a mLearning activity. For example, students can use their camera phone fon a field trip to take pictures, and easily post them to their own Flickr photoblog. Later, students can write about their experiences on the field trip, reflect, and share their thoughts with their learning community via a Flickr group (Baird, 2005).

Flickr holds great potential as part of a multi-faceted approach that blends constructivist learning theory and mobile technologies in the curriculum. To be sure, Flickr and other mobile social media cannot, and should not, replace face-to-face communication between teachers and students; rather, it should be used as one of many digital tools that, when skillfully integrated into the curriculum, has the potential to open lines of dialogue, communication, and learning.

One of the challenges for educators is finding open copyright images and graphics they can use in their classroom. A partnership between Creative Commons, a non-profit that provides an alternative to copyright, Flickr and the generosity of the Flickr community has resulted in over a million photographs being made available for educators to use in their classroom.

Flickr provides educators with a powerful resource that can support differentiated instruction and support the multiple learning styles of their students. The visual and interactive nature of Flickr supports students who excel in learning activities that are centered on visual, kinthestic, and tactile learning activities.

Moreover, Flickr provides opportunities for students and instructors to create an engaging, open, and decentralized learning environment where ideas, creativity, and dialogue can be shared in an "always on" format that meets the needs of today's digital learner.

EDUCATION 2.0: MASH UP, REMIX, REUSE

A mash up is a Website, widget, or Web application that uses content from more than one source to create a completely new service (Wikipedia, 2006). They combine separate, stand-alone technologies into a new application.

The following chart illustrates how mash ups of new media platforms have been mashed up to create social and interactive learning activities that appeal to the digital and mobile sensibility of Gen Y students.

EMERGING EDUCATIONAL MEDIA

The fates guide those who go willingly; those who do not, they drag.

— Seneca

Looking towards the future, the next wave of learning will take place in the mobile space. The convergence of mobile technologies into student-centered learning environments requires academic institutions to design new and more

Table 10. RSS resources & tools

Platform	url
Yahoo! Pipes	http://pipes.yahoo.com/pipes
Google Reader	www.google.com/reader
Bloglines	http://www.bloglines.com
Feedburner	http://www.feedburner.com
New York Times RSS Generator	http://nytimes.blogspace.com/genlink

Table 11. Educational mash-up of Web 2.0 platforms

Platform	URL	About
Flickr		
delivr	http://www.delivr.net	Search Flickr tags to find photos and create postcard or greeting cards.
Slide	http://www.slide.com/flickr	Create embeddable slideshows using Flickr tag(s).
Spell with Flickr	http://metaatem.net/words	Use Flickr tags to enhance your spelling lists.
Huge Big Labs	http://bighugelabs.com/flickr	Several Flickr mashups including mosaic maker, slideshows, calendar & more.
Bubblr	http://pimpampum.net/bubblr/	Create comic strips using Flickr photos and/or tags.
Findr	http://www.forestandthetrees.com/findr	Use Findr to locate photographs by related tags and refining your tag search.
Spell with Flickr	http://www.krazydad.com/defacement/squirclescope.php	Create a kaleidoscope using Flickr tags.
North American Wildflower Guide	http://www.flickr.com/groups/wildflowers/	Search and discover hundreds of images of North American wildflowers.
Boardr	http://gallery.yahoo.com/apps/12356/locale/en	Create a storyboard using Flickr photos.
Google Maps		
Oral History of Route 66	http://maps.google.com	View landmarks & read narratives of the historic Route 66
Lit Trips	http://www.googlelittrips.org	Google Earth Maps mashed together with pictures, videos and other information tied to classic literature.
Google Mars	http://www.google.com/mars/	View topography, narratives of space explorers, and view spacecraft used to explore the Red Planet. Created in conjunction with NASA.
Jack Kerouac	http://maps.google.com	View landmarks and see pictures of the places in Kerouac's "On the Road."
Yahoo! Maps		
Exploring Shakespeare	http://gallery.yahoo.com/apps/5551/locale/en	Created by the Kennedy Center, this map plots the life and works of William Shakespeare.
Geologic Atlas of the United States	http://gallery.yahoo.com/apps/2490/locale/en	Map gallery of geologic features.
Life in San Francisco	http://gallery.yahoo.com/apps/1/locale/en	Watch videos mashed together with Yahoo! Maps explore San Francisco.
Disappearing Places	http://gallery.yahoo.com/apps/13126/locale/en	Archive and collective map of places that no longer exist.
Mile Calculator	http://gallery.yahoo.com/apps/11863/locale/en	Allows users to drag a path using the mouse on a mapped location and finds the miles or kilometers traversed over it.
Yahoo! Pipes (RSS)		
Yahoo! Pipes	http://pipes.yahoo.com/pipes/pipe.info?_id=hMj_M5_42xG0ZSPIJhOy0Q	Edublog mash up
WPR Science & Education	http://pipes.yahoo.com/pipes/pipe.info?_id=DrfI595U3BG5Ef_VouNLYQ	WPR interviews on science and education.
Second Life	http://pipes.yahoo.com/pipes/pipe.info?_id=qswEzwu92xGA5Up_lfXiAA	Mash up of RSS feeds on using Second Life in education.
CS Education	http://pipes.yahoo.com/pipes/pipe.info?_id=Hr9BCQTE2xGFf5qPmLokhQ	Mash up of K-12 CS education blogs.

Table 11, continued

Platform	URL	About
Wiki		
Yackpack + PBwiki	http://www.blip.tv/file/196824	Video showing how to embed Yackpack audio into a PBWiki.
WikiMapia	http://www.wikimapia.org/	Community generated content and Google Map mash up.
Musipedia	http://www.musipedia.org/	Collective musical encyclopedia & wiki platform.
Frappr	http://www.frappr.com/	Social map application; created with Google Maps. Users can create maps and embed on wiki, blog or web page.
MemoryWiki	http://memorywiki.org	Community generated collective encyclopedia of first-person narratives of historical events. Created using the Wikimedia suite of tools.
MS Office		
Blogger for Word	http://buzz.blogger.com/bloggerforword.html	Publish to Blogger via MS Word plug-in.
Creative Commons for MS Office	http://wiki.creativecommons.org/Microsoft_Office_Addin	Easily apply a Creative Commons license to your MS Word documents with this plug-in.

effective learning, teaching, and user experience strategies.

The rapid adoption of wireless, mobile and cloud computing by Gen Y learners will require educators to designl earning environments for wireless, mobile, or other portable Web-enabled devices (video iPod, PSP, Palm, iPhone). In addition to mLearning (mobile learning), Web applications like Twitter, Facebook and Second Life hold great promise as an educational platform.

Twitter

Twitter is an online microblogging application that is part blog, part social networking site, and part mobile phone/IM tool. It is designed to let users describe what they are doing or thinking at a given moment in 140 characters or less. As a tool for students and faculty, Twitter could be used academically to foster interaction and support metacognition (Educase, 2007).

Twitter also holds great promise as a way for seasoned educators to easily and quickly share their practice with novice or pre-service teachers. In this way, Twitter is being used as a digital legitimate peripheral participation or mentoring tool (Holahan, 2007).

Facebook

Facebook has taken an open source approach by releasing an API which allows developers to create Facebook Applications for the education community. The Facebook team has issued a call to action for the developer community to "create the applications that help people connect, track, and collaborate with their teachers, professors, and classmates (Moran, 2007)."

This open platform approach has resulted in an influx of new educational oriented Facebook Apps as well as a mash up of existing Web 2.0 tools. For example the wiki you created with Zoho can now be used in Facebook with a mash up between Zoho and Facebook. Other popular education tools like Slideshare, Flickr, Twitter, delicious and YouTube have all recently created Facebook applications.

Table 12. Second life teaching resources

Platform	url
Tutorial for Teen Second Life	http://wintermute.linguistics.ucla.edu/lsl
Salamander Project	http://www.eduisland.net/salamanderwiki/index.php?title=Main_Page
Second Life Tutorial	http://cterport.ed.uiuc.edu/technologies_folder/SL

Second Life

Second Life is an advanced virtual world simulation where users can create their own avatar (digital identity) and connect with other members of the Second Life community. Many higher education institutions, including ISTE, have already set up a virtual campus, classroom space and other learning environments within the Second Life grid.

This globally connected virtual learning environment (VLE) is also being used as a way to supplement traditional classroom activities, provide avenues for collaboration, as well as hosting distance-learning courses. There is also a new mobile version of Second Life that allows users to be connected anywhere they have an internet connection.

iPhone

The iPhone, a mobile device created by Apple, is getting a lot of buzz in educational circles as the next "killer app" for e-learning. In fact, since its release, several higher education institutions have started pilot programs to test the viability of using the iPhone as a mobile learning platform.

The App Store on iTunes has thousands of applications, many of them educational, that users can download to their iPhone. In addition, students can download podcasts and video from iTunes U and YouTube, created by their professors, onto the iPhone for on-demand viewing.

Learning 3.0: Mobile Learning

The use of mobile technologies continues to grow and represents the **next frontier for learning**. Increasingly we will continue to see academic and corporate research invest, design and launch new mobile applications, many of which can be used in a learning context. Learning 3.0 and beyond will be about harnessing the ubiquity of the mobile phone/handheld device and using it as an educational tool.

At the 2006 International Consumer Electronic Show, Yahoo! CEO Terry Semel outlined the explosive growth of mobile technology. According to Semel (2006), there are 900 million personal computers in the world. But this number pales in comparison to the 2 billion mobile phones currently being used in the world.

Even more astounding is how mobile devices are increasingly being used as the primary way in which people connect to the Internet. In fact, Semel notes that 50% of the Internet users outside the US will most likely never use a personal computer to connect to the Internet. Rather, they will access information, community, and create content on the Internet via a mobile device.

The convergence of mobile and social technologies, on-demand content delivery, and early adoption of portable media devices by students provides academia with an opportunity to leverage these tools into learning environments that seem authentic to the digital natives filling the 21st Century classroom. Clearly, the spread of Web-based technology into both the cognitive and social spheres requires educators to reexamine and redefine our teaching and learning methods.

Table 13. Other emerging educational technologies

Platform	url
Twitter (Mobile)	http://twitter.com
Second Life	http://secondlife.com/education
Red Halo (Mobile)	http://redhalo.com

The 2005 study conducted by the USA-based Kaiser Family Foundation (Rideout et al, 2005) found that, although **90% of teen online access occurs in the home**, most students also have Web access via mobile devices such as a **mobile phone (39%), portable game (55%), or other Web-enabled handheld device (13%).**

Palm estimates that mobile and handheld devices for public schools will be a **300 million dollar** market. A few progressive school districts in the USA, UK, and Ireland have already started using mobile devices in the classroom. Mobile devices are also seen by many as the solution bringing Internet access and information to students living in developing countries.

In order to create a better learning environment designed for the digital learning styles of Generation Y, there is a need to use strategies and methods that support and foster motivation, collaboration, and interaction. The use of mobile devices is directly connected with the personal experiences and authentic use of technology students bring to the classroom (Fisher & Baird, 2006).

The use of mobile technologies is growing and represents the next great frontier for learning. Increasingly we will continue to see academic and corporate research invest, design and launch new mobile applications, many of which can be used in a learning context.

CONCLUSION: IT'S ABOUT LEARNING, NOT TECHNOLOGY

With knowledge doubling every year or two, "expertise" now has a shelf life measured in days; everyone must be both learner and teacher; and the sheer challenge of learning can be managed only through a globe-girdling network that links all minds and all knowledge…We have the technology today to enable virtually anyone to learn anything…anywhere, anytime.

— Lewis Pereleman

Looking towards the future, perhaps the advice of management guru Peter Drucker provides educators with a mantra for teaching in the digital age: "*We now accept the fact that learning is a lifelong process of keeping abreast of change. And the most pressing task is to teach people how to learn*."

The proliferation of old and new media, including the Internet and other emerging social and mobile technologies, has changed the way students communicate, interact, and learn. And a new digital pedagogy, based on authentic learning activities, observation, collaboration, intrinsic motivation, and self-organizing social systems, is emerging to meet the needs of Gen Y students filling our educational institutions.

In many cases, students spend as much (or more) time, receive more feedback, and interact with peers more in an online environment than they do with their teachers in the classroom. In fact, a 2002 Pew Internet Study (Levin, et al, 2002) found that 90% of student media consumption (8 hours worth) occurs *outside the classroom*.

Now more than ever, instructors must keep track of these sociological trends and learn how to effectively integrate social media into their curriculum as a means to meet both the learning goals and digital learning styles of their Gen Y students.

AUTHOR NOTE

Links for all of the resources, references, and services cited in this chapter can be found at http://del.icio.us/mashup.edu

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KEY TERMS AND DEFINITIONS

Blog: A blog, short for "Weblog", is a Web site in which the author writes their opinions, impressions, etc., so as to make them public and receive reactions and comments about them.

Instant Messaging (IM): Instant messaging is the act of instantly communicating between two or more people over a network such as the Web.

Mash Up: A Web application that combines data from more than one source into an integrated experience.

Moblog (Mobile + Blog): A site for posting blog content from a mobile device, usually a cellular phone. Most often refers to photo sharing via a camera phone.

Palm: A handheld portable device or personal digital assistant.

Really Simple Syndication (RSS): Really Simple Syndication feeds provide Web content or summaries of Web content together with links to the full versions of the content. RSS is used by news Websites, Weblogs and podcasting to synch and deliver content.

SMS (Short Message Service): Written messages that you can send through a mobile phone.

Social Networks: A term used to describe virtual or online communities of shared practice.

Social Software, Social Media: Social software enables people to connect or collaborate through computer-mediated communication (wiki, Weblog, podcasts) and form online communities.

Text Messaging (TM): Another term used to describe SMS.

Web 2.0: Web 2.0 generally refers to a second generation of services available on the Web that lets people collaborate, and share information online.

Vlog: (**Video + Blog):** A Weblog using video as its primary presentation format.

Wiki: A collaborative environment where any user can contribute information, knowledge or embed rich media such as video, audio, or widget(s) (Adapted from Wikipedia and Wiktionary, 2006).

APPENDIX A: OVERVIEW OF SOCIAL LEARNING THEORY

Table 14.

Situated Learning (Lave/Wenger)	**Knowledge needs to be presented in an authentic context. Learning requires social interaction and collaboration with peers. As learners engage in social interaction they become involved in a community of knowledge and practice.**
Constructivist Theory (Bruner)	Learners construct new ideas based on their current or past knowledge or experiences. Learners acquire new knowledge by building upon what they have already learned. Understanding comes through "active dialogue" Learning takes place via collaboration and social interaction with peers.
Social Development Theory (Vygotsky)	Full cognitive development requires social interaction. The range of skills that can be developed with peer collaboration exceeds what can be attained alone.
Multiple Intelligences (Gardner)	Human intelligence is comprised of several faculties that work in conjunction or individually with each other to achieve full cognitive development.
Social Life of Information (Seeley/Duguid)	Become a member of a community of practice (CoP) Engage in its practice Acquire and make use of its knowledge
Cognitive Apprenticeship (Brown, Collins, and Duguid)	Cognitive apprenticeship is an instructional design and learning theory wherein the instructor through socialization, models the skill or task at hand for the student. Students may also receive guidance from their peers. The role of the teacher is to help novices clear cognitive roadblocks by providing them with the resources needed to develop a better understanding of the topic.
Legitimate Peripheral Participation (Lave/Wegner)	Theoretical description of how newcomers are integrated into a community of practice (CoP). Newcomers ability to observe experts in practice enables them to be integrated deeper into the community of practice.
*Chart adapted from Wikipedia (*www.wikipedia.com*)*	

APPENDIX B: ROLES OF STUDENTS IN VIRTUAL LEARNING ENVIRONMENTS/SOCIAL NETWORKS

Table 15.

Roles	**Task**	**Procedure**	**Group Value**
Organizer	**Provides an ordered way of examining information**	**Presents outlines, overviews, or summary of all information**	**Lead thinker**
Facilitator	**Moderates, keeps on task**	**Assures all work is done and/or all participants have opportunity**	**Inclusive**
Strategist	**Decides the best way to proceed on a task**	**Organization**	**Detail**
Analyst	**Looks for meaning within the content**	**Realizes potential of content to practical application**	**Analytical**
Supporter	**Provides overall support for an individual or group**	**Looks for ways to help members or groups**	**Helpful**
Summarizer	**Highlights significant points; restates conclusion**	**Reviews material looking for important concepts**	**Gives the overall big picture**

Roles	Task	Procedure	Group Value
Narrator	**Generally relates information in order**	**Provides group with a reminder of order**	**Keeps group focused on goal**
Elaborator	**Relates discussion with prior learned concepts or knowledge**	**Presents previous information as a comparative measure**	**Application or expansion**
Researcher	**Supplies outside resources to comparative information**	**Goes looking for other information with which to compare discussion**	**Inclusiveness**
Antagonist	**Supplies contrasting ideas**	**Looks for opposing viewpoints and presents in a relative way**	**Opposing viewpoint**
(Fisher, Coleman, Sparks, & Plett, 2006)			

APPENDIX C: GLOSSARY OF NEW/SOCIAL MEDIA TERMS

Table 16.

Term	Definition
Mash up	A Web application that combines data from more than one source into an integrated experience.
Social Software, Social Media	Social software enables people to connect or collaborate through computer-mediated communication (wiki, Weblog, podcasts) and form online communities.
Blog	A blog, short for “Weblog”, is a Web site in which the author writes their opinions, impressions, etc., so as to make them public and receive reactions and comments about them.
Moblog (mobile + blog)	A site for posting blog content from a mobile device, usually a cellular phone. Most often refers to photo sharing via a camera phone.
Vlog (video + blog)	A Weblog using video as its primary presentation format.
SMS (Short Message Service)	Written messages that you can send through a mobile phone.
Palm	A handheld portable device or personal digital assistant.
Social Networks	A term used to describe virtual or online communities of shared practice.
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Instant Messaging (IM)	Instant messaging is the act of instantly communicating between two or more people over a network such as the Web.
Text Messaging (TM)	Another term used to describe SMS.
Really Simple Syndication (RSS)	Really Simple Syndication feeds provide Web content or summaries of Web content together with links to the full versions of the content. RSS is used by news Websites, Weblogs and podcasting to synch and deliver content.
Wiki	A collaborative environment where any user can contribute information, knowledge or embed rich media such as video, audio, or widget(s).
(Adapted from Wikipedia and Wiktionary, 2006)	

This work was previously published in Handbook of Research on New Media Literacy at the K-12 Level: Issues and Challenges, edited by L.T.W. Hin; R. Subramaniam, pp. 48-71, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.2
Legal Issues Associated with Emerging Social Interaction Technologies

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ABSTRACT

This chapter focuses on legal issues that may arise from the increasing use of social interaction technologies: prospective employers searching the Internet to discover information from candidates' blogs, personal web pages, or social networking profiles; employees being fired because of blog comments; a still-evolving federal law granting online service providers sweeping immunity from liability for user-published content; and attempts to apply the federal computer crime law to conduct on social networking sites. The U.S. legal system has been slow to adapt to the rapid proliferation of social interaction technologies. This paradox of rapid technological change and slow legal development can sometimes cause unfairness and uncertainty. Until the U.S. legal system begins to adapt to the growing use of these technologies, there will be no change.

DOI: 10.4018/978-1-60566-368-5.ch031

INTRODUCTION

This chapter focuses on legal issues that may arise from the increasing use of two specific types of social interaction technologies: blogs and social networking sites. These two Web 2.0 applications are emphasized due to a particular paradox: while there has been tremendous growth of blogs and social networking sites during the first part of the twenty-first century, rules of law develop slowly. Within this gap, laws regulating online conduct are continuing to evolve, leaving the exact status of certain activities in limbo.

BACKGROUND

The promise of the Internet as an information sharing platform (Leiner et al., 2003) has been fulfilled to a large extent in the twenty-first century by the emergence of Weblogs or blogs and social networking sites. Blogs, which originated as online diaries in which authors published information of interest for themselves and their few readers, usually in reverse chronological order, now number over 70 million (Sifry, 2007), covering just about every conceivable topic. Blogs are interactive because they link to other content on the Internet and many have the capability for readers to post their own comments, creating the possibility for ongoing dialog.

Social networking sites allow individuals to create online profiles (also referred to as *pages*) providing information about themselves and their interests, create lists of users (often referred to as *friends*) with whom they wish to share information, and to view information published within the network by their friends (Boyd & Ellison, 2007). The two most popular social networking sites, Facebook and MySpace, together boast nearly 100 million users (Stone, 2007).

As blogs and the use of social networking sites have proliferated, so too have potential legal problems. Prospective employers are reviewing job applicants' social networking profiles to glean information not contained in résumés. Employees have been fired as a result of their personal blogs. Online services, including social networking sites, have been sued based on content provided by users. Criminal conduct has been partially extended to violating the terms of service required to join interactive sites. These situations present challenges to a legal system which historically has been slow to adapt to new technologies. As a result, many of these legal issues remain unsettled.

LEGAL ISSUES BROUGHT TO LIGHT BY EMERGING SOCIAL INTERACTION TECHNOLOGIES

Googling Job Applicants

Many employers wish to know more about job applicants than what can be discerned from a résumé and interview—and for good reason. Surveys have indicated that nearly half of job applicants mislead employers about their work history and education (How to ferret out instances of résumé padding and fraud, 2006). Employers also seek to find individuals who will work and perform well within the organization (Piotrowski & Armstrong, 2006).

Employers are compelled to investigate the backgrounds of prospective employees because of the negligent hiring doctrine, which will impose liability on an employer when it "places an unfit person in an employment situation that entails an unreasonable risk of harm to others" (Lienhard, 1996, p. 389). Negligent hiring occurs when, prior to the time the employee is actually hired, the employer knew or should have known of the employee's unfitness. Liability is focused on the adequacy of the employer's pre-employment investigation into the employee's background (Ponticas v. K.M.S. Invs., 1983). But employers' ability to investigate applicants is hindered by the reluctance of former employers to provide letters of reference in fear of defamation suits from former employees (Finkin, 2000). Traditional pre-screening techniques are also restricted by various laws. For example, an employer may not ask questions which would allow the employer to screen applicants based on a protected class (race, color, national origin, religion, or gender) under Title VII of the Civil Rights Act of 1964. The Equal Employment Opportunity Commission has issued a number of guidelines on what employers can and cannot ask in an employment interview to help ensure that employers do not discriminate on the basis of religion (29 C.F.R. § 1605.3), national origin (29 C.F.R. § 1606.6), or sex (29 C.F.R. § 1604.7).

Prospective employers are finding that with a quick search on Google, they can discover a substantial amount of additional information from a candidate's blog, personal web page, or social networking profile. Unfortunately for the candidate, some of that information may be embarrassing, or even frightening—eliminating the candidate from further consideration (Finder, 2006). More problematic, there is no control over how a prospective employer may use the Internet to discover additional information about candidates, allowing the employer to potentially base a hiring decision on information that would otherwise be prohibited from disclosure in a job interview or questionnaire.

Since most of the information a prospective employer may glean from an applicant's blog or social networking profile is published by the applicant himself or herself, there is no right to privacy that could protect the applicant. United States privacy laws presume there is no privacy interest in information one exposes to the public (Prosser, 1960). As one court has stated, it is "… obvious that a claim to privacy is unavailable to someone who places information on an indisputably, public medium, such as the Internet, without taking any measures to protect the information" (United States v. Gines-Perez, 2002, p. 225).

A person must assume, therefore, that any information he or she publishes on the Internet can and will be used by prospective employers when considering that person for an employment opportunity.

Fired for Blogging

The law also favors employers when employees have been fired based on content published in personal blogs. What, in the past, may have been simple "water cooler" griping easily becomes publicly-available criticisms when an employee complains about work on a blog, leading to dismissals even when the employee is publishing anonymously. There have been a number of instances in which employees have been dismissed because of blog comments about work after their true identity had been revealed to their supervisors (Blachman, 2005; Gutman, 2003; Joyce, 2005).

Most employees in the United States are "at-will" (Sprang, 1994), meaning either the employer or employee may terminate the employment relationship at any time, with or without cause. Taken to its extreme, the employment-at-will doctrine means that employers can dismiss employees for arbitrary or irrational reasons: "because of office politics, nepotism, preference for left-handedness, astrological sign, or their choice of favorite sports team" (Bird, 2004, p. 551). However, over time, exceptions to the employment-at-will doctrine have evolved.

Even if an employee is at-will, he or she cannot be fired if doing so would violate public policy. Traditionally, violations of public policy have prevented at-will employees from being fired after they refused to break a law on behalf of their employer, insisted on exercising a legal right (such as voting), or exposed the employer's illegal behavior to the pubic (e.g., whistle blowing) (Sprague, 2007). As part of this public policy exception, some courts have found that employers cannot fire employees based on information obtained through an invasion of the employees' privacy (Pagnattaro, 2004). But, as discussed above, since the information used to fire an employee comes from a blog published by the employee himself or herself, there would be no right to privacy in that information.

A number of states have adopted laws which prevent employers from considering certain off-site, off-duty conduct in employment decisions, such as the use of tobacco or other lawful products (Pagnattaro, 2004). Six states (California, Colorado, Connecticut, Massachusetts, New York, and North Dakota) restrict employers from considering off-site, off-duty conduct with minimal restrictions. These laws have been applied in only very limited circumstances, usually relating to romances between employees (Pagnattaro, 2004). However, in one case, a court upheld the dismissal of an employee who had written a letter which was published in the local newspaper complaining about management practices, concluding that the employee was wrongfully taking public a private employment dispute (Marsh v. Delta Air Lines, Inc., 1997). These laws also require that for the conduct in question to be protected, it must have no relationship to the employer's business. Therefore, if the employee's blog contains entries discussing his or her workplace, then the employee's off-duty conduct does relate to the employer's business, and would therefore not be protected.

Title II of the Electronic Communications Privacy Act, known as the Stored Communications Act ("SCA") makes it illegal to access stored electronic communications without authorization. The SCA can protect an employee's blog if access to the blog is restricted only to authorized users. For example, a pilot (Robert Konop) employed by Hawaiian Airlines maintained a website that contained commentary critical of the airline's management practices (Konop v. Hawaiian Airlines, Inc., 2002). Konop's website required users to have an assigned username and password to access the site, and Konop maintained a list of authorized users, which consisted primarily of other Hawaiian Airline employees. A Hawaiian Airlines senior manager (a vice president who did not have authorized access to the website) used other pilots' usernames and passwords (with their permission) to access the website. Because the manager had used other authorized users' accounts, with their permission, to access the website, it would appear the manager had not violated the SCA. However, the court concluded the manager did violate the SCA, but only because the accounts used by the manager had never been actually used by the authorized users—therefore, under a strict reading of the statute, the manager did not have the permission of an authorized "user." Konop v. Hawaiian Airlines, Inc. (2002) demonstrates that unauthorized access to a restricted website can be a violation of federal law.

Of course, in a profession which values blogging, a person's blog may lead directly to his or her being hired, rather than fired (Hammock, 2005). Most employees, though, may be jeopardizing their employment status, with no legal recourse available, if they choose to include in their blog any references to the workplace.

Liability for Online Content

Online service providers are granted sweeping immunity from liability for user-published content on their sites. This immunity is derived from § 230 of the Communications Decency Act ("CDA"), which provides two types of immunity: (1) that a provider or user of an interactive computer service will not be treated as the publisher or speaker of any information provided by another information content provider; and (2) websites that make good-faith attempts to screen objectionable material will also be immune from liability for the content of that material. In essence, the CDA provides immunity to Internet publishers of third-party content.

The case of Zeran v. Am. Online (1997) exemplifies the application of § 230 immunity. Kenneth Zeran was the victim of an anonymous prank in which someone published on America Online ("AOL") a fake advertisement for shirts containing offensive content, instructing users to contact Zeran for purchase. Zeran then received numerous derogatory and obscene phone calls, including death threats. When AOL did not immediately remove the advertisement, Zeran sued AOL for delay in removing the advertisement and failure to publish a retraction. In essence, according to the court, Zeran sought to hold AOL liable for defamatory speech initiated by a third party (Zeran v. Am. Online, 1997).

In refusing to hold AOL liable, the Zeran v. Am. Online (1997) court noted that the purpose of § 230 immunity under the CDA was "…to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services …" (p. 330). With the vast amount of information published online by third parties, it would be impossible for interactive computer service providers to screen each message posted by users, and "[t]he specter of tort liability in an area of such prolific speech would have an obvious chilling effect" (Zeran v. Am. Online, 1997, p. 331).

Section 230 immunity is not absolute. As noted above, it protects Internet publishers from liability only for content provided by third parties. The immunity does not apply if the online publisher originates the content. For example, when the online auction site eBay was sued based on its claim, "Bidding on eBay Live Auctions is very safe[,]" a court refused to grant eBay § 230 immunity (Mazur v. eBay, Inc., 2008). If eBay's claim that its Live Auctions were safe was a material misrepresentation, then the CDA would not "... immunize eBay for its own fraudulent misconduct" (Mazur v. eBay, Inc., 2008, p. *28).

One concern is whether the publisher can make any editorial modifications and still preserve § 230 immunity. This issue was addressed in the case of Fair Housing Council of San Fernando Valley v. Roommates.com, LLC (2008). Roommates.com is an online roommate matching service. Before individuals can use the Roommates.com service, they must create profiles, which require disclosures as to sex, sexual orientation, and whether children would be brought into a household. California-based fair housing councils sued Roommates.com, alleging its business violated the federal Fair Housing Act and California housing discrimination laws. The court refused to grant Roommates.com CDA immunity because it both elicited the allegedly illegal content and made "aggressive" use of it in conducting its business (Fair Housing Council of San Fernando Valley v. Roommates.com, LLC, 2008, p. 1172). "Roommate[s.com] does not merely provide a framework that could be utilized for proper or improper purposes; rather, Roommate[s.com]'s work in developing the discriminatory questions, discriminatory answers and discriminatory search mechanism is directly related to the alleged illegality of the site" (Fair Housing Council of San Fernando Valley v. Roommates.com, LLC, 2008, p. 1172). In other words, Roommates.com was directly involved with developing and enforcing a system that subjected users to allegedly discriminatory housing practices.

What is not settled is the degree of involvement required for an information content provider to lose immunity. The Fair Housing Council of San Fernando Valley v. Roommates.com, LLC (2008) court did state that an editor's minor changes to the spelling, grammar and length of third-party content would not remove CDA immunity. However, "if the editor publishes material that he does not believe was tendered to him for posting online, then he is the one making the affirmative decision to publish, and so he contributes materially to its allegedly unlawful dissemination[,]…" and would thus be "deemed a developer and not entitled to CDA immunity" (Fair Housing Council of San Fernando Valley v. Roommates.com, LLC, 2008, p. 1171). Ultimately, the question may be whether the "the website did absolutely nothing to encourage the posting of defamatory content…" (Fair Housing Council of San Fernando Valley v. Roommates.com, LLC, 2008, p. 1171).

Shortly before the Fair Housing Council of San Fernando Valley v. Roommates.com, LLC (2008) case was decided, a different federal court followed this latter approach. In Chi. Lawyers' Comm. for Civil Rights Under Law, Inc. v. Craigslist, Inc. (2008), Craigslist, an online classified advertising service, was sued because of the discriminatory content of some of the real estate rental advertisements it published (e.g., ads proclaiming "NO MINORITIES") (p. 668). The Chi. Lawyers' Comm. for Civil Rights Under Law, Inc. v. Craigslist, Inc. (2008) court granted Craigslist § 230 immunity because it did not "cause" any discriminatory statements to be made (p. 671).

Section 230 immunity was specifically applied to a social networking site in Doe v. MySpace Inc. (2007). The mother of a thirteen-year-old female MySpace user sued MySpace for negligence after a nineteen-year-old male MySpace user befriended the girl and ultimately sexually assaulted her. Unlike Zeran v. Am. Online (1997), in which immunity was granted based on AOL's status as a publisher, the mother in Doe v. MySpace Inc. (2007) claimed MySpace was not subject to immunity because its negligence was based on its failure to take reasonable safety measures to keep young children off of its site, and not based on MySpace's "editorial acts" (p. 849). The court rejected this argument, noting it was the exchange of personal information through MySpace that led to the two individuals meeting (which ultimately led to the assault). The court reasoned that if MySpace had never published their communications, the victim and the perpetrator would never have met. As a result, the court concluded that the mother's claims against MySpace were directed toward "… its publishing, editorial, and/or [message] screening capacities[,]" for which MySpace is immune under § 230 of the CDA (Doe v. MySpace Inc., 2007, p. 849).

While an individual who publishes defamatory information on a social networking site can be held individually liable (Zeran v. Am. Online, 1997), one cannot conclude absolutely that as long as the complaint focuses on communications published on a website, the service provider itself will be immune from liability. While minor editing changes will not necessarily remove § 230 immunity, the courts have indicated that originating content (Mazur v. eBay, Inc., 2008), materially contributing to the creation of content or publishing material not originally intended for publication (Fair Housing Council of San Fernando Valley v. Roommates.com, LLC, 2008) can transform a website from merely a publisher to a developer of content.

Computer Crime

One trend that has developed with social media sites is *cyberbullying*, which has been defined as "an aggressive, intentional act carried out by a group or individual, using electronic forms of contact, repeatedly and over time against a victim who cannot easily defend him or herself" (Smith, Mahdavi, Carvalho, Tippett, 2005, p. 6). What has caught the attention of legislators and educators are suicides of young people who were reportedly the victims of cyberbullying (Norton, 2007; Steinhauer, 2008). Legislators and educators also say that cyberbullying has gone unchecked for years, with few laws or policies addressing it (Norton, 2007).

One notorious incident has caught the attention of not only the public but also legislators. In 2006, Lori Drew, a 48-year-old Missouri woman, created a MySpace account and posed as a teenage boy, Josh. Through this fictitious persona, Drew began corresponding with Megan Meier, a 13-year-old neighbor. Drew reportedly created the "Josh" profile to find out what Megan was saying online about her (Drew's) teenage daughter (Parents want jail time for MySpace hoax Mom, 2007). Initially, "Josh" showed a romantic interest in Megan, but after a few weeks, the tone changed with "Josh" telling Megan at one point "the world would be a better place" without her (Steinhauer, 2008). Shortly thereafter, Megan Meier committed suicide.

As abhorrent as Drew's actions may have been, the question quickly arose as to whether she had committed a crime. Missouri, where both Drew and Meier lived, has a criminal harassment law prohibiting statements made to frighten or intimidate someone or to cause emotional distress. However, at the time of Drew's conduct, the law only applied to statements made in writing or via telephone (Offenses Against the Person: Harassment, 2008). The Missouri attorney general believed online statements were not covered by the statute (Steinhauer, 2008).

Federal prosecutors believe Drew did, in fact, commit a crime. In 2008 they filed a federal felony indictment against Drew, accusing her of violating the Computer Fraud and Abuse Act ("CFAA"). In particular, prosecutors allege that by creating the "Josh" profile and communicating with Megan Meier, Drew violated the CFAA by intentionally accessing a computer (the MySpace servers) without authorization and in excess of authorized access, and obtained information from that computer to further tortious acts, namely, intentional infliction of emotional distress on Megan Meier (United States v. Drew, 2008).

If the language of the indictment sounds a bit odd, it is because of the language within the CFAA. When the CFAA was first enacted in 1984, no one envisioned the facts surrounding the United States v. Drew (2008) case. Initially, the scope of the CFAA was narrow, focusing on unauthorized access to certain governmental or financial computers (Andreano, 1999). The CFAA has been amended a number of times to address an expanding array of computer-related activities. Currently, the CFAA contains criminal and civil penalties for various forms of unauthorized access to computer systems: (1) intentionally accessing a computer without authorization or exceeding authorized access to obtain information from a computer; (2) knowingly and with intent to defraud, accessing a computer without authorization, or exceeding authorized access, and obtaining anything of value, which can include the use of the computer accessed; (3) knowingly causing the transmission of a program, information, code, or command, and as a result of such conduct, intentionally causing damage without authorization, to a computer; (4) intentionally accessing a computer without authorization, and as a result of such conduct, recklessly causing damage; or (5) intentionally accessing a computer without authorization with the intent to defraud, and trafficking in any password or similar information through which a computer may be accessed without authorization (Credentials Plus, LLC v. Calderone, 2002). Typical violations of the CFAA have involved: the introduction of an "Internet worm" that shut down computers across the country (United States v. Morris, 1991); taking customer login information from one website and using it to access another website (Creative Computing v. Getloaded.com LLC, 2004); and using computer programs to infiltrate hundreds of computers and steal encrypted data and passwords (United States v. Phillips, 2007).

But within the CFAA, the terms "access" and "authorization" are not defined, so it is left to the courts to determine what constitutes "unauthorized access" or "exceeding authorized access." One approach used by the courts has been to determine whether a user's access to a computer has gone beyond the norms of intended use. For example, introducing a computer program into a computer network that is designed to exploit weaknesses within the network is an unauthorized access because it was not in any way related to the network's intended function (United States v. Morris, 1991).

Courts have also found unauthorized access arising from a breach of contract. For example, in EF Cultural Travel BV v. Explorica, Inc. (2001), a court found that a former vice president of EF Cultural Travel BV ("EF") had used information that was subject to a confidentiality agreement between the vice president and EF to obtain pricing information from EF's website. The court concluded the vice president's use of the information breached the confidentiality agreement, constituting unauthorized access to EF's computers in violation of the CFAA. Following EF Cultural Travel BV v. Explorica, Inc. (2001), courts have held that violations of computer service terms of use agreements can constitute unauthorized access. For example, courts have found unauthorized access in violation of the CFAA in the following situations: accessing the WHOIS database by automated software to collect website registration information to use for mass marketing purposes was access with a means and purpose in violation of the end use agreement (Register.com, Inc. v. Verio, Inc., 2000); using an AOL account to harvest e-mail addresses and then send bulk e-mails ("spam") to AOL members violated AOL's Terms of Service (Am. Online v. LGCM, Inc., 1998); and sending spam from Hotmail accounts in violation of the Terms of Service agreement (Hotmail Corp. v. Van Money Pie Inc., 1998). Courts have also taken a rather expansive view of "access," holding that it is merely the ability to "make use of something" (Am. Online v. Nat'l Health Care Disc., Inc., 2000, p. 1373). For example, when someone sends an e-mail message from his or her own computer, and the message then is transmitted through a number of other computers until it reaches its destination, the sender is making use of all of those computers, and is therefore "accessing" them (Am. Online v. Nat'l Health Care Disc., Inc., 2000).

Based on these previous applications of the CFAA, one can discern the logic in the federal indictment of Lori Drew. She was accused of violating the MySpace Terms of Service by creating a fictitious profile, which therefore established her unauthorized access of MySpace computers. Commentators have referred to the United States v. Drew (2008) indictment as the "first of its kind" (Steinhauer, 2008), as well as "dangerously flawed" and "scary" (Zetter, 2008). In some corners of the blogosphere there is concern that merely pretending to be someone else on the Internet can lead to a federal felony indictment (User charged with felony for using fake name on MySpace, 2008). One blogger has expressed concern that government enforcement agencies are misreading and misusing website user agreements: "Most websites like MySpace include contractual restrictions like the ones at issue simply to preserve their ability to kick off troublesome users at their discretion—not to put every non-conforming user at risk of looking down the barrel of an FBI agent's .45" (Goldman, 2008).

But one must keep in mind that unauthorized access alone is not enough to violate the CFAA. The unauthorized access must be also accompanied by access to or theft of information, fraud, extortion, damage to computers by malicious software, trafficking in passwords, or the commission of a crime or tortious conduct. In the United States v. Drew (2008) indictment, the government alleges Lori Drew accessed MySpace computers without authorization, by creating a MySpace account under a fictitious name, and then used that unauthorized access to obtain information from Megan Meier, another MySpace user, to then "torment, harass, humiliate, and embarrass" her, which constituted the tort of intentional infliction of emotional duress (p. 6). As such, merely creating a fictitious Internet persona—assuming it violates a service's terms of use agreement—will not violate the CFAA without further nefarious or illegal conduct committed as a result of the unauthorized access.

Since the Drew/Meier incident, Missouri has amended its harassment statute to eliminate the requirement that the harassment must occur by writing or telephone, which means it could apply to cyberbullying (Missouri Senate Bills Nos. 818 & 795, 2008). Several states are also considering cyberbullying legislation (State action on cyberbullying, 2008), as is Congress (Megan Meier Cyberbullying Prevention Act, 2008). Should cyberbullying laws proliferate, it will eliminate the need to use the CFAA for purposes arguably beyond its original intent.

FUTURE TRENDS

As social interaction technologies become more ingrained in American society, the U.S. legal system will have to adjust. Traditional notions of employment, privacy, publishing responsibilities and liabilities, and computer crime will have to catch up with the use of new technologies. In the near term, the only safe prediction is that employees, current and prospective, will have to censor what they publish online about themselves to avoid either being fired or eliminated from consideration for a job. In the meantime, unless Congress amends § 230 of the Communications Decency Act, online service providers, such as MySpace, will enjoy near complete immunity from liability for content published by users on their sites. But, for MySpace as well as other websites, it is only "near complete" immunity, somewhere between minor editing and doing absolutely nothing to encourage wrongful content. And without legislation specifically written to address cyberbullying, the Computer Fraud and Abuse Act may continue to be applied to online activities beyond the original intent of the Act.

CONCLUSION

The U.S. legal system has been slow to adapt to the rapid proliferation of social interaction technologies. Consequently, employees are being fired as a result of blogging; employers are searching the Internet to learn as much as possible about job candidates—possibly too much; interactive websites enjoy substantial immunity from liability for content published by users on their sites; and the notion of computer crime has been extended to violating website terms of use agreements. As this chapter has discussed, these consequences, which arise from the paradox of rapid technological change and slow legal development, can sometimes cause unfairness and uncertainty. Until the U.S. legal system begins to adapt to the growing use of these technologies, the status quo will remain for the foreseeable future.

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KEY TERMS AND DEFINITIONS

Blog: A personal diary published on the Internet, with entries appearing in reverse chronological order.

Defamation: A published false statement harmful to the interests of another (Restatement, 1977, § 623A). Defamation is a tort (a civil wrong) for which the victim may bring a lawsuit against the defamer to recover damages suffered as a result of the defamatory comments.

Employment-at-Will Doctrine: Legal doctrine applied to employment relationships of indeterminate length, allowing either the employer or employee to terminate the relationship at any time, with or without cause.

Intentional Infliction of Emotional Distress: Outrageous or extreme conduct which results in severe emotional distress. It does not apply to mere insults, indignities, threats, or annoyances (Restatement, 1965, § 46). However, as discussed in this chapter, tormenting or harassing an individual to the extent she commits suicide would constitute the requisite level of emotional distress.

Interactive Computer Service: A term defined by the Communications Decency Act, meaning any person or entity that is responsible, in whole or in part, for the creation or development of information provided through the Internet or any other interactive computer service.

Negligence: An act which a reasonable person would recognize as involving risk of harm to another (Restatement, 1965, § 291). Negligence is a tort (a civil wrong) for which the victim may bring a lawsuit against the negligent party to recover damages suffered as a result of the negligent conduct.

Negligent Hiring Doctrine: Legal doctrine holding an employer liable for harm caused to third parties by an employee, assuming the employer would not have placed the employee in a situation in which the third party was harmed had the employer, prior to hiring the employee, adequately investigated the employee's background.

Social Networking Site: Internet-based service which allows individuals to create online profiles and share information with other users. Popular examples include Facebook and MySpace.

Tortious Conduct: Causing harm to an innocent third party. The victim of tortious conduct seeks money damages through a private (civil) lawsuit brought against the tortfeasor.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 351-362, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 8.3
Public Intimacy and the New Face (Book) of Surveillance:
The Role of Social Media in Shaping Contemporary Dataveillance

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ABSTRACT

In recent years, social media have become an important avenue for self-expression. At the same time, the ease with which individuals disclose their private information has added to an already heated debate about the privacy implications of interactive media. This chapter investigates the relationship between disclosure of personal information in social media and two related trends: the increasing value of subjective or private experience as a social currency and the evolving nature of automated dataveillance. The authors argue that the results of the extended ability of individuals to negotiate their identity through social media are contradictory. The information revealed to communicate the complexity of one's identity becomes an extensive source of data about individuals, thereby contributing to the functioning of a new regime of surveillance.

DOI: 10.4018/978-1-60566-368-5.ch035

INTRODUCTION

Since their first inception in 1997 (with SixDegrees.com), social network sites - such as *Facebook*, *Friendster*, *Orkut*, and *MySpace* - allowed users to create online profiles about themselves and connect with other users. Starting with MySpace, user profiles on social network sites were no longer limited by preset categories determined by the network owners (Boyd & Ellison, 2007). Today, the types of information that users can post on their social network accounts are virtually limitless. A few examples include: age, educational status, favorite music bands, movies or books, current mood, a detailed list of daily activities performed, relationship status, likes and dislikes, and hobbies.

According to Liu (2007), an important consequence of this characteristic of social media is that social network sites have become very suitable venues for self-expression and identity formation. By enabling users to list their own interests, hobbies, social preferences, among other forms of information, social network sites empower individuals to go beyond the traditional tokens of identity, such as profession and social class, to engage in what he calls "taste statements" (p. 253) and more freely communicate oneself to others. And according to Evans, Gosling, and Carroll (2008), what individuals have to say about themselves in social media does not fall on deaf ears: a person who views the online profile of another person usually forms impressions that are congruent with the profile owners.

However, the same feature that enables individuals to freely communicate their identity to their social networks also leaves traces of data in unprecedented detail. As such, the main purpose of this chapter is to discuss these two related trends and their implications for intimacy, social relations, privacy and identity in contemporary societies. Following a brief overview of social media, the chapter begins by arguing that increased transparency is one of the defining characteristic of the *new individual* in contemporary societies. Next, the chapter focuses on how social media, in a world of transparency, enable individuals to communicate their multiple identities to others. In the final sections, the chapter focuses on the privacy implications of this heightened transparency by discussing the characteristics of a regime of surveillance that increasingly relies on an automated collection, collation and interpretation of the data individuals reveal and by summarizing the role that social media play in this regime of surveillance.

BACKGROUND

According to Barnes (2006), *social media* is an all-encompassing term that describes loosely organized online applications through which individuals can create personas and communicate with each other. Especially since 2003, social network sites (such as MySpace, Orkut, Facebook, and LinkedIn) have become extremely popular. For example, in 2007, Facebook had close to 100 million and MySpace had more than 100 million unique visitors (Comscore.com, 2007). Weblogs or blogs are another form of widely used social media. By the end of 2007, there were an estimated 67 million blogs worldwide (Rappaport, 2007).

This rising popularity of social media, within which individuals reveal minute details of their lives, is closely related to the transformation of society's expectations about what constitutes an acceptable form of information. Noting this transformation in individuals' expectations about the type of truth that the media should make available, several commentators suggest that an important characteristic of current culture is the elevation of individualism around mid-1960s and the subsequent rise of the subjective and intimate experience of individuals as the guarantor of truth (Cavender, 2004; Corner, 2002). Commenting on this transformation, social theorist Beck (1994) points out that there has been a shift in individuals' relationship with institutions. Accordingly, whereas in early modernity, meaning and identity were grounded on somewhat loyal reliance on institutions and structures, starting with late 20th century, the locus of meaning shifted to the individual. The self became the primary agent of meaning.

Within this context, by aiding the circulation of the intimate, social media are quickly becoming a platform for self-expression and creation of meaning. However, the audiences for these attempts at self-expression via intimate disclosure are usually not limited to a few friends or potential friends. As such, the ease with which users reveal their personal information, while using social media, has triggered a heated debate over the privacy implications of social media in general and social network sites in particular (Solove, 2007; Viegas, 2005). Researchers have focused on a number of issues including: social media users' ability to limit who has access to identification information (Lange 2007); corporate snooping and intrusion (for marketing and employee recruitment) (Maher, 2007; Solove, 2007); data security and use of publicly accessible personal information for fraud (Gross & Acquisti, 2005; Jagatic, Johnson, Jakobsson, & Menezer. 2007); and protection of underage users' privacy (Barnes 2006; George 2006).

Despite their invaluable contribution to current debates regarding privacy in social media, most of the current studies in this area adopt a piecemeal approach. Within this approach, different privacy threats are considered in isolation from each other and from the greater framework of surveillance as an increasingly data-intensive risk management tool for institutions (government and private). Gary Marx (2004) argues that this newer form of surveillance has several important characteristics such as being continuous, automated, more intensive and extensive (because every individual is subjected to his/her data being collected in a data collection phase), invisible (as is the case when data about individuals is collected and subsequently disseminated to dispersed databases) and involuntary (partly as a result of this invisible nature of data intensive surveillance). The typical end-result that institutions seek from this process is to utilize the data to draw inferences about their identities and sort them into common types of so-called "unique" categories (Gandy, 1993; Lyon, 2001). Then, what could be ahead for individuals is a conflict between the personas and identities that they communicate in social media and the identity that they have been ascribed to as a result of this automated surveillance (also called *datavaillence*). The remainder of this chapter explores the relationship between disclosure of personal information in social media and two related trends: the increasing value of subjective/private experience as a social currency and the evolving nature of automated dataveillance.

PUBLIC INTIMACIES AND THE NEW SURVEILLANCE

Formations of the *New* Individual

Since the 1980s, the imaginary timeline of change, which can also be traced back to the anti-conservative upheavals of the 1960s in almost every facet of life, the individual has increasingly come to the center stage of social, economic, and technological order. Her rights have been significantly expanded, in particular with impetus generated by the hegemonic discourses of human rights (Benhabib, 2002; Turner, 1986; Soysal Y., 1994). The *new* individual, so to speak: (a) has rights to her identity and culture (in other words, she possesses identities as a member of a categorically cultured collectivity that is differentiated by gender, sexual preference, disability, ethnicity, religion or spirituality); (b) is extensively involved in financial and security markets as a rational actor (she is entrusted with security of her own self, family, and future under terms dictated by the market); and, (c) achieves intimacy in public (she lives her sociality and establishes her intimate relations primarily in public stages, enabled by institutionalized public discourses). She is at the center of multiple, and ever increasing, life spaces that enact synthetically modular lives.

In the globalizing world the new individual asserts herself, the lines that so preciously divide the time renowned cultural, social, and political categories into inside and outside, private and public are rapidly fading away under the duress of massive economies of circulation, imitation, and sociability. As sociability is amplified and externalized, and public and private become indistinguishable, intimacy (social, cultural, or personal) becomes displaced and public (Soysal L., 2007).

While intimacy as conventionally understood requires an inward movement toward the private sites of self, family, home, marriage, culture, and nation (Berlant, 1997, 1998; Herzfeld 1997), public intimacy suggests an outward move to locate the formations of intimacy. In public intimacy, the emphasis is on the shared discursive spaces of public engagement, rather than the shared, inviting spaces of the cultural or personal kind (Soysal L., 1999; Berlant, 1997, 1998; Wilson, 2004). Public discourses and expressions, even in their most formalized discursive modes, constitute and conjure intimate connections. They provide a vocabulary to engage and question prescribed techniques and "institutions of intimacy" (Berlant, 1997, 1998) as in romance, dating, and marriage, while suggestively constructing intimate attachments between persons.

Furthermore, in today's world, the "close association, privileged knowledge, deep knowing and understanding" (Jamieson, 1998) anticipated by proper definitions of intimacy are incomplete and temporary. When the engagement ends, the setting and conditions for organized intimacy simply cease to exist. Individuals leave behind their provisional partners in intimacy with whom they shared stories and sociality.

A corresponding transformation can be observed in how individuals live and enact sociality—in that sociality today is increasingly exogenous. Contemporary metropolitan spaces have become locations for year-round festivity. What's true for mega cities such as London, Paris, New York is true for most metropolitan centers. Festivals of all sorts and sizes mark the topography of culture in cities. City becomes unthinkable without its festivals—its impressive and expressive façade. Even cities not so famous for its carnivals, such as Istanbul and Berlin, are now year-round stages for spectacles—film, music, theater festivals, street parades, international sports meets, as well as commercial fairs, IGO and NGO meetings, state summits, and professional conferences. The moment one of them ends, another is given start (Soysal L., 2005). Add to this the fact that individuals spend more time and money on extra-home entertainment as epitomized by the proliferation of eating-out, fitness activities, shopping, and travel.

Said differently, as the sociality of the spectacular and extra-home entertainment—or the hold of what is anthropologically known as *expressive culture*—amplifies, the exogenous encircles the individual and the interior dissolves in the lives lived, enacted outside. Under circumstances of globalization, not only social lives increasingly happen outside the privacy of homes, offices, and selves. Gradually, but surely, sociality takes place in virtual worlds. In other words, intimacies are being carried into virtual worlds where privacy proper is not operational.

The new individual now lives, works, and shops in transparent interiors of buildings with glass facades (for example, Berlin's parliament with its transparent dome, Richard Meier apartments in New York). In fact, as Sternberg (2001) notes, the new individual now is occupied in a phantasmagoric workplace and is responsible to create a suitable persona to present her "iconographic capabilities" (p. 11). In other words, the labor of the new individual is a labor of self-presentation. Strangely enough, this labor of self-presentation, which used to be the domain of celebrities such as movie or rock stars, is now a full-time labor for many individuals, who, for example, wear their emotions on their t-shirts or sweatpants that read *Milf in Training*, *Jerk Magnet*, *Your Boyfriend Wants Me*, or *Juicy.*

In the digital realm, live webcam feeds through which individuals broadcast what transpired in their bedroom can be considered as an example to the trickling down of the act of self-presentation. And nowadays, the new individual has Facebooks, MySpaces, YouTube—the proliferated virtual worlds of sociality—where she not only displays but also actualizes intimacies in public. First, thanks to the modular structure of social media sites, e.g., Facebook or MySpace, the new individual can now determine what components of her own modular identity to display and prioritize (Donath & Boyd, 2004; Liu, 2007, Lampe, Ellison, & Steinfeld, 2007; Marwick, 2005). For example, she can choose to display information about her music taste at the top of the page whereas another might choose to share her travel experiences and the places she visited. Second, specialized social network sites allow the individuals to compartmentalize their personas by displaying information they see fit for different contexts. For social shopping, she can use VogueShopTV and go to StyleHive, FashionWalker. From the convenience of her cell phone, she can announce the course of her new love affair by minute to anyone who listens—actually to anyone who has Twitter, the "quick blogging" tool. If she is interested in networking to find new employment opportunities, she creates an account in LinkedIn to share her professional background. And let us not forget second lives and socialities she may enact in Second Life and its clones. Friends can even be determined via DNA matching by a visit to a social-networking website (https://www.23andme.com) to be unveiled by a new personal genomics start-up in Silicon Valley (Soysal L., 2007).

In this respect, what users of social media do by creating their online personas is to engage in what can be called "introversive publicity." In social psychology, individuals with introversive personality are characterized as retiring people who value introspective thinking and intimate relationships (Eysenck & Eysenck, 1975). The act of subjective expression on social media (introversive publicity), despite its public nature, is introspective. It requires careful consideration of how each modular component of one's identity works in coherence with each other. As such, the resulting persona is as intimate as it is public. It is as coherent as it is modular. However, the public presentation of the virtual modular self is not solely a self-publicity project. Rather, it is a crucial component of how individuals develop and negotiate their own identity. As Simmel (1922/1964) pointed out with respect to rational group memberships, each component added to this modular identity helps establish a unique identity. This is the world of amplified sociality, virtual intimacy, and actual simulacra we inhabit. And in this brave new world, as Google prophesizes in its newest slogan, "Social Will Be Everywhere" and intimacies that matter will be public (Soysal L., 2007).

Social Media: Reclaiming the Right to Privacy

What are the privacy implications of public intimacies on social media? Being able to create online profiles and communicate one's own identity in a manner that one prefers may be considered as exercising one's privacy rights. This perspective reflects a long-standing socio-legal understanding that defines *privacy* as one's ability to have control over when, how and to what extent information about them is known by others (Bing, 1972; Fried, 1984; Wacks, 1989; Weintraub, 1997). As such, by publicizing information about their subjective experiences and everyday lives, users may be exercising their privacy right to disseminate information about themselves.

Recently, several commentators suggested that individuals' voluntary submission to the gaze of other people (as is the case when Internet, users leave their Webcam turned on throughout the day) is not only an exercise of privacy rights but also an act of counter-surveillance (Dholakia & Zwick, 2001; Koskela, 2004). Accordingly, in an environment of extensive surveillance, self-disclosure is seen as the only viable way for individuals to actively participate in the creation of images about themselves (Groombridge, 2002).

The real situation of Hasan Elahi is a perfect illustration of this perspective. After being mistakenly put on the U.S. government terrorist watch list, Mr. Elahi decided that the best way to be free from government intrusion would be to document and publish online every single detail of his daily affairs. Today, Mr. Elahi's blog, sometimes visited by U.S. law enforcement officers, contains a slew of details including scanned images of the receipts of every transaction he enters and regularly updated GPS location images of his whereabouts.

The key to being left alone, Mr. Elahi says, is to give away one's privacy (Thompson, 2007).

Regarding such a conceptualization of privacy, Gavison (1980) argues that although knowing disclosure of information can be construed as an exercise of privacy rights, it is nevertheless a loss of control over information because after the act of disclosure, individuals will have little control in the subsequent dissemination of the information. The popular media frequently covers such mishaps. For example, recently Kansas University decided to penalize students after finding out that the photographs they uploaded on Facebook contained evidence that they violated an alcohol policy of the University (Acquisti & Gross, 2006). Similarly, Microsoft officials admit that they frequently peruse Facebook profiles of job candidates (Solove, 2007). However, as the remainder of this chapter will discuss, these incidents of corporate/institutional snooping may be the tip of the iceberg with respect to the problematic of privacy as control over personal information.

Uncertainty and Risk Externalization in the New Surveillance

Since Foucault's *Discipline & Punish: The Birth of the Prison* (1977), Bentham's panopticon—an architectural design that would allow the constant monitoring of prisoners from a central tower—has captured the imagination of many scholars studying contemporary surveillance. In perhaps one of the most influential studies of surveillance in the information age, Gandy (1993) used the panopticon metaphor to characterize the continuous surveillance of everyday transactions and sorting of populations into "consuming types" as a form of rationalization (in the Weberian sense) of inequality—through computers, which are for all practical purposes rationality incarnate.

An important characteristic of the new surveillance is that it relies on a machine based, automated collection of personal information. Even the most innocuous transactions leave data trail that can be stored for later analysis (Gandy, 2002; Marx, 2004). To some extent, the development of interactive media (e.g., the Internet, digital cable), which allow for a two-way flow of information between the content provider and the consumer, has added to the impetus for continuous tracking of individuals' behavior and creating profiles that can be used to categorize them into homogenous segments (Baruh, 2004; Turow, 2005b). Within this context, social media and social network sites add to what is already a very large pool of data about individuals. Private information that individuals voluntarily reveal in social media about their hobbies, favorite pastimes, music preferences, close friends and even changes in their mood can be used further to refine their profiles and categorize them into groups.

An important problem concerning the vast amount of information that institutions collect about individuals is to interpret the ensuing data. Just as with the collection phase, a process known as "data mining" increasingly allows the use of algorithms for automatic detection of patterns that can be used to predict future behavior and risk (Gandy, 2002; Zarsky, 2002, 2004). That the data collection and interpretation process is automated has important consequences in terms the uncertainty that surround individuals' interaction with contemporary surveillance. Clearly, uncertainty was an important component of the disciplining function of the panopticon. Whereas guards can observe prisoners at any time, prisoners have no way of knowing when they are being observed. The concept "chilling effect of surveillance" underlines an important consequence of this uncertainty regarding when one is being monitored. Accordingly, an individual will be less likely to express her controversial opinions in public if she suspected that any behavior she engages in can be recorded (Marx, 1988), or vice versa, individuals may reveal opinions, at times abundantly, as if it should matter to their listeners.

The prospect of fully automated analyses of data about individuals may introduce additional uncertainties. As Gary Marx (2004) argues, the new surveillance does not target suspected individuals. It is carried out superficially, with an intention to closely investigate later. As such, surveillance systems that rely on automated data mining are akin to a fishing expedition that starts by comparing each data-point to the population base. This comparison, done without human interpretation or prior hypotheses about what constitutes risk, has the potential to signal any deviation as risk, which could then invite further scrutiny (Andrejevic, 2007).

A related component of such uncertainty regarding what constitutes the automated risk categorization is the violation of the contextual integrity of information. As noted by several theorists, an important function of privacy in a world where information about us is abundant is to protect individuals from being (mis)identified out of context (Nissenbaum, 1998; Rosen, 2000). As we suggested before, the self is a modular and perennially evolving entity. This notion is perhaps best reflected in Erving Goffman's (1959) conceptualization of selfhood, which is comprised of multiple roles we play and masks we wear.

Each snapshot of the multi-modular self in a different context will provide factually correct information about that context. However, in automated data mining, rather than interpreting each photograph as an independent unit, the analysis is based on creating a collage without paying attention to the contextual background. A collage created from hundreds of independent snapshots of the same person will probably not contain factually incorrect information. Each bit of data is actually about the subject. However, depending on how the independent photographs are rearranged, the person may look overweight, underweight or right on scale.

The point that we seek to make with this discussion is not that the inferences made through automated data mining will always be factually inaccurate. Rather, this process largely diminishes individuals' ability to determine (and find ways to challenge) inferences that are made about them. This is partly due to an informational asymmetry between individuals and surveillant institutions. The concept of privacy, which supposedly protects individuals from undue attention, when combined with intellectual property rights, provides institutions with a high level of protection from external oversight regarding the accuracy of data, how the data are used, and whether the data are properly protected (either from individuals or from agencies representing individuals). Noting this trend, Andrejevic (2007) argues that *privacy* is now the keyword for increased surveillance with "diminished oversight and accountability" (p. 7).

FUTURE TRENDS

Considered from the perspective provided above, the new surveillance (if fully utilized) will be more Kafkaesque than Orwellian (Lyon, 2001; Solove, 2001). In Kafka's *The Trial* (1937) the main character, Joseph K. is subjected to a long judicial process without ever knowing what he was accused of.

In *The Trial* Joseph K.'s circumstances are particularly illustrative of two characteristics of the new surveillance this chapter discusses. First, the subject will not know when she is being surveilled, who uses the data, who wants the information, and what or who distinguishes acceptable behavior from risky behavior (Baruh, 2007; Solove, 2007). Second, the digital revolution (along with enhanced storage capacity) makes it increasingly difficult for our society to forget and move on, making it almost impossible for individuals to have a second chance (Solove, 2007): "We are losing control…because if what we do is represented digitally, it can appear anywhere, and at any time in the future. We no longer control access to anything we disclose" (Grudin, 2001, p. 11). Third, data mining rationalizes surveillance by removing humans from the interpretation process. The dehumanization of the analyses is important because it removes the so-called human bias from the interpretation process. As such, when combined with the fact that contemporary data mining relies on quantification of information (a seemingly dispassionate and objective method of interpreting the social world), this dehumanization projects an aura of objectivity, consequently making it even more difficult to challenge its premise (and the findings it provides).

In the end, data targets lose whatever control they used to have over the management of their multiple identities. Many scholars would argue that rather than being a loss of control over one's identity, what happens is increased accountability, which in turn reduces social costs associated with individuals' tendency to misrepresent themselves to others (Posner, 1978). However, it is very difficult to argue that just because individuals may occasionally misrepresent themselves, the inferences that institutions make about individuals should gain such an absolute credence over individuals' self-representations (Baruh, 2007).

CONCLUSION

The rise of social media coincides with shifting norms about what constitutes an acceptable form of private information in contemporary societies. Namely, an important characteristic of contemporary popular culture is the elevation of individualism (especially since the 1960's) and the subsequent rise of the subjective experience of the individual as an acceptable form of truth. Within this context, social media have become the loci of virtual public intimacies within which individuals communicate their multifaceted identities through their virtual personas.

Perhaps, then, virtual public intimacies can even be considered as enabling individuals to actively practice their privacy rights by giving them an opportunity to communicate the complexity of their identity. However, the paradoxical consequence of this ability to make active decisions regarding one's own immediate privacy through public intimacy is that the subjective information revealed in social media becomes the most extensive source of data about individuals, thereby contributing to the functioning of a new regime of surveillance. This new regime of surveillance is characterized by an expansion in the uncertainty that surrounds the criteria surveillance systems utilize to distinguish between prospects and threats. Each component of our modular online identity can be a potential factor that leads to discrimination. And in the end, the individual is left assigned to a category that may not only ignore the complexity of her modular identity but also is virtually (and practically) impossible to challenge because of its automated nature and consequent aura of objectivity.

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KEY TERMS AND DEFINITIONS

Contextual Integrity: Nissenbaum (1998) developed the concept of privacy as *contextual integrity* to propose a normative framework that evaluates the flow of information about individuals. Accordingly, given the multifaceted nature of individuals' identities, contextual integrity is violated when the informational norms associated with a specific social relationship are breached.

Data Mining: *Data mining* refers to a technologically driven process of using algorithms to analyze data from multiple perspectives and extract meaningful patterns that can be used to predict future behavior.

Dataveillance: The concept of *dataveillance* refers to the application of information technologies to monitor individuals' activities by investigating the data trail they leave through their activities.

Interactive Media: *Interactive media* is an umbrella term describing communication media that allow the two-way flow of information between content users and producers.

Public Intimacy: *Public intimacy* suggests an outward move to locate personal matters in the public domain. The emphasis is on the shared discursive spaces of public engagement, rather than inviting spaces of the cultural or personal kind. In other words, public discourses and expressions, even in their most formalized discursive modes, constitute and conjure intimate connections.

Social Media: The concept of *social media* refers to online applications and platforms through which individuals can create and distribute content and communicate with each other.

Social Network Sites: Social network sites are web-based systems that enable end-users to create online profiles, form virtual networks or associations with other users, and view other individuals' profiles.

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 392-403, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 8.4
Analysis of Content Popularity in Social Bookmarking Systems

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ABSTRACT

The recent advent and wide adoption of Social Bookmarking Systems (SBS) has disrupted the traditional model of online content publishing and consumption. Until recently, the majority of content consumed by people was published as a result of a centralized selection process. Nowadays, the large-scale adoption of the Web 2.0 paradigm has diffused the content selection process to the masses. Modern SBS-based applications permit their users to submit their preferred content, comment on and rate the content of other users and establish social relations with each other. As a result, the evolution of popularity of socially bookmarked content constitutes nowadays an overly complex phenomenon calling for a multi-aspect analysis approach. This chapter attempts to provide a unified treatment of the phenomenon by studying four aspects of popularity of socially bookmarked content: (a) the distributional properties of content consumption, (b) its evolution in time, (c) the correlation between the semantics of online content and its popularity, and (d) the impact of online social networks on the content consumption behavior of individuals.

DOI: 10.4018/978-1-60566-816-1.ch011

To this end, a case study is presented where the proposed analysis framework is applied to a large dataset collected from Digg, a popular social bookmarking and rating application.

INTRODUCTION

The emergence of Web 2.0 technologies and the widespread use of applications integrating such technologies have transformed the way people experience and act in online settings. In the first days of the Web, people were excited to browse through and consume online content (mostly static web pages) that was prepared and published by website owners or administrators. Nowadays, digital content consumption – e.g. online article reading, picture viewing and video watching – still appears to be one of the main activities for most internet users[1]. However, the advent of the Web 2.0 application paradigm has transformed the established "browsing-based" online content consumption behavior of users. This change was possible by means of offering users a host of rich interactivity features, such as content sharing, rating as well as online community building. Thus, users of today's Web 2.0 applications are empowered to share, organize, rate and retrieve online content. In addition, users are exposed to the content-related activities of other users and can even form online relations to each other. Consequently, online content consumption within a modern Web 2.0 application constitutes an overly complex phenomenon with interesting dynamics which have not been thoroughly investigated yet.

Social Bookmarking Systems (SBS) hold a prominent place among Web 2.0 applications with respect to content consumption since they provide a platform where users are provided with two significant features:

- Submitting and sharing bookmarks (links) to online resources, e.g. articles, photos or videos, which they consider interesting.
- Indicating their preference or disapproval to bookmarks submitted by other users, by voting for or against the interesting-ness/appeal of online resources and by commenting on them.

In addition to these two features which are fundamental for an SBS, there are two other optional groups of features, namely Taxonomic and Social-Community features. Taxonomic features pertain to the possibilities offered to users for assigning bookmarks to a predefined topic-scheme or for tagging them with freely chosen keywords. Social-Community features enable the users to create "friendship" relations with each other (which can be unilateral or mutual) or to create groups of topical interests. A number of social bookmarking applications have been recently launched. Systems such as *delicious* are meant to be used as general bookmark organization and sharing applications, while there are also social bookmarking applications focused on online news such as *Digg* and *newsvine*, and even niche bookmarking services such as *CiteULike*, used only for bookmarking citations to research articles. Table 1 lists some of the most popular SBS along with their features.

There has been a recent surge in the usage of social bookmarking applications, many of which currently attract several million of unique users per month. An illustrative overview of usage statistics pertaining to the most popular SBS is provided in Table 2, where the top 10 social bookmarking applications are ranked based on the number of unique monthly visitors they attract. Several additional web popularity metrics are provided in the same table, namely the number of inbound links, the Google Page

Rank and the Alexa Rank. According to the table, *Digg*, *StumbleUpon*, propeller and *reddit* are the most popular social bookmarking applications in terms of the number of unique visitors per month. Although *delicious* is the oldest bookmarking application from this list and features the largest number of bookmarks, it appears to attract a smaller number of visitors than its main competitors.

The widespread and intense use of such applications is responsible for the ceaseless creation of massive data sets where the content consumption patterns of users are imprinted. The description and analysis of the intricate phenomena related to these patterns could provide answers to a series of interesting questions:

- What kinds of distributions emerge in the content consumption behavior of the masses?
- How does the attention attracted by a particular online resource evolve over time?
- Is there correlation between the content of a resource (semantics) and its popularity?
- What is the impact of social networking on the consumption of online content?

This chapter provides insights into such questions by investigating recent and ongoing research efforts in the area of Web 2.0 data mining as well as by carrying out an analysis of a large dataset collected from Digg. The next section provides an account of existing studies on the analysis of content consumption behavior within Web 2.0 applications, organized around four research tracks. The third section formalizes a framework for the analysis of content-related phenomena in SBS. The application of this framework is illustrated in the fourth section, with Digg used as a case study. The final two sections of the chapter present an outlook on future trends in this area and conclude the chapter respectively.

BACKGROUND

Considerable research interest has been recently developed in the analysis and modeling of the

Table 1. Taxonomic and social/community features of several social bookmarking services

Application name / URL	Type of Bookmarks	Taxonomic Feats		Social/Community Feats	
		Tags	Topics	Friends	Groups
Digg.com	News		+	+	
www.**StumbleUpon**.com	General	+		+	
www.**propeller**.com	News	+	+	+	+
www.**reddit**.com	News		+	+	
www.**fark**.com	News		+		
www.**newsvine**.com	News	+	+	+	+
delicious.com	General	+		+	
www.**blinklist**.com	General	+		+	
www.**clipmarks**.com	General	+		+	
furl.ne	General	+	+		+
www.**citeulie**.org	Ctation	+			+
bibsonomy.org	Citations	+			+

Table 2. Top 10 Social Bookmarking services ranked by averaging the number of unique visitors as provided by Compete[2] and Quantcast[3]. The number of inbound links was collected from Yahoo! Site Explorer. The data were collected in June 2008.

Site	Monthly Visitors		Inbound Links	Page Rank	Alexa Rank
	Compete	Quantcast			
Digg	**23,988,437** (1)	**19,906,963** (1)	27,589,161 (6)	8	**114**
StumbleUpon	2,338,242 (3)	1,331,110 (3)	160,863,707 (2)	8	372
propeller	1,521,706 (5)	6,055,679 (2)	8,590,778 (7)	7	876
reddit	2,489,583 (2)	1,115,655 (5)	4,859,451 (8)	8	4,074
fark	368,566 (7)	1,235,481 (4)	2,915,127 (9)	5	1,938
newsvine	625,115 (6)	986,471 (6)	66,154,514 (3)	8	6,923
delicious	1,632,204 (4)	420,043 (9)	**462,168,833** (1)	**9**	1,161
blinklist	307,673 (9)	510,838 (7)	43,226,590 (5)	7	5,613
clipmarks	322,011 (8)	448,437 (8)	460,278 (10)	6	6,208
furl	153,987 (10)	79,462 (10)	60,312,568 ()	8	15,914

content consumption behavior of Web 2.0 application users. Much of this research is focused on the mining of web log data where the user transactions are recorded. In our study, we have identified four major research tracks addressing the study of phenomena that arise through the online content consumption by masses of users:

1. *Statistical analysis:* The monitoring of the activities of large user masses enables the application of powerful statistical analyses in order to study the distributional properties of observed variables and to make inferences about the recorded data.
2. *Temporal data mining:* The analysis of content consumption patterns over time is crucial for in-depth understanding of the dynamics emerging in the phenomena that take place within social bookmarking applications. Discovering trends and periodic patterns as well as producing summaries of multiple data streams is the focus of this perspective.
3. *Content semantics:* The lexical and semantic analysis of the content that is consumed within SBS provides insights into the interests of the masses and has broad implications in the design of effective Information Retrieval (IR) systems.
4. *Social network effects:* The influence of the users' online social environment on their content consumption behavior is increasingly important for describing diffusion processes and viral phenomena arising in the SBS user communities.

In order to gain a high-level understanding of the phenomena emerging in complex systems such as SBS, researchers commonly employ statistical analysis techniques; more specifically, they inspect and analyze the distributional properties of the variables observed in the system under study. Previous studies of social, biological and computer systems have confirmed in a series of phenomena the emergence of highly-skewed distributions, frequently taking the form of a *power law*. Power-law distributions – commonly referred to as Zipf's laws or Pareto distributions – provide a statistical model for describing the "rich-get-richer" phenomena frequently appearing in complex systems. Two noteworthy survey studies on power laws are provided by Newman (2005) and Mitzenmacher (2004). In an attempt to explain the emergence of such distributions in complex systems, a series of generative models have been recently proposed; among those, one of the most prominent is the *preferential attachment* model by (Barabási & Albert, 1999). Later in the chapter, we will confirm that the interest attracted by online resources in Digg, as well as the voting patterns of SBS users follow highly-skewed patterns that can be often well approximated by a power law.

Furthermore, analysis of the temporal aspects of phenomena similar to the ones appearing within SBS-like environments provides further insights into the evolution of variables such as the intensity of user activity, or the number of votes that an online resource collects. For instance, the temporal analysis of the user posting and commenting activity in Slashdot, a social bookmarking and public discussion application focused on technology news, revealed that the time intervals between a post and its comments closely follow a log-normal distribution with periodic oscillatory patterns with daily and weekly periods (Kaltenbrunner et al., 2007a). Subsequently, the same authors managed to predict the future Slashdot user activity based on their past behavior by creating prototype activity profiles (Kaltenbrunner et al., 2007b). Another related study is provided by Cha et al. (2007) where the authors analyze the temporal video viewing patterns in YouTube[4] and Daum[5]. In line with these studies, we devote part of this chapter to analyzing the story popularity evolution in Digg as well as the temporal activity profiles of its users.

Another aspect of content popularity pertains to the correlation between the popularity of bookmarked online items (as quantified by number of votes or hits) and their semantics, which are conveyed by means of their textual features[6]. Considerable work has been carried out with the goal of separating between different classes of content based on machine learning methods that make use of features extracted from their text (Yang & Pedersen, 1997). For instance, automatic methods based on machine learning have been devised for differentiating between positive and negative online product reviews (Dave et al., 2003; Pang et al., 2002; Turney, 2002). Further text classification problems involve the automatic classification of textual items based on their utility (Zhang & Varadarajan, 2006) or their quality (Agichtein et al., 2008). In part of the case study presented in this chapter, we examine the potential of automatically predicting whether a given bookmarked item will become popular or not based on its textual content. Although this problem is very complex to tackle by means of the machine learning paradigm adopted in the aforementioned studies, we can establish significant correlations between the popularity of content items and their textual features.

Finally, the study of social network effects on the behavior of users constitutes another analysis perspective for content popularity in social bookmarking applications. In (Richardson & Domingos, 2002), evidence is provided supporting the significance of network effects on a customer's online purchase behavior. In an effort to exploit such effects, Song et al. (2007) propose an information flow model in order to exploit the different information diffusion rates in a network for improving on recommendation and ranking. On the other hand, an empirical study by Leskovec et al. (2007) based on an online recommendation network for online products (e.g. books, music, movies) indicated that there is only limited impact of a user's social environment on his/her purchasing behavior. Finally, the study by Lerman (2007) concludes that the users of Digg tend to prefer stories that their online friends have also found interesting. Here, we define two measures of social influence on (a) content popularity and (b) users' voting behavior, conceptually similar to the ones introduced by Anagnostopoulos et al. (2008). Then, we carry out a set of experiments to quantify the extent of the social influence effects on bookmarked content popularity and consumption in Digg.

SBS ANALYSIS FRAMEWORK

This section introduces the *Diggsonomy* framework, which aims at facilitating the study and the description of the phenomena arising in social bookmarking applications. This framework was originally presented in (Papadopoulos et al., 2008); here, we repeat the definition of the framework. The framework considers an SBS and the finite sets U, R, T, S, D, which stand for the sets of users, resources, timestamps, social relations and votes on resources respectively. Note that T is an ordered set.

Definition 1 (Diggsonomy): Given an SBS, its derived Diggsonomy $\boldsymbol{B}$ is defined as the tuple $\boldsymbol{B} = (U, R, T, S, D)$, where $S \subseteq U \times U$ is the social network of the SBS users, and $D \subseteq U \times R \times T$ is the users' voting set, modeled as a triadic relation between U, R, and T.

Definition 2 (Personomy): The Personomy $\boldsymbol{P_u}$ of a given user $\boldsymbol{u} \in \boldsymbol{U}$ is the restriction of $\boldsymbol{B}$ to u, i.e. $\boldsymbol{P_u} = (R_u, S_u, D_u)$ with $D_u = \{(r, t) \in R \times T \mid (u, r, t) \in D\}$, $S_u = \pi_U(S)$ and $R_u = \pi_R(D_u)$.

Definition 3 (Vote-history): The Vote-history for a particular resource (story) r, denoted as H_r is defined as the projection of the Diggsonomy D on $U \times T$ restricted on r, i.e. $H_r = \pi_{U\times T}(D \mid r) \subseteq U \times T$. The user u_0 for whom the statements $(u_0, t_0) \in H_r$ and $\forall\ t \in \pi_T(H_r)$, $t_0 < t$ hold is called the submitter of the story.

The framework is inspired by the Folksonomy definitions appearing in (Mika, 2005) and (Hotho et al., 2006a). The major difference is that the Diggsonomy formalism enables the description of the temporal aspects of content rating. The notation introduced by this framework will form the basis of the following discussion, which will be organized around the four analysis perspectives that were introduced in the background section:

- Analysis of statistical properties of variables measured in an SBS.
- Temporal analysis of content popularity and user behavior.
- Semantic aspects of popularity.
- Impact of social networks on popularity.

In the rest of this section, each of these perspectives will be discussed separately and existing analysis approaches will be reviewed.

The Heavy Tails of Social Bookmarking

A widely researched and empirically supported model for popularity (and variables generated by skewed distributions) is the power-law distribution. A comprehensive review of the properties observed in such distributions is provided in (Newman, 2005). According to this model, the probability density function of the skewed variable should be described by the following law:

$$p(x) = Cx^{-a} \tag{1}$$

In Equation (1), α is called the exponent or the scaling parameter of the power law (the constant C is part of the model in order to satisfy the requirement that the distribution sums to 1). A straightforward way to empirically identify a power-law is to plot its histogram. However, this might be tricky in practice since the tail of the distribution would appear very noisy (due to the regular histogram binning which is not appropriate for distributions of this nature). A potential solution to this problem would be to employ logarithmic binning; however, a more elegant way to deal with the problem is to calculate and plot the Cumulative Distribution Function (CDF), $P(x)$. Based on Equation (1), we get:

$$P(x) = \int_0^{\infty} p(x')dx' = C\int_0^{\infty} x'^{-a}\, dx' = \frac{C}{a-1} x^{-(a-1)} \quad (2)$$

It appears from Equation (2) that the cumulative distribution function $P(x)$ also follows a power law, but with a different exponent (α-1). Since $P(x)$ is derived by integrating over $p(x)$, the resulting curve has a much smoother tail (integration acts as a low-pass filter), thus rendering clear the power-law nature of the distribution. Also, an important consideration when modeling skewed distributions with power-laws (and other related models) is the range of values for which the power law approximates sufficiently well the real distribution. Typically, a value x_{min} can be identified such that Equation 1 is a reasonable approximation for the distribution only for $x \geq x_{min}$. The employed approach for estimating the parameters α and x_{min} of the power law will be described in the case study section.

A set of quantities measured within real-world complex systems have been reported to exhibit power-law behavior (Newman, 2005). Examples of such quantities are the frequency of words in the text of the *Moby Dick* novel, number of citations to scientific papers, number of calls received AT&T telephone customers and others (Newman, 2005). Recent research on social web data has confirmed the power-law nature of a series of Web 2.0 originating distributions, e.g. tag usage in delicious (Hotho et al., 2006a) and (Halpin et al., 2007), number of votes to questions/answers in the Yahoo! Answers system (Agichtein et al., 2008), video popularity in YouTube and Daum (Cha et al. 2007) and story popularity in Digg (Papadopoulos et al., 2008).

Apart from the classic power-law distribution of Equation (1) reported in the aforementioned works and used for the subsequent analysis of Digg popularity, a set of more elaborate models have recently been proposed in the literature for modeling skewed distributions. For instance, the Discrete Gaussian Exponential is proposed by Bi et al. (2001) as a generalization of the Zipf distribution (i.e. power-law) to model a variety of real-world distributions, e.g. user click-stream data. Furthermore, statistical analysis of the distribution of 29,684 Digg stories by Wu and Huberman (2007) resulted in a log-normal distribution model for the data. The truncated log-normal distribution was also found by Gómez et al. (2008) to accurately describe the in- and out-degree distributions of the Slashdot user network formed on the basis of their participation in the online discussion threads. Finally, the recently formulated Double Pareto log-normal distribution was presented by Seshadri et al. (2008) as an accurate model for a set of variables in a social network created by mobile phone calls.

There are significant benefits in recognizing and understanding the heavy-tail nature of skewed distributions. As pointed by Bi et al. (2001), typical statistical measures such as mean, median and standard deviation are not appropriate for summarizing skewed distributions. In contrast, parametric models, such as the power-law or the log-normal distribution, convey a succinct and accurate view of the observed variable. Furthermore, comparison of the observed variable with the fitted model may reveal deviant behavior (outliers). Similar benefits of employing a parsimonious model such as the power-law to summarize and mine massive data streams that depict skewed distribution were reported in (Cormode & Muthukrishnan, 2005). Finally, the work in (Cha et al., 2007) demonstrated the utility of understanding the heavy-tail content consumption patterns by demonstrating a potential for 40% improvement in video content consumption (in YouTube) by alleviating information delivery inefficiencies of the system (e.g. by recommending niche content lying in the long tail of the distribution). Later in the chapter, we will confirm the emergence of heavy-tail distributions in Digg.

Temporal Patterns of Content Consumption

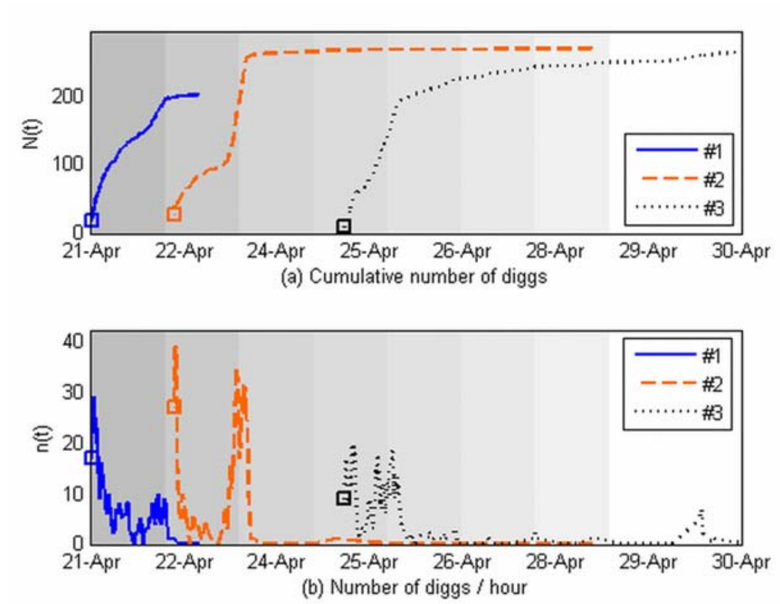
The study of the temporal aspects of online content consumption and rating in the context of a Web 2.0 application has been beneficial for a series of tasks, e.g. planning an online campaign, anticipating voluminous requests for content items or detecting malicious user activities. For instance, by analyzing the temporal activity patterns of Slashdot users (i.e. posting and commenting on posts of others), the authors of (Kaltenbrunner et al., 2007b) could predict with sufficient accuracy the future comment activity attracted by a particular post. Similarly, the study by Cha et al. (2007) presents an analysis of the temporal video content popularity patterns observed in YouTube and demonstrates the potential for short-term popularity prediction. Furthermore, studies of the temporal aspects of story popularity in Digg were carried out by Lerman (2007) and Papadopoulos et al. (2008). In both studies, it was confirmed that Digg stories when moved to the front page of the site go through a staggering popularity growth phase, thus anticipating voluminous user requests for particular content items.

The temporal data appearing within a bookmarking system are usually generated by means of recording event timestamps; specifically, the set of instances when a story collects votes from users constitute the popularity timeline of the particular story (cf. $\pi_T(H_r)$ of Definition 3) and the instances when a user gives votes to stories form his/her activity timeline (cf. $\pi_T(D_u)$ of Definition 2). For convenience, we will denote the raw timestamp set comprising the event instances of object i (where i can either denote a story or a user) in an ordered fashion as $T_i = \{t_0, t_1 .... t_N\}$. The first step in analyzing such data is to select a small but sufficiently representative subset of stories or users and then to inspect their timestamp sets on an individual basis.

However, these timestamp sets are not time series in a typical sense, i.e. they are not the result of measuring the value of a variable at regular intervals. Thus, in order to visually convey the information contained in them in a meaningful way, we consider two kinds of time series based on these raw timestamp sets: (a) the time series of the aggregate count of events at time t, and (b) the time series of the count of events falling in the interval $[t-\Delta t, t+\Delta t]$. For ease of reference, we shall denote the aforementioned time series as $N(t)$ and $n(t)$ respectively. Figure 1 illustrates the characteristics of such time series for a small sample of Digg story popularity time series.

A complication arises when attempting to study the temporal behavior of numerous SBS entities (stories or users) in an aggregate manner: The entities of interest are active in different time intervals and have different activity rates. In order to overcome this complication, we consider the projection on T of the Vote-history set H_r, denoted by $T_r = \pi_T(H_r)$. For each story, we perform the following transformation:

Figure 1. Two alternatives for inspecting event-based time series: (a) cumulative number of Diggs, (b) number of Diggs per hour. Here, three sample Digg story popularity curves are shown



$$T_r = \frac{T_r - \min(T_r)}{\max(T_r) - \min(T_r)} \tag{3}$$

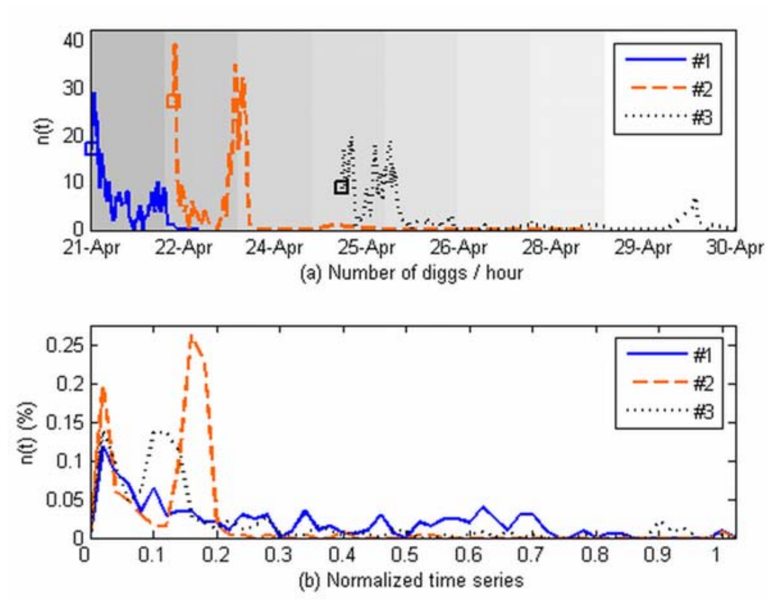
where *min(T)*, *max(T)* return the minimum and maximum timestamp values of the input timestamp set. In that way, it is possible to normalize the temporal activity of an SBS entity to an artificial temporal space spanning the interval [0, 1], which makes it possible to perform a set of operations between time series, e.g. addition, subtraction, averaging and so on. This possibility is of significance since we are particularly interested in deriving an "average" time series which is representative of hundreds or even thousands of time series. Figure 2 depicts the effect of the transformation on the set of time series of Figure 1 (under the representation *n(t)*, i.e. number of events per time interval). One should note that while the transformation removes the notion of temporal scale from the individual time series, it preserves their structural characteristics.

Finally, it is possible to apply the transformation of Equation 3 to a subsequence of a given time series and in that way to map a particular "phase" of a time series to the *[0, 1]* interval with the purpose of comparing the evolution of the phenomenon within this phase to its evolution within the full lifetime of the time series. Comparison between time series phases provides additional insights to the understanding of temporal phenomena, especially in cases where there is prior knowledge that a phenomenon takes place in more than one phases.

Semantic Aspects of Content Popularity

In a social media website where a stream of online stories is continuously flowing through the site's pages, one could argue that the popularity (number of votes) of a given resource (e.g. news article) will strongly correlate with the

Figure 2. The effect of the proposed time series normalization



semantic content featured by the story as well as the linguistic style of the story text. Stories usually appear in the form of a short title and description which should provide sufficient incentive to readers to read the whole story and then vote in favor of it. Therefore, one could attempt to predict which stories will draw the attention of the masses by plain inspection of their textual content. In other words, one could cast the problem of popularity prediction as a text classification task, comprising a feature extraction and a training step (exploited by some machine learning algorithm).

Text classification usually takes place by processing a corpus of documents (bookmarked content items in our case), extracting all possible terms from them and considering them as the dimensions of the vector space where the classification task will be applied. This is commonly referred to as the Vector Space Model (VSM) in the Information Retrieval literature (Salton et al., 1975). However, due to the extremely large variety of vocabulary in large corpora (millions of unique terms), the dimensionality of such a vector space is frequently prohibitive for direct application of the model. The problem gets even worse when combinations of more than one term are considered as text features. For that reason, feature selection (or reduction) techniques are crucial in order to end up with a manageable set of dimensions that are sufficient for the classification task at hand.

In (Yang & Pedersen, 1997), a series of measures were evaluated regarding their effectiveness to select the "proper" features (i.e. these features that would result in higher classification performance). The simplest of these measures is the *Document Frequency* (DF), i.e. the number of content items where the particular feature (term) appears. *Information Gain* (IG) is a more sophisticated feature selection measure. It measures the number of bits of information obtained for class prediction (popular vs. non-popular) by knowing the presence or absence of a term in a document. Further, *Mutual Information* (MI) is an additional criterion for quantifying the importance of a feature in a classification problem; however, Yang & Pedersen (1997) found this measure ineffective for selection of discriminative features. In contrast, they found that the χ^2 *statistic* (CHI), which measures the lack of independence between a term and a class, was quite effective in that respect. Finally, another interesting feature selection measure introduced in the aforementioned paper is the *Term Strength* (TS), which estimates the term importance based on how commonly a term is likely to appear in closely-related documents.

Assuming that a subset of terms from the corpus under study have been selected as features, each content item is processed so that a feature vector (corresponding to the selected feature space) is extracted from it. Then, it is possible to apply a variety of machine learning techniques in order to create a model that permits classification of unknown pieces of texts to one of the predefined classes. Previous efforts in the area of sentiment classification (Dave et al., 2003; Pang et al., 2002) have employed Support Vector Machines (SVM), Naïve Bayes, as well as Maximum Entropy classifiers to tackle this problem.

In our case study, we investigated the potential of popularity prediction based purely on textual features. We conducted a series of feature extraction and text classification experiments on a corpus of 50,000 bookmarked articles. The feature selection measures used to reduce the dimensionality of the feature space were DF and CHI. For the classification task, three standard methods were used: Naïve Bayes (Duda et al., 2001), SVM (Cristianini & Shawe-Taylor, 2000) and C4.5 decision trees (Quinlan, 1993).

Social Impact on SBS Usage

It was previously argued that story popularity depends on the textual content of the particular story. However, it is widely recognized that readers do not select their content in isolation. Users of social bookmarking applications form online relations and are constantly made aware of the preferences and content consumption patterns of other SBS users. Therefore, one would expect the emergence of viral phenomena in online content consumption within an SBS. The value of understanding and exploiting viral phenomena has been already acknowledged in online knowledge sharing communities, for e.g. improving online advertising campaigns (Richardson & Domingos, 2002), understanding viral marketing dynamics (Leskovec et al., 2007) and identifying experts (Zhang et al., 2007). Therefore, we introduce here two measures in order to quantify the social influence on the content rating process. We name these two measures, the u*ser Social Susceptibility* (SS) I_u, and the *story Social Influence Gain* (SIG) I_r.

Definition 4 (Social Susceptibility - SS): The social susceptibility of a given user u denoted by I_u quantifies the extent to which his/her voting behavior (as expressed by his voting set D_u) follows the behavior of his/her friends' voting behavior (denoted by $D_u{}'$).

$$I_u = \frac{|D_u^{'}|}{|D_u|} \tag{4}$$

Definition 5 (Social Influence Gain - SIG): The social influence gain for a given story r denoted by I_r is a measure of the extent to which r has benefited from the social network of the story submitter.

$$I_r = \frac{|H_r^{'}|}{|H_r|} \text{ where}$$

$$H_r^{'} = \{(u, t_k) \in H_r \mid \exists(u_0, t_0) \in H_r, u_0 \in S_U, t_0 < t_k\} \tag{4}$$

and u_0 is the submitter of the story as defined in Definition 3.

SS and SIG are similar in nature to the concept of *Social Correlation* as discussed in (Anagnostopoulos et al., 2008). Social Correlation (SC) within an SBS can be defined either for two users, u_1, u_2 as the Jaccard coefficient of the sets R_{u1} and R_{u2} (cf. Definition 2) or for a single user u as the proportion of his/her stories that are common with the stories of the users of his/her social network. Here, we adopt the latter definition since it is directly comparable with the SS of a user, i.e. it can be derived by removing the temporal constraint from Equation 4. Note that SC may be attributed to a combination of the following: (a) an inherent tendency of friends to have similar interests (homophily), (b) some external factor causing two users to vote in favor of the same story (confounding) and (c) the possibility for users to see through the Digg interface which stories their friends have already dugg (influence). By imposing temporal constraints in Equations 4 and 5, we attempt to isolate the effect of (a) and (b) in order to use SS and SIG as measures of social influence rather than measures of generic SC.

CASE STUDY: SOCIAL BOOKMARKING PATTERNS IN DIGG

Since the case study for the discussion of the chapter is based on data collected from Digg, a short introduction on the specifics of the application will precede the presentation of the data analysis in order to facilitate the interpretation of the derived results. The basic rationale of Digg is the discovery of interesting web resources (or *stories* as they are commonly called in Digg-speak) by means of empowering simple users to submit and then collectively decide upon the significance (or interesting-ness) of the submitted web items (mostly news items, images and videos). In other words, Digg can be considered as an example of a Social Media application. When a story is submitted, it appears in the *Upcoming* section of the site, where stories are displayed in reverse chronological order. Users may vote on a story by "Digging" it. Digging a story a story saves it to a user's history (obviously a given user may Digg a particular story only once). There is also the possibility to "bury" a story, if one considers it to be spam or inappropriate material.

When a story collects enough votes, it is promoted to the *Popular* section, which is also the front page of the site. The vast majority of people who visit Digg daily or subscribe to its RSS feeds, mostly read the front page stories; thus the story exposure to the online public increases steeply, once it is transferred to the Popular section. The exact promotion mechanism is not disclosed to the public and is modified periodically in order to prevent malicious efforts of artificially promoting a story. The service moderators state that consensus by many independent users is required in order for a story to become popular.

Stories are categorized by media type (i.e. news, videos, images, and podcasts) and topic. Additionally, there is a predefined two-level topic hierarchy available for use, which is specified in Table 3. Apart from these story browsing capabilities, the application also features user-based story browsing, i.e. one can browse through the stories dugg by a particular user. Finally, it enables users to form social networks, by adding other users to their list of "friends". Such "friendship" relations are one-way (i.e. it takes

Table 3. Topic hierarchy of Digg

Container	Topic
Technology	Apple, Design, Gadgets, Hardware, Industry News, Linux/Unix, Microsoft, Mods, Programming, Security, Software
World & Business	Apple, Design, Gadgets, Hardware, Industry News, Linux/Unix, Microsoft, Mods, Programming, Security, Software
Science	Environment, General Sciences, Space
Gaming	Industry News, PC Games, Playable Web Games, Nintendo, PlayStation, Xbox
Lifestyle	Arts & Culture, Autos, Educational, Food & Drink, Health, Travel & Places
Entertainment	Celebrity, Movies, Music, Television, Comics & Animation
Sports	Baseball, Basketball, Extreme, Football (US/Canada), Golf, Hockey, Motorsport, Olympics, Soccer, Tennis, Other Sports
Offbeat	Comedy, Odd Stuff, People, Pets & Animals

both users to add each other to their friends list in order to have a mutual relation).

Apart from the basic SBS functionality mentioned above, the application offers a set of features for personalized reaction to content, more specifically it enables users to comment on stories, approve/disapprove of comments of others and blog on stories (i.e. write and submit a post to their own blog through Digg). Also, it is worth noting that a story recommendation engine has been recently launched (in July 2008) which recommends news items to users based on their past activity.

The bulk of the click stream generated by the masses of Digg users is made publicly accessible via a RESTful API. The analyses presented in the subsequent sections have been based on data downloaded via this API. The downloaded data contain information about the stories (title, description, container, topic, number of Diggs, number of comments, etc.), the users (username, subscription date, and friends) and the Diggs collected by stories (story, username, and timestamp). A first set of stories was collected by constantly monitoring the stories submitted to the site during the week between 24 and 30 April 2008. A set of 109,360 stories, S_0, were collected during this phase. This set of stories was submitted by a set of 34,593 users, U_0, who were used as seeds to collect data about a total of 354,150 users by requesting for the friends and the friends' friends of each user *u* belonging to U_0. Finally, the full Digging history for a random sample of these users was collected (both the Diggs and the stories that were dugg). In that way, a total of 98,034,660 Diggs given to 2,084,498 stories were collected. We will refer to the sets U_0 and S_0 of users and stories that were gathered in the first data collection phase as the *core* dataset, while the rest of the dataset will be referred to as *extended* dataset. It occasionally happened that stories or users were removed from the system (probably due to spamming behavior) in which case they were also removed from the local dataset.

Statistical Analysis of Digg Usage

The first step of our analysis involved the study of the heavy-tail nature of several variables of interest arising through the mass usage of Digg. The following distributions were examined:

- Diggs collected by stories.
- Comments collected by stories.
- Diggs given by users.
- Friends in the Digg social networks of users.

Figure 3: Four heavy-tail Digg Cumulative Distribution Functions (CDF) and their power-law approximations: (a) Diggs per story, (b) comments per story, (c) Diggs per user, and (d) Digg friends per user.

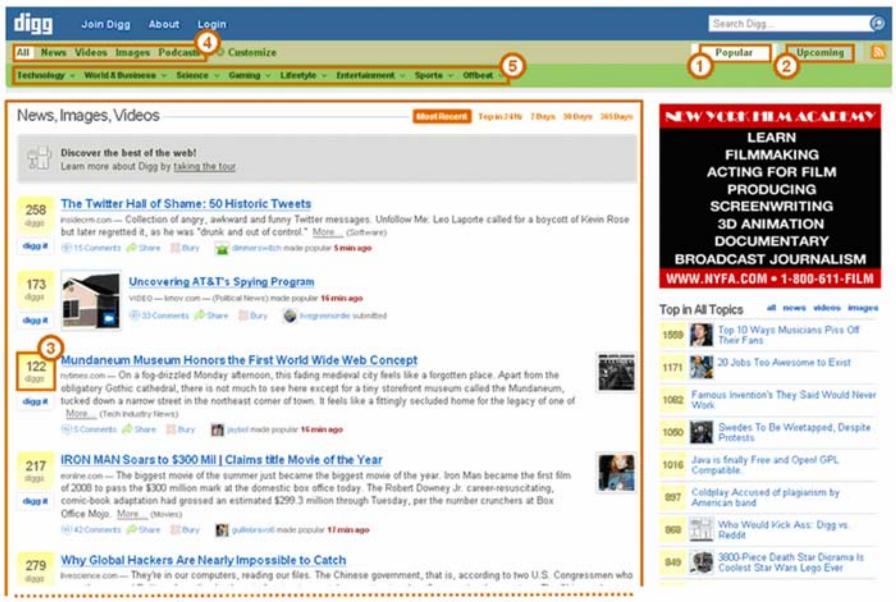


Figure 3 provides logarithmic plots of the aforementioned distributions. The figure renders clear the heavy-tail nature of the depicted distributions, by overlaying on top of the observed distributions their power-law fits according to the fitting method presented by Clauset et al. (2007). The proposed method employs an approximation to the Maximum Likelihood Estimator (MLE) for the scaling parameter of the power law:

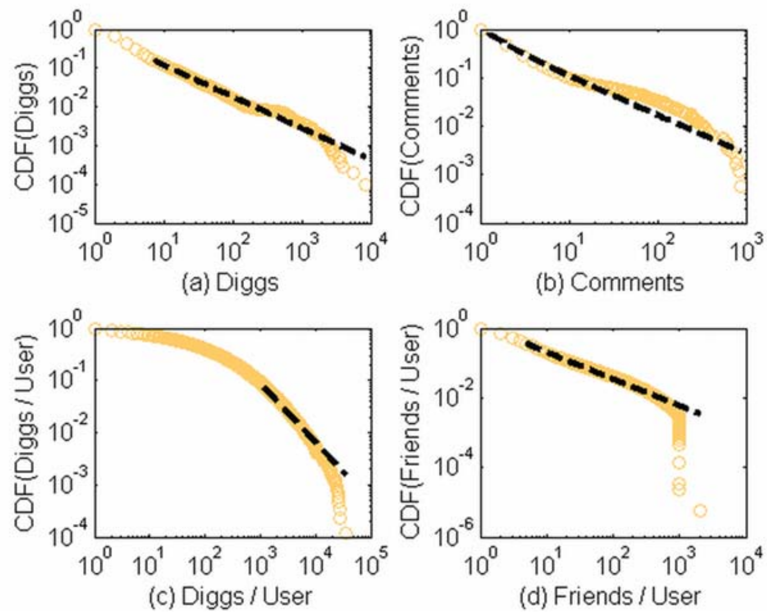
$$\hat{a} \cong 1 + n\left[\sum_{i=1}^{n} \ln \frac{x_i}{x_{\min} - \frac{1}{2}}\right]^{-1} \tag{6}$$

This estimator assumes that the value x_{min} above which the power law holds is known. In order to estimate this value, the authors recommend the use of the Kolmogorov-Smirnov (KS) statistic as a measure of goodness-of-fit of the model with parameters (α, x_{min}) with the observed data. The KS statistic is defined as the maximum distance between the CDF of the data *S(x)* and the fitted model *P(x)*:

$$D = \max_{x \geq x_{\min}} | S(x) - P(x) | \tag{7}$$

Apparently, the plain power-law model is not sufficient for accurately fitting all of the observed distributions. For instance, the shape of the distribution of Diggs per user in Figure 3(c) indicates that a truncated log-normal distribution would be a better fit for the observed variable. Further, by inspection of the number of friends per user, a few conspicuous outliers can be identified that deviate significantly from the fitted power-law.

Figure 4. Two possible popularity evolution patterns. Note the two different phases in the popularity evolution for stories that are selected for the 'Popular' section of the site

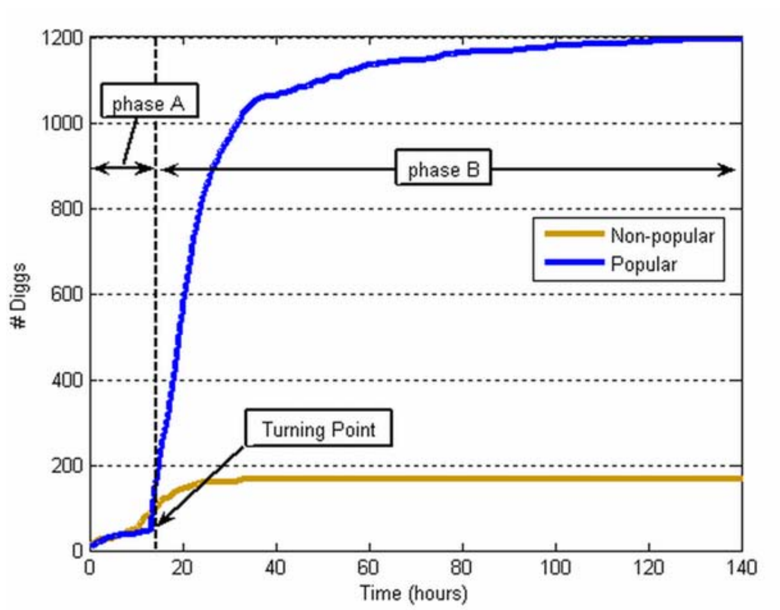


Temporal Analysis of Content Consumption

The temporal study of story popularity curves and user activity of Digg was carried out by means of the temporal representation and aggregation framework presented in the previous section. Based on that, a first noteworthy observation about the popularity of submitted stories in Digg is that they typically evolve in two ways: (a) they reach a plateau of popularity while in the 'Upcoming' section of the site and remain there until they are completely removed in case they do not receive any Diggs for a long time, (b) they attain the 'Popular' status after some time and they are moved to the 'Popular' section, where they undergo a second phase of popularity growth at a much higher intensity. Figure 4 depicts the cumulative number of Diggs, *N(t)*, collected by a sample popular and a sample non-popular story during their lifetime. For convenience, we denote the set of unpopular stories as R_U and the set of popular stories as R_P[7].

After establishing by inspection the difference of temporal evolution between popular and non-popular stories, we then proceed with comparing the distributions of their Digg arrival times. To this end, the time series, *n(t)*, of 5,468 non-popular and 852 popular stories, which were normalized by means of the transformation of Equation 5, were aggregated[8]. This resulted in the distributions of Figure 5. Together with the distributions we present the areas of confidence for their values; more specifically, around each instance *n(t)*, we draw the interval $[n(t)-\sigma_n/3, n(t)+\sigma_n/3]$. In 6(a), the time series of the number of Diggs *n(t)* is normalized with respect to the total number of Diggs throughout the whole lifetime of each story. In that way, it is possible to directly compare the local temporal structures of popular stories to the ones of the non-popular stories. In Figure 5(b), we present the absolute number of Diggs per hour in order to provide a

Figure 5. Digg arrival time distributions of popular vs. non-popular stories



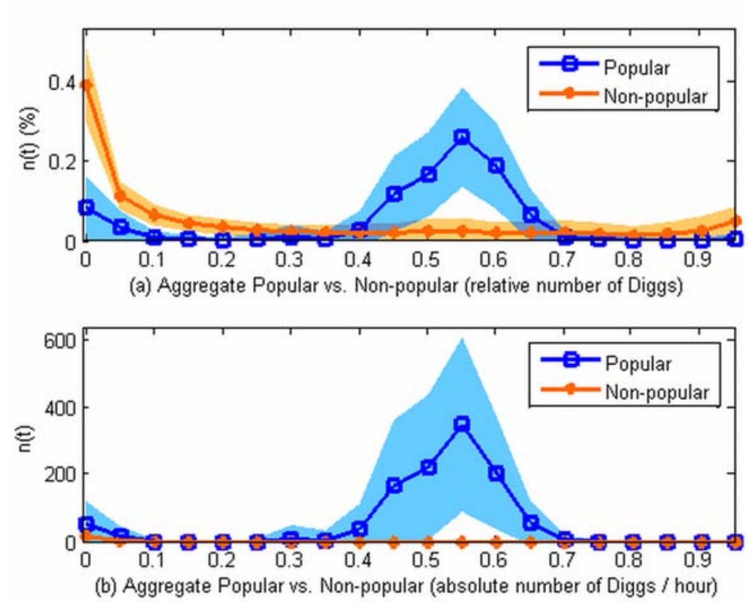
complete picture of the comparison between the popular and the non-popular stories.

Figure 5 clearly illustrates the fact that while the non-popular stories gather the majority of their Diggs during the very first moments of their lifetime (first two bins in the histogram), the popular ones are characterized by two growth stages: (a) a first growth stage which is similar to the full lifetime of the non-popular stories, i.e. it is characterized by a monotonically decreasing trend, (b) a second growth stage, which takes place once a story is moved to the 'Popular' section of the site and is characterized by a steep increase in the number of votes that a story receives.

The intensity of popularity growth for the stories that become members of R_P can be attributed to the high exposure that these stories get for a few minutes after they are moved to the 'Popular' section (which happens to be the front page of Digg). Also, one should note that big search engines regularly index and rank favorably the most popular stories of Digg (and stories coming from other SBS and social media applications) and thus they act as a secondary source of exposure for these stories, which contributes to sustain their popularity growth for some time.

After analyzing the temporal evolution of story popularity, we apply a similar analysis on the user Digging behavior. For such a study, we investigate the structure of the time series that are formed from counting the number of Diggs given by users to stories that fall within the interval *[t-Δt, t+Δt]*. Figure 6 presents the result of aggregating the user activity over 539 users drawn randomly from the set of users belonging to D_0^9. Inspection of the outer diagram reveals that Digg users are intensively active during the very first period after subscription to the service (note the extremely high number of Diggs occurring in the first 5-10% of the users' lifetime). This is not particularly surprising since users are more enthusiastic and eager to explore the service once they discover it. As time goes

Figure 6. Aggregate user Digging behavior. In subfigure 6(a), the embedded graph contains a zoomed view of the [0.1, 1.0] interval



by, their enthusiasm wears off resulting in more stable usage patterns.

A further noteworthy observation can be made by comparing the aggregate user activity time of Figure 6(a) series with the three sample activity time series of Figure 6(b) which come from three individual users. It appears that the individual activity time series do not present any distinct pattern. On the other hand, the aggregate activity is quite stable (though the high variance indicated by the magnitude of the shaded area in 6(a) implies the instability of the individual time series). Thus, it appears that a set of independent behavior patterns of individuals leads to a stable mass behavior when aggregated.

Semantic Aspects of Digg Story Popularity

In this section, we are going to employ the previously discussed feature selection and text classification techniques in order to investigate the potential of popularity prediction based on text features. For that reason, we consider large samples of stories out of the dataset collected from Digg. The majority of Digg stories are written in English, with few stories being in German, Spanish, Chinese and Arabic. We filtered out such non-English text items by means of checking against characters or symbols that are particular

Table 4. Two-way contingency table of term t

	Popular	Non-popular
Term exists	A	B
Term doesn't exist	C	D

Table 5. Top 30 text features based on χ^2 statistic

#	Term	χ^2 (10^6)	#	Term	χ^2 (10^6)	#	Term	χ^2 (10^6)
1	see	61.5	11	seen	7.7	21	news	4.2
2	drive	60.4	12	nintendo	7.6	22	making	4.1
3	japanese	28.5	13	program	5.6	23	breaking	4.0
4	video	17.2	14	way	5.4	24	amazing	3.5
5	google	12.9	15	gets	5.2	25	say	3.4
6	long	11.7	16	computer	4.9	26	coolest	3.4
7	cool	11.0	17	need	4.8	27	release	3.3
8	term	9.9	18	want	4.7	28	right	.9
9	look	8.8	9	play	4.7	29	xbox	2.8
10	high	7.9	20	job	4.3	30	looks	.5

to those languages (e.g. characters with umlaut, non-ASCII characters, etc.).

First, a random sample of $N = 50{,}000$ English Digg stories was drawn from the extended dataset and was processed to extract the text features. For each story, the information on whether it became popular or not was available, so, after extracting all terms from the Digg stories, it was possible to create the two-way contingency matrix of Table 4 for each term t. According to this, A is the number of popular stories containing term t, B the number of non-popular stories containing t, and C and D are the number of popular and non-popular stories respectively that don't contain term t.

Then, the χ^2 statistic is calculated based on the following equation:

Table 6. Top 10 features ranked by χ^2 statistic for four Digg topics. The respective topic corpora consist of 50,000 documents each

	Technology		World & Business		Entertainment		Sports	
#	Term	χ^2	Term	χ^2	Term	χ^2	Term	χ^2
1	Apple	1215.88	Bush	2532.04	RIAA	1457.53	Amazing	1264.88
2	Windows	1080.11	president	1456.52	Movie	1346.79	Nfl	1181.59
3	Linux	995.02	Iraq	1182.86	movies	1015.56	game	1158.17
4	Google	945.72	house	1016.15	Industry	940.50	baseball	1146.77
5	Firefox	919.13	years	974.60	Time	727.12	time	1040.09
6	Just	784.83	administration	964.33	Just	672.92	history	975.46
7	Digg	773.09	congress	872.78	Show	671.09	year	972.57
8	Mac	756.55	officials	841.12	Says	647.37	just	894.85
9	OS	715.56	war	27.25	ilm	635.63	Top	892.82
10	check	643.97	federal	18.37	Lost	628.37	player	877.17

Table 7. Popularity prediction results, namely Precision (P), Recall (R) and F-measure (F). Classifier abbreviations used: NB → Naïve Bayes, SVM → Support Vector Machines and C4.5 → Quinlan's decision trees. Tests were carried out with the use of 500 features on a 50,000 story randomly selected corpus and by use of 10-fold cross validation to obtain the recorded measures

		Popular			Non-popular		
Classifier	**Accuracy (%)**	**P**	**R**	**F**	**P**	**R**	**F**
NB (CHI)	67.21	0.160	0.426	0.233	0.903	0.705	0.791
NB (DF)	88.32	1.000	0.001	0.003	0.883	1.000	0.938
SVM (CHI)	88.10	0.130	0.003	0.006	0.883	0.997	0.937
C4.5 (CHI)	88.18	0.222	0.004	0.008	0.883	0.998	0.937

$$\chi^2(t) = \frac{N \cdot (A \cdot D - C \cdot B)^2}{(A + C) \cdot (B + D) \cdot (A + B) \cdot (C + D)} \tag{8}$$

The χ^2 statistic naturally takes a value of zero if term *t* and the class of Popular stories are independent. The measure is only problematic when any of the contingency table cells is lightly populated, which is the case for low-frequency terms. For that reason, we filter low-frequency terms prior to the calculation of Equation 8. In addition, stop words and numeric strings were also filtered out of the feature selection process. In order to keep the experiments simple, no stemming or other term normalization was carried out. Table 5 lists the top 30 terms of this story set along with their χ^2 scores. Although not very informative to the human inspector, these keywords can be considered as the most appropriate (from a text feature perspective) for use in making the distinction between Popular and Non-popular stories.

In order to get a more fine-grained view of such keywords per topic, we also calculate the χ^2 scores on independent corpora that contain stories

Table 8. Popularity prediction results when features are selected per topic. Classification was done by means of the Naïve Bayes classifier with the use of 500 features selected based on CHI. For each topic, 50,000 stories were used as dataset and 10-fold cross-validation was used to obtain the performance results

		Popular			Non-popular		
Topic	**Accuracy (%)**	**P**	**R**	**F**	**P**	**R**	**F**
Entertainment	71.39	0.108	0.418	0.172	0.943	0.737	0.827
Gaming	70.26	0.152	0.389	0.218	0.910	0.740	0.816
Lifestyle	72.53	0.121	0.432	0.189	0.943	0.749	0.835
Offbeat	69.03	0.124	0.409	0.191	0.925	0.718	0.809
Science	64.71	0.141	0.444	0.214	0.909	0.672	0.560
Sport	65.79	0.079	0.538	0.138	0.964	0.664	0.787
Technology	67.53	0.159	0.415	0.230	0.902	0.710	0.794
World & B.	65.84	0.098	0.457	0.161	0.941	0.674	0.786

only from particular topics. Table 6 provides such a topic-specific χ^2-based ranking of terms.

After ranking the terms of each corpus based on their class separation ability, it is possible to select the top *K* of them and use them in an automatic text classification scheme. Table 7 presents the results achieved by such a classification scheme, i.e. the success of predicting the popularity of Digg stories, where three classifiers are compared, namely a Naïve Bayes classifier, an SVM and a C4.5 decision tree. The dataset used consists of 50,000 randomly selected stories and the performance metrics were calculated by use of 10-fold cross validation (i.e. repeated splitting of the dataset to 10 parts and usage of nine of them for training and one of them for testing).

Although in terms of accuracy, the combination of Naïve Bayes with DF-selected features appears to perform best, a closer examination of the Precision and Recall measures obtained separately for the classes Popular and Non-popular provides a different insight. Specifically, it appears that all classifiers have trouble achieving descent classification performance when the input stories are Popular. That means that classifiers can predict accurately that a story will remain Non-popular (when indeed that is the case), but they usually fail to identify Popular stories. The combination of Naïve Bayes with CHI-selected features is better in that respect. The aforementioned problem is related to the well recognized *class imbalance* problem in machine learning (Japkowicz, 2000). Indeed, in the 50,000 stories of the evaluation dataset the ratio of Popular to Non-popular stories is 0.132, i.e. there is almost only one Popular story for every ten Non-popular ones.

Similar results are also obtained for the case that the feature selection and classification process is applied separately per topic. The results of Table 8 provide the respective evidence.

Social Impact on Digg Story Popularity

The last part of our case study involved the estimation of the distributions for the social influence measures of Definitions 4 and 5, namely the SS of Digg users, as well as the story SIG values. These estimations were based on a subset of users and stories randomly selected[10] from the core dataset. From Equations 4 and 5, it is clear that these computations require data that fall outside the core data set (e.g. the Personomies

Figure 7. (a) Scatter plot of social correlation vs. social susceptibility, (b) Social susceptibility distributions for frequent vs. circumstantial users

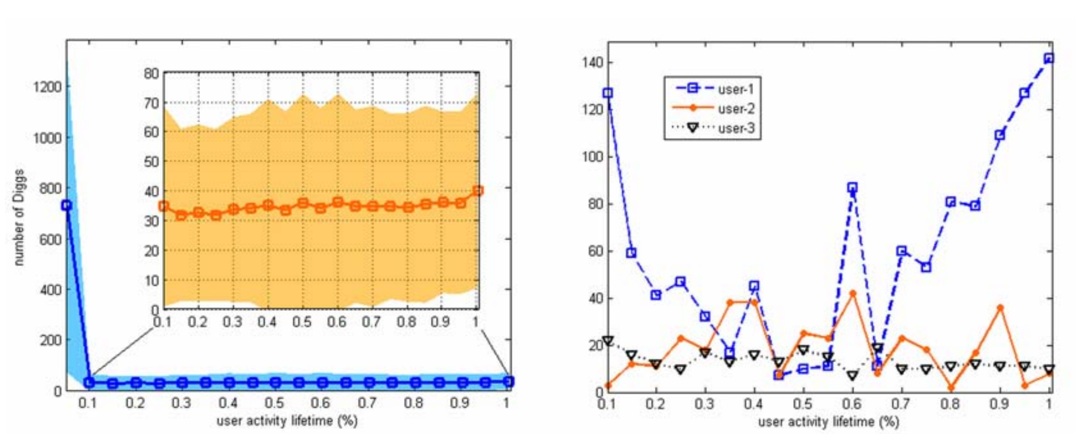
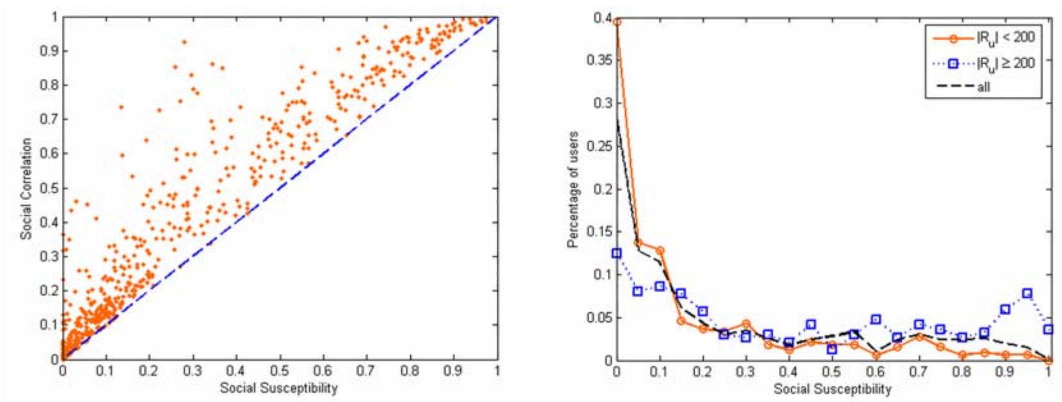


Figure 8. Distribution of story social influence gain (SIG) for popular and non-popular stories



of the users' friends); it was for this reason that the extended dataset was collected.

The estimation of the SS distribution was based on a random sample of 672 users, of whom the SC and SS values were computed. Inspection of the scatter plot of the SC versus the SS of these users, cf. Figure 7(a), reveals that social susceptibility closely follows social correlation. That means that in most cases, when a story has been dugg by both a user and one or more of his/her friends, it is likely that the one or more of the user's friends dugg the story before the user. Few users deviate from this behavior and can thus be considered as the *opinion leaders* of the system (the more a point in Figure 7(a) deviates from the unitary straight line the more the user represented by this point can be considered an opinion leader).

Furthermore, a look into the user SS distributions as presented in Figure 7(b) indicates that the majority of circumstantial Digg users (these users that have dugg a story less than 200 times) present low social susceptibility. In contrast, Digg users with more intense activity tend to be influenced by their social network at a higher frequency. This may indicate that the more users are active within the system the more they rely on their online friends as a source of potentially interesting content.

Finally, insights into the mechanism of story promotion employed by Digg are provided through study of the story SIG patterns. Figure 8 clearly depicts the difference in the SIG distributions between the popular and the non-popular stories. These distributions were estimated by sampling 830 popular and 5076 non-popular stories and computing their respective SIG values. The histograms indicate that the event of a story with $I_r > 0.35$ becoming popular is highly unlikely while in contrast it is very common for non-popular stories to take SIG values in the interval *[0.2, 0.7]*. This could support the hypothesis that high SIG for a story implies low probability of becoming popular; however, instead of the above conclusion, we would rather speculate that Digg employs filters based on social measures similar to I_r to prevent groups of 'friends' from gaining control over which stories appear in the 'Popular' section[11].

FUTURE TRENDS

The startling success of social web applications may be just the preamble in the new era of information and communication technologies we are currently entering. Although it is extremely risky to attempt even rough predictions concerning the future of Social

Web, we would like to take this chance and provide a sketch of the future trends in systems involving the creation, discovery, rating and organization of digital content by masses of users.

In the short term, we anticipate the proliferation of existing social media applications such as Digg, reddit and newsvine, as well as the take-off of mobile social web applications, such as Twitter, used for micro-blogging through mobile devices (Java et al., 2007). Further, existing and new applications will incorporate personalization and context-awareness features, thus meshing with the daily reality of people. Thus, data will be recorded that will capture all aspects of people's lives, such that new insights into human behavior will be possible through "reality mining" (Eagle & Pentland, 2006), raising new concerns about privacy. By closely monitoring the actions of the individual, machine learning will be employed to predict future consumption patterns, e.g. in order to enable effective personalized advertising schemes (Piwowarski & Zaragoza, 2007) or to spawn social interactions between strangers based on profile matching (Eagle & Pentland, 2005).

There is already evidence that the analysis of data coming from social bookmarking usage can be beneficial for search engine tasks, such as new website discovery and authoritative online resource identification (Heymann et al., 2008). In the long run, advanced information extraction and semantic analysis techniques, e.g. automatic quality evaluation of user contributed content (Hu et al., 2007), are expected to be deployed in real-world applications (e.g. Wikipedia) and provide the basis for even more advanced collaborative applications, such as innovation management platforms (Perlich et al., 2007). The requirements of such applications will in turn instigate research into underlying technology disciplines, i.e. database systems for the support of online community services and collaborative platforms (Ramakrishnan, 2007), as well as frameworks for scalable knowledge discovery from streaming data (Faloutsos et al., 2007).

CONCLUSION

The widespread adoption of SBS has transformed online content consumption due to the powerful features that such systems offer to their users. The possibility for users to submit links to content of their interest, tag, rate and comment on online resources submitted by other users as well as to form relations with each other has stimulated intensive user activity in SBS, such that massive amounts of web activity data capturing the content consumption patterns of users are produced in a streaming fashion. This novel content consumption paradigm has spawned a series of interesting research questions related to the generation and evolution of such patterns. These questions pertain to the distributional attributes of online resource popularity, the temporal patterns of content consumption by users, the semantic as well as the social factors affecting the behavior of the masses with regard to their preferences for online resources.

This chapter presented an overview of existing research efforts that are germane to these questions and provided additional insights into the phenomena taking place in the context of an SBS by carrying out an analysis of a large dataset collected from Digg. The power-law nature of web resource popularity was established in accordance with previous studies of similar online systems (Cha et al; 2007, Hotho et al., 2006a; Halpin et al., 2007). Furthermore, a set of characteristic temporal patterns of content consumption were revealed which confirmed previous findings about social media content popularity evolution (Lerman; 2007). In addition, a preliminary investigation into the semantic elements of content popularity lent support to the hypothesis that popularity is affected by the semantic content and the linguistic style. What is more, it was empirically shown that users of SBS are socially susceptible, i.e. they tend to express interest for online resources that are also considered interesting by their online "friends".

Finally, the chapter provided an outlook on the exciting new prospects for online content publishing and mining on the massive amounts of data produced in the context of SBS and related applications.

ACKNOWLEDGMENT

This work was supported by the WeKnowIt project, partially funded by the European Commission, under contract number FP7-215453.

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ENDNOTES

1 An estimate of the allocation of internet users' time to different online activities is provided by the Online Publishers Association through the Internet Activity Index (IAI) in: http://www.online-publishers.org.

2 http://www.compete.com

3 http://www.quantcast.com

4 http://www.youtube.com

5 http://ucc.daum.net

6 Although the semantics of a digital resource can be also conveyed by other kinds of features (e.g. audio, visual), we restrict our study to the semantics conveyed by textual features of the content.

7 Whether a story jumps to the 'Popular' section or not does not solely depend on the number of Diggs it receives (although it is certainly taken into account). The Digg administrators make this decision on the basis of a set of proprietary criteria and heuristics, which they keep secret since sharing such knowledge would render the system prone to malicious attacks (e.g. to artificially boost the popularity of a story).

8 Only stories with $|H_r| > 20$ were studied to prevent the 'noisy' time series from distorting the resulting aggregate time series of the non-popular stories.

[9] Users with $|R_u| < 20$ *were not considered in the sample selection in order to prevent users with sparse (and therefore noisy) activity to affect the aggregate activity time series.*

[10] The filtering rules of $|R_u| > 20$ and $|H_r| > 20$ (same as above) were applied here too.

[11] The post in http://blog.Digg.com/?p=106 provides further evidence in favor of this speculation.

This work was previously published in Evolving Application Domains of Data Warehousing and Mining: Trends and Solutions, edited by P. N. San-Bento Furtado, pp. 233-257, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 8.5
Conceptualizing Codes of Conduct in Social Networking Communities

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ABSTRACT

This chapter reviews the capabilities of social networking tools and links those capabilities to recent legal and ethical controversies involving use of social networking tools such as Facebook and MySpace. A social cognitive moral framework is applied to explore and analyze the ethical issues present in these incidents. Three ethical vulnerabilities are identified in the use of social networking tools: 1) the medium provides a magnified forum for public humiliation or hazing, 2) a blurring of boundaries exists between private and public information on social networking sites, and 3) the medium merges individuals' professional and non-professional identities. Prevalent legal and social responses to these kinds of incidents are considered and implications are suggested for encouraging responsible use. The chapter includes a description of the authors' current research with preservice students involving an intervention whereby students read and think about real cases where educators use social networking. The intervention was created to improve students' critical thinking about the ethical issues involved. Recommendations for applying institutional codes of conduct to ethical dilemmas involving online tools are discussed.

DOI: 10.4018/978-1-60566-729-4.ch002

INTRODUCTION

Social networking sites such as Facebook and MySpace have become ubiquitous. Whereas email was the electronic communication norm in the late twentieth century, social networking is rapidly replacing email as the most favored means of networking, connecting, and staying in touch. In fact, MySpace is the sixth most visited site on the Internet (Alexa, 2008) and Facebook is the world's largest and the fastest growing social networking site (Schonfeld, 2008). These tools are quite popular with teenagers, college-age students, and young professionals because they allow them to more easily stay connected. Using social networking sites, individuals can present themselves to others through an online identity that is tailored to their unique interests and desires, and participate in a variety of interconnected communication networks - personal, professional, creative, or informative. However, when individuals create a personal space online, they also create a digital footprint—the kind of footprint that can be permanent. And when a trail of personal information is left behind in a searchable and open format, notions of public and private information are challenged and the potential for liabilities may be high. This is of particular importance to those who wish to convey a professional image. An online profile that may have seemed innocuous and private during one stage of life may haunt an individual at the point in their life when they transition from student to professional.

For educational institutions, the widespread popularity of social networking sites as a means of communication, provide in-roads for experimenting with ways to connect with clientele. While innovative educators are quick to embrace and harness the learning potential of Web 2.0 tools, an understanding of the ethical issues in these unusual forms of social interaction has been slower to develop. Undoubtedly there are value-added features, many of which are yet to be discovered; but some institutions are refusing to innovate with this powerful technology tool due to the risks involved.

In order to design and endorse effective use of these tools, educators need socially responsible models and guidelines. What are the ethical considerations required of online social networking, and how can educational organizations capitalize on this innovative means of communicating while promoting responsible use? This chapter will highlight legal and ethical controversies surrounding social networking sites, identify ethical vulnerabilities associated with using the online tools through a social cognitive moral framework, and discuss implications for promoting socially responsible use of social networking tools.

BACKGROUND

Our inquiries into this topic began when one of the authors of this chapter encountered a situation involving social networking in her preservice teacher education class. What started as a class assignment turned into a moral and ethical dilemma for the instructor when a student revealed his MySpace profile as a part of a larger class assignment. Students were to create a homepage and provide three links to sites that a future teacher might use in the classroom as part of a lesson plan. Many students chose to link to their MySpace profiles as part of the assignment, but one particular link captured the attention of the instructor who was not prepared for what she saw—a MySpace profile showing a bloody machete stabbed into a hand with the caption that read, "Twist the hand that forces you to write." Other images and words on the profile were equally disturbing. The personal icon used to identify the profile owner was an image of a cut wrist with directions on how to commit suicide. The instructor wondered why a student would turn in what seemed to be a private and personal site as part of a class assignment. Perhaps Web 2.0 and online social networking caused this student to think differently than the instructor about revealing private thoughts in such a public forum. Because technology users in the Web 2.0 environment can be both consumers and creators of information, similar scenarios are occurring often. At what point is the boundary crossed when sharing information about self and others via social networking tools? And who draws that line? The ability to communicate personal, informational, or editorial information en masse—at the click of a mouse—poses new and different ethical dilemmas not as prevalent in the pre-Web 2.0 world. And this issue is compounded by the fact that as users share authored information with others, they invite countless people into their personal space. Social networking creates a window into users' lives that is much more immediate, permanent, and impactful than ever before.

Social Networking Tools and Their Capabilities

Social networking sites are Websites designed to bring together groups of people in order to communicate around shared interests or activities (Wikipedia, 2008). Because meeting places are virtual, the idea that any two people can be connected through several intermediaries, commonly known as "six degrees of separation," is magnified and expanded (Leskovec & Horvitz, 2007). This kind of interconnectivity among individuals would be impossible without the Web. The online manifestation of social networking typically refers to a minimum of three networking capacities, first popularized by Friendster in 2002. This includes publicly displayed profiles, publicly accessible lists of friends, and virtual walls for comments or testimonials (boyd, 2008). In any of the myriad social networking sites created since Friendster, individuals can join a Web service, and then design a profile to showcase and highlight personal information, hobbies, employment and any other topics they wish to be shared. Upon becoming a member of an online social network, the user can communicate with other members or groups, link their profile to others, and even invite those outside the social networking site to join the system and link to their profile. Thus, a network continually expands.

Revisiting the story of the student with the disturbing MySpace profile highlights the differences between in-person and online social networks. Prior to viewing the profile, the instructor had only the day-to-day interactions in the classroom to form an opinion of the student. The informal social network of this student was not revealed to the instructor prior to viewing the MySpace profile. However, it was the student's choice to share the public profile with the instructor, and when that happened the cloak over a previously invisible network was removed and a facet of this student's life that was markedly different than his in-class persona was revealed. The instructor had more information from which to form an opinion of the student, and could not help but think differently about the student from that day forth. However, the student was naively unaware of impact that his online profile had on interactions with the instructor.

More importantly though, with the lasting vision of a bloody hand, the instructor was in turmoil about the ethics behind what was brought to light. Unlike an incident in the classroom where a course of action would be clear, the most appropriate response to the personal information revealed through the online profile was not obvious to the instructor. Where did the instructor's authority end and the student's personal life begin? Was the instructor responsible for reporting the actions that took place outside of her classroom? Was the online information within or outside the classroom? How would this student interact with children during his field placement and in his future classroom? Was the profile indicative of a troubled individual or was it simply a manifestation of creative, albeit dark, expression? For these reasons, the instructor grappled with whether to report the student to campus authorities for the disturbing images and ideas relayed on his profile.

Legal Actions and Campus-Based Incidents

Professional or formal relationships may become tainted when people either purposefully or inadvertently share information about themselves via online social networking services, and some users fail to think about the consequences that may arise as a result. Furthermore, appropriate responses to online personal information by those in authority, such as instructors and supervisors, may not be clear.

In recent years, many campus-based incidents involving perceived student misuse of social networking sites have occurred in both K-12 and postsecondary institutions. For example, Elon University in North Carolina took disciplinary action against members of the baseball team after photos of players involved in hazing activities found their way onto a student's MySpace profile (Lindenberger, 2006). An academic institution's *in loco parentis* responsibilities are often interpreted by campus administrators as encompassing the cyberworld. Some universities including Penn State University and the University of California-Davis utilize information contained in social networking sites to investigate campus incidents of harassment, code of conduct violations, and criminal activity (Lipka, 2008).

Slightly different problems exist for younger students. K-12 students have been suspended or expelled for creating false and potentially libelous profiles of faculty or administrators. These suspensions have been met with an interesting reaction from parents; in some cases, parents have filed suit against the educational institution for impeding a student's right to free expression by nature of the discipline imposed for creating the profile (see Layshock v. Hermitage School District, 2007; Requa v. Kent School District, 2007; J.S. v. Blue Mountain School District, 2007; A. B. v. State of Indiana, 2008). These claims of free speech violations have largely been unfounded by the courts. However, in some cases decisions have held a student's right to free expression in the form of an Internet parody if no significant disruption to the educational institution has occurred. Faculty have also filed suit or pressed criminal charges against students for harassing, defaming, or intimidating speech online (see Wisniewski vs. Board of Education, Weedsport Central School District, 2007; WSBTV.com, 2006).

And faculty sanctions for perceived misuse of social networking are becoming commonplace as well. Regulation of faculty conduct outside of professional duties is embedded in institutional codes and social norms, and many cases exist where faculty have claimed that sanctions or dismissals are unconstitutional (Fulmer, 2002). However, with the advent of online social networking, traditional tests of rights vs. duty may not apply. In a conventional sense, educational institutions realize the boundaries of faculty behavior to be regulated. But the transparency of online social networking has somewhat eroded those boundaries. For example, do faculty have the *right* to free expression online even if it conflicts with the values of the institution? Or do institutions have the *duty* to ensure that the values of the institution are upheld online as they are in the physical world?

One particularly striking example of this dilemma is the Tamara Hoover case. Hoover, a high school art teacher in the Austin (Texas) Independent School District, was fired when nude photographs were discovered on her MySpace profile and on her photo-sharing website, Flickr (May, 2006). Hoover was fired based on "conduct unbecoming a teacher," even though the photographs displayed could be interpreted as artistic and professional. Hoover agreed to a cash settlement from the school district, and now uses her MySpace profile to promote teachers' free speech rights (Hoover, 2007). The case has attracted national media attention.

The Hoover case is not an isolated incident. Many other cases of faculty sanctions over social networking have occurred in recent years (Crawford, 2007; Phillips, 2007; Vivanco, 2007). Do education administrators have the right to screen potential employees by "Googling" them, or to monitor employees' electronic communications without evidence of inappropriate contact with students (Wheeler, 2007)? These and other questions concerning ethical conduct within social networking sites have been met with a variety of responses from teacher preparation programs, school districts, and universities. Some have warned faculty not to use the sites at all (e-School News, 2007) and others have taken an educational approach, encouraging users to critically think about what they post online (The Pennsylvania State University, 2007). Given the ubiquity of online social networking communities among youth (boyd, 2008) as well as the potential of these powerful tools to provide communications that would not otherwise be possible, barring their use strikes the authors of this chapter as an educational disservice. To best calculate the risks that could be incurred in leveraging the power of these innovative tools, we believe a careful analysis of the potential ethical issues involved in interactions in online social networks is necessary.

APPLYING A MORAL FRAMEWORK

The events described above begin to illustrate the confusing social and ethical landscape of communications in this changing time, especially for educators who are obligated by their professional standards to serve as role models. To add to the complexity, the multiple players, including faculty, students, administrators, and parents, appear to have vastly different points of view about what is appropriate and inappropriate conduct. This is partly due to the multiple and often competing social and moral concerns present in these types of incidents. To both investigate the ethical points of view involved in judging these incidents and to uncover the ethical vulnerabilities inherent in this new medium, we have applied a socio-moral framework with a legacy of describing moral and non-moral features of complex social interactions. Specifically, social cognitive domain theory (Turiel, 1983; Turiel, 2002) is an appropriate starting point for understanding the complexities in online social networking.

First, the theory provides an analytical framework that differentiates moral from non-moral concerns in social interactions. Prior research applying this framework has demonstrated that people consistently think about moral (such as notions of harm, fairness, and rights), conventional (such as social roles, institutional organization, and matters of social efficiency), and personal matters (such as tastes and choices) in different ways (see Smetana, 2006 for a review). From early childhood, individuals actively distinguish between these domains and make judgments specific to domains about these distinct categories of social interaction. These insights are critical because many real-world social interactions are multi-faceted in the sense that multiple social domains are involved. Judgments and actions based on social interactions often involve weighing and coordinating various moral and non-moral concerns. For example, a judgment about whether a teacher should be disciplined for approaching parents with alarming information acquired from a student's online profile involves the consideration of multiple issues. There are concerns for the student's welfare (moral), the limits of teacher authority (conventional), and the student's right to privacy (moral) when choosing to post information in a public forum (personal).

Second, the framework allows for analytical investigation rather than a prescribed approach to how one should behave in ambiguous situations. There are conflicting perspectives about whether a teacher should be disciplined in such a situation; the authors of this chapter do not pretend to be certain about the right or ethical course of action in complicated, multi-faceted events. Our purpose is not to prescribe a set of moral actions that fit under a wide variation of circumstances, but instead to better understand the issues involved and also discover the ways people weigh those various issues in their thinking as online social networks continue to grow. To this end we conducted an investigation into student ethical decision-making in online social networking communities. This study has implications for how instructors might develop ways to allow students to ponder their ethical reasoning while engaging in the use of these tools.

Research within this framework can provide insights and useful points of comparison for our topic because of multiple studies of reasoning about two relevant social issues: developing concepts of role-related authority (Laupa, 1991; Laupa & Turiel, 1993; Laupa, 1995) and thinking about rights and privacy issues with the use of modern technologies (Friedman et al., 2006; Friedman, 1997). For example, when asked about the limits of educators' authority and responsibility over students, older students are more likely than younger students to limit their influences to the concrete boundaries of the school context (Laupa & Turiel, 1993). As classroom and school boundaries become progressively virtual, limits on educators' responsibilities and authority are unclear for students and staff alike. While reasoning about moral issues in technology, one study demonstrated that many students who believe in property and privacy rights in non-technological arenas condone piracy and hacking activities on computers (Friedman, 1997). Interviews with these students revealed that this apparent contradiction had to do with fundamental aspects of technology: the perceived distance between the actor and potential victims, the indirect nature of the harmful consequences, the invisibility of the act, and the lack of established consequences for such behavior online.Therefore, social cognitive domain theory is a useful framework to guide an analysis of the kinds of issues that can arise in the use of social networking tools. It allows us to do so in a way that respects the complexity of these kinds of interactions. Finally, it enables us to connect directly with a body of research that informs investigations of the ways in which online social interaction might cultivate its own set of ethical vulnerabilities. For example, the studies highlighted above suggest at least three such vulnerabilities:

1. A magnified forum for public humiliation and hazing--Students might be more likely to engage in public humiliation through social networking tools because harmful consequences are not directly observed, in contrast to acts in physical public spaces such as the cafeteria or locker room. Furthermore, when hazing or humiliation is conducted online there is greater distance (and sometimes even anonymity) between the actor and the victim.
2. Privacy issues in public spaces--Online social networking has the power to re-frame the way we consider and apply traditional rights to privacy.
3. The merging of professional and non-professional identities--The classroom walls and school premises no longer frame the jurisdiction of the educational institution. How does this shift impact higher education? How can social networking tools be appropriately used by university programs, administrators, instructors, and students?

Using the social cognitive moral framework as a lens for analysis, these ethical vulnerabilities are described in detail in the following section.

ETHICAL VULNERABILITIES OF SOCIAL NETWORKING TOOLS REVEALED

A Magnified Forum for Public Humiliation and Hazing

It is not uncommon to see academic units represented on MySpace or Facebook, as they attempt to find ways to provide services and assistance to students who are familiar with online tools (Hermes, 2008). Additionally, academic units can use these spaces as an outreach tool for marketing (Berg, Berquam & Christoph, 2007; O'Hanlon, 2007). With this level of transparency it would be easy to witness students engaging in the kinds of online activities that could be characterized as public humiliation and hazing. Most university codes of conduct prohibit this sort of behavior. However, when the behavior is discovered online, questions may arise about whether academic officials should access online profiles at all. While conducting research recently on the feasibility of creating a presence for a university academic library in Facebook, one of the authors came across a student group called "Have you seen the homeless guy in the library?" The description of the group was, "He's always on the computers. He stinks really bad. And he has like 1,000's of plastic bags..." Updated in the *recent news* section of the page was a description of where he was sitting in the library that day as well as a Web site that he had viewed. There were seventeen students in this group (no doubt with various levels of engagement), creating and sustaining a public community with the sole purpose of ridiculing one specific human being.

Public humiliation is not a new phenomenon; but the power of the collective sentiment conveyed by this online "community" would be hard to fathom offline, as a group with a purpose such as this would take considerably more time and effort to create. But by accident this particular group became visible, and when the activity was reported to the library administration, the university student affairs department was alerted. The student affairs officer explained to the library representative that student issues involving online public humiliation and hazing are not uncommon, and that the department frequently engages in mediation to resolve disputes—student to student, student to instructor, and around potentially disturbing group behavior. The officer explained that she would talk to the students who had joined the Facebook group, and use the incident as a "teachable moment" to address ethical use of the social networking tool among the students.

More and more educational administrations are grappling with issues between and among students that have extended into online social networking. As these online forums become ubiquitous to the masses, they have developed into a natural extension of students' social and personal lives. In a recent survey the Pew Internet & American Life Project found that fifty-five percent of online teens (ages 12-17) have created a profile at a social networking site such as MySpace or Facebook (Lenhart, Madden, Macgill, & Smith, 2007). University students in particular frequent social networking sites. In fact, a recent survey of all first-year English students at the University of Illinois-Chicago (Hargittai, 2007), reported that 88% use social networking sites.

Incidents involving public humiliation or hazing such as the one that took place in the university library as described above, have become commonplace in both K-12 and institutions of higher learning. Through "cyberbullying," defined as "willful and repeated harm inflicted through the medium of electronic text," (Patchin & Hinduja, 2006, p.152) students and faculty can either become the targets or perpetrators of incidents that would be unacceptable in offline situations. Electronic humiliation and hazing of this nature can have lasting physical and psychological effects on the victims such as depression, insomnia, and anxiety disorders (Griffiths, 2002). In the interest of student and faculty welfare, educational institutions have responded to these incidents in a variety of ways. Some situations are minor and can easily be solved through mediation by administrators or student affairs professionals (Lipka, 2008) while others have warranted more serious disciplinary or even criminal action.

It is because of the sheer reach of electronic communication that the Internet and social networking have become a magnified forum for public humiliation and hazing. This activity occurs within all sectors of the educational spectrum. Almost one-third of teens who use the Internet say that they have been a victim of annoying or potentially threatening activities online, including others "outing" personal information via email, text messaging, or postings on social networking sites. Those who share personal identities and thoughts are more likely to be the targets of such activities (Lenhart, 2007). Additionally, in a recent survey conducted by the Teacher Support Network of Great Britain, 17% of K-12 teachers indicated that they had been a target of online humiliation or harassment (Woolcock, 2008). College-age students and faculty are not immune from online defamation of character. In a survey conducted at the University of New Hampshire 17% of students reported experiencing threatening online behavior, yet only 7% of those experiencing vicitmization reported it to campus authorities (Finn, 2004). Sites such as JuicyCampus.com and TheDirty.com, perhaps the most notorious Web sites aimed at college students, allow anyone to post humiliating or threatening messages and photos, some of which have cost students job opportunities and internships (O'Neil, 2008). Female law school students have reported sexual harassment and defamation on AutoAdmit.com, a message board about law school admissions (Nakashima, 2007). And Web sites like RateMyProfessors.com and RateMyTeachers.com allow students to be anonymous as they air their opinions about faculty, including rating an instructor's easiness and "hotness".

Such activity on social networking sites has led to several court cases over perceived defamation. For example, *Drews vs. Joint School District* (2006) described a situation where Casey Drews, a high school student, was the subject of rumors and gossip at school after a snapshot her mother took of Drews kissing a female friend was circulated on the Internet. Drews sued the school district for deliberately ignoring the harassment. Cases illustrating faculty harassment and defamation are evident as well. A Georgia teacher brought criminal charges against a high school student who created a fake MySpace profile about the teacher, claiming that the teacher "wrestled midgets and alligators" and stating that he liked "having a gay old time" (WSBTV.com, 2006). And a federal circuit court found that a student's distribution of a text message icon depicting a gun firing at a picture of his English teacher and the words "Kill Mr. Van der Molen" was threatening speech not protected by the First Amendment (Wisniewski vs. Board of Education, Weedsport Central School District, 2007).

Steve Dillon, director of student services at Carmel Clay Schools, states, "Kids look at the Internet as today's restroom wall. They need to learn that some things are not acceptable anywhere" (Carvin, 2006). If the Internet is a restroom wall, then it is a giant, unisex restroom open to all citizens. But unlike a restroom wall that can be painted over, the Internet can be a permanent archive of electronic communication. Localized or place-bound codes of conduct are clearly no longer adequate in a Web 2.0 environment. How do educational organizations come to terms that the school's four walls have been virtually obliterated, and craft appropriate responses in codes of conduct that protect the privacy and welfare of its students and faculty, while simultaneously honoring First Amendment rights?

Privacy Issues in Public Spaces

A number of recent controversies highlight our collective lack of clarity about how we can and should use personal information that is publicly available on the Web. English Education candidate Stacy Snyder of Millersville (Pennsylvania) University was denied her teaching certificate and given an English degree rather than an education degree after campus administrators discovered photos where she portrayed herself as a "drunken pirate" on her MySpace profile, even though she was of legal drinking age. The 27-year old filed a lawsuit against the university, and is asking for $75,000 in damages (Steiner, 2007). In another example (one which we have used to explore reasoning in our own research), a teacher revealed to students that she had a MySpace profile. The student consequently "friended" the teacher, giving the teacher access to the student's profile. In the process of exploring the student's profile, the teacher discovered information about activities such as underage drinking in which the student was engaged. Concerned about what she saw online about the student, the teacher contacted the parents. The parents contacted the school, outraged that the teacher was snooping into the student's personal life, and demanded that the teacher be disciplined. Scenarios such as these suggest that both producers and consumers of online information are unclear as to exactly what is public and exactly what is private.

Are producers aware of the extent to which their online disclosures are publicly accessible? Are consumers clear about producers' rights to privacy in this online community? Studies reveal that teens and adults alike underestimate who accesses their online submissions and how that information is used (Viègas, 2005). The nature of online social interaction allows for such vulnerabilities to protecting privacy. Palen and Dourish (2003) suggest that this illusion is perpetuated, at least in part, because of our reliance on non-virtual strategies for monitoring privacy, and that online interactions call for implications for better controlling privacy violations and for different ways of thinking about privacy rights in online environments.

According to this view, our mechanisms for managing privacy have traditionally been spatial and sensory: we know who our audience is (and can control it) because we can see, hear, and read traditional forms of communication. Online, these cues are distorted. Our audience is frequently unknown and underestimated (Viègas, 2005) and the boundaries between personal and professional domains are often easily crossed. Lastly, information shared online is often available for access at future times and for future audiences. Not only do these attributes impact our abilities to regulate our intended audience, they also weaken our control over how that information is interpreted and used. In an attempt to understand and improve privacy management in information technology, computer scientists have engaged in analysis of the concept of privacy and an examination of privacy online (Palen & Dourish, 2003). Conceiving privacy as a *boundary regulation process* (Altman, 1977), Palen & Dourish identify three boundary negotiation processes as essential to the management of privacy in a networked world: disclosure, identity, and temporality.

Issues involving disclosure dominate recent social networking controversies, including the two scenarios above. Some would argue that both teacher and student should have known better than to reveal personal information in a public forum -- both should simply have avoided disclosing information. But Palen & Dourish argue that this view undermines the true social interactive nature online. Disclosure is essential to online interaction. Effectively negotiating private and public spaces involves selective decisions about what to disclose and what kind of persona to display. Problems arise, they argue, in how we control who is targeted by this public display and consequently how the display is interpreted.

There is also an inherent tension in our attempts to control how others see us online. When creating and publishing our virtual identities we choose to affiliate with certain groups, networks, each with their own set of identity markers, language conventions and patterns of interaction (Yates & Orlikowski, 1992). Likewise, we modify our ways of interacting based on our perceptions of the identities and affiliations of our audience. Online, these various identities can appear quite fragmented and disconnected, such that viewing one facet of an online persona out of context (such as the "drunken pirate") can lead to distortions and errors in judgments of the person's character and personality, largely outside of the individual's control. Assessments can be made and then applied to the hiring and firing decisions within a variety of professions. Central to protecting privacy is "the ability to discern who might be able to see one's action" (Palen & Dourish, 2003, p.4).

Lastly, our attempts to control the information we share have a temporal quality. That is, in any moment of information sharing, we typically respond to the results of past attempts at information sharing and anticipate future consequences of information sharing. Moments of information sharing are connected historically and logically. However, online these moments can be viewed out of sequence, preserved for future use, and even reorganized into alternative sequences. The photos, stories, and conversations uploaded during college may return to contribute a completely different image of responsibility than the one conveyed by the professional resumé uploaded ten years later.

This analysis has implications for both education and ethics. First, these lenses offer useful entry points for developing awareness and understanding of the vulnerabilities to privacy online for both those sharing and those interpreting information shared online. Second, the review suggests a way of thinking about privacy rights online. In contrast to those who believe that privacy rights are surrendered when information is made public, this review suggests that rights to privacy might still be negotiated after information is publicly accessible. For example, individuals sharing the information might deserve the right to have that information understood in context or within its original logical sequence; that is, understood in a way which maintains the integrity of the sharer's initial intentions. There is some limited empirical evidence suggesting that people already do uphold privacy rights in public spaces (Friedman et al., 2006). In one study, when college students were asked to judge whether an installed video camera capturing video of them in a public place was an invasion of their privacy, the majority of students judged that it was. Furthermore, in this study, students' responses illustrated a complex construal of privacy issues in public. Judgments of privacy were mediated by a variety of factors such as the location of the camera, the perceived purpose of the video camera (safety vs. voyeurism), the audience viewing the footage, and the extent of disclosure about the video camera (from posted signs to informed consent). As new technologies continue to alter the nature of our social interactions in online communities, more studies are needed both to highlight the privacy vulnerabilities inherent in these types of social interaction and to capture the adaptive reasoning about privacy rights that are constructed through those experiences.

The Merging of Professional and Non-Professional Identities

Social networking tools can serve as both a rich resource and a potential liability. As with any powerful tool, there are far-reaching risks and potential disaster if use of the tool is not thoroughly calculated—but there are beneficial uses as well. Some online social networking tools go beyond a function of socialization to include professional communication functions. For example, Zinch.com helps students connect with the colleges and universities they are interested in attending. After students register with Zinch, they complete a personal profile and prepare an online digital portfolio illustrating their talents. Profiles are automatically private to those other than approved admissions officers. Recruiters across the nation use the network to connect with students whose profiles are of interest to their institutions. A similar site, Cappex.com, has the added feature of a calculator that estimates students' chances for admission to their desired institution. These tools take admissions criteria beyond testing, basic academics, and letters of recommendation, to allow those in non-local areas to connect with learning institutions, and provide a convenient opportunity for individual students and admissions officers to connect.

Once schooling is out of the way and the job hunt begins or a promotion is imminent, students in some professions face the news that a background check, also known as a consumer report, is required. Background checks can be conveniently conducted during the hiring process through third party investigation services to verify any level of candidate qualifications from education records to drug tests and credit records. The Fair Credit Reporting Act mandates that a consumer report should be conducted within compliance of the law to prevent discriminatory actions (Federal Trade Commission, 2004). To assure their compliance, most often employers conduct screenings by contracting with consumer reporting agencies that have access to specialized information sources. But consumer reports can also reveal information about a candidate that is irrelevant, taken out of context, or even inaccurate. This leaves room for concern for some applicants who have not paid attention or were unaware of how their prior behavior could be interpreted by employment agencies.

An online search of a person's name could also be conducted to obtain as much information as possible about a candidate's level of qualification. An Internet search can reveal a candidate's Web site or portfolio, professional accomplishments and awards, and other pertinent information. But use of an Internet search during the hiring process could also pull up a candidate's social networking profile or other Internet-based information outside a normal background check. Voluntarily-disclosed information on profiles that are public may reveal an applicant's sexual orientation, political affiliation, age, and marital status, and an employer who allows consideration to these factors could be acting in violation of workplace-discrimination statutes. But, it appears that use of information from social networking sites such as "drunken, racy, or provocative photographs" in order to make a judgment about the candidate's suitability is perfectly legal (Byrnside, 2008).

These scenarios play out over and over during the hiring process. For example, a Boston marketing recruiter was screening applications and noted one of particular interest. A member of the interview team asked the recruiter if she had seen the applicant's MySpace page, which included pictures of the recent college graduate "Jell-o wrestling." Based on more relevant factors the applicant was not interviewed, but the MySpace page remained in the recruiter's memory (Aucoin, 2007). Here again, misimpressions about privacy could pose life-changing implications if conscious actions were not promoted. How many emerging professionals have lost jobs or been denied opportunities because of the blurred boundaries between professional life and private life? The liabilities associated with social networking are potentially staggering, for both employers and employees.

Also consider the fact that individuals can experience a sort of identity theft through social networking sites. Cicero (Illinois) Town President, Larry Dominick, had two MySpace profiles. City officials found the sites, which were "replete with photos and questionable comments about his sexuality and ethics." But both sites were created by imposters (Noel, 2008). Imposter profiles are so prevalent that MySpace now has protocol and a division within the company to address cyber-bullying, underage users, and imposter profiles (MySpace, 2008). Cicero attorneys are asking MySpace to identify the anonymous users who created the profiles, and Dominick is planning on suing.

When social networking sites are made public, everyone in the world, including colleagues, has the capability to view the content. No doubt, we make judgments about a person's character based on what we see. The merging of professional and non-professional identities has implications for those who choose to create and display personal profiles.

IMPLICATIONS FOR SOCIALLY RESPONSIBLE USE OF SOCIAL NETWORKING TOOLS

Given the prevalence of incidents surrounding social networking within educational institutions, there is a need to embed socially responsible usage principles in academic programs rich in technological innovation. We have begun to implement and study such interventions. As instructors in a teacher education program we (Foulger, Ewbank, Kay, Osborn Popp, & Carter, 2008) investigated the use of case-based coursework (Kim et al., 2006; Kolodner, 1993) for encouraging change in preservice teachers' reasoning about ethical issues in Web 2.0 tools. As we have grappled with ethical dilemmas around social networking at our own institution, we were curious about the ways in which new technologies might alter traditional forms of social interaction. These circumstances gave rise to the following questions that drove our research: a) What are preservice teachers' perspectives regarding a social networking scenario that involves multiple ethical dilemmas? And b) In what ways does case-based coursework change preservice teachers' reasoning about social networking? In this study we assessed the effectiveness of a case-based intervention with a group university freshman-level education class. They participated in a homework assignment that was developed to help them better understand the features of social networking tools. It also helped them clarify their ethical positions about recent legal sanctions pertaining to the use of social networking tools by students and teachers.

Based on a review of the literature about case-based reasoning, we expected coursework that included case-based teaching about controversial social networking issues to (a) increase students' recognition and integration of multiple perspectives or viewpoints about the benefits and harms of teachers' use of social networking tools and (b) develop students' appreciation for the range of ethical vulnerabilities inherent in social networking media. Fifty students participated in a three-part assignment. First, they were asked to respond to online selections about the technological nature of social networking. Students then commented on cases where teachers used social networking tools for pedagogical purposes. Finally students responded to cases where teachers were disciplined or dismissed for inappropriate conduct as defined by educational institutions. Comparisons of perceptions before and after the assignment were examined to analyze the preservice teachers' reasoning about controversial social networking incidents. Some significant changes in student perceptions did occur, indicating that case-based coursework increases awareness of the ethical complexities embedded in social networking tools.

Several trends emerged from the analysis. The homework helped students develop more complex ethical reasoning to the scenarios posed and revealed a significant increase among students in the call for some form of teacher discipline. Additionally, the homework developed students' recognition of the complexities of social networking sites and the need to develop clearer protocols around their educational use. Finally, the assignment had an impact on students' understanding of the ethical vulnerabilities of social networking tools. A deeper exploration of one common set of responses revealed that the study participants grappled with the line between a teacher honoring a student's right to privacy and a teacher's responsibility of caring for the students' well-being.

It was apparent that the case-based coursework encouraged students to contemplate rights to privacy in a public online forum. This level of thought is important because of the unknown norms of social networking. Even though many students are immersed in technology every day, there is still room for education about social networking and professional ethics..

Future studies should include investigations about educator conduct and rights to privacy in online spaces. Those who are engaged in supporting future professionals should consider ways in which they can assist the development of thinking about these kinds of ethical dilemmas so that new professionals can anticipate and prevent potential problems, develop well-reasoned responses to ethical decisions, and participate in the construction of protocols that continue to harness the educational potential of social networking tools. Developing such awareness and protocols are initial steps toward encouraging responsible use of these tools.

THE FUTURE OF SOCIAL NETWORKING IN EDUCATION

News stories continue to surface about questionable social behaviors that occur online. Although some behave as though the faceless world of online communities is lawless territory and continue to test the waters, no firm legal precedents have been established to guide online codes of conduct.

Educational organizations have taken a variety of positions on this issue, some in response to real problems they have encountered, and some prompted by attempts to be proactive in light of the news events they hear. Lamar County School Board has taken a conservative position. Although no incidents led to the decision, the attorney of the southern Mississippi district recommended adoption of a policy to lessen liabilities. Now communications between teachers and students through social networking sites or through texting are prohibited (Associated Press, 2008).

But Tomás Gonzales, Senior Assistant Dean at Syracuse University School of Law and a nationally recognized speaker in the legal issues concerning on-line communities, believes that educational organizations should embrace collaborative technologies and explore appropriate uses even in the midst of much negative press about the drawbacks of social networking (2008). He also claims that current codes of conduct about appropriate face-to-face behavior are probably sufficient for providing online guidance for students and administrators.

Codes of conduct in educational institutions should be examined to determine whether protocols for online behavior are embedded within existing policies. At a minimum, institutions should consider how their existing codes of conduct would be applied in the event of a dilemma involving social networking tools. Additionally, education programs that result in awareness of both proactive behaviors as well as potential situations to be avoided in social networking would benefit students and faculty alike.

CONCLUSION

We must recognize the limitations of our own experience and expertise. This applies to the use of many Web 2.0 tools, including online social networking. With the use of social networking tools, as with any powerful tool, come many vulnerabilities. As society becomes more technologically advanced, it has become the responsibility of educational institutions to support the use of the kinds of technologies that might prove to strengthen and support the learning process. However, it is also the responsibility of policymakers to assure participation in a safe learning environment. Ironically, news broadcasts have been mostly negative press about the pitfalls of social networking tools, and have not showcased innovative and pedagogical uses of Web 2.0 features. In order for any beneficial uses of such tools to be realized and refined, and then incorporated into learning environments, the fear and apprehension surrounding them must be set aside long enough for real innovation to occur.

We encourage institutions to first create a safe place for ideas to percolate by revisiting existing codes of conduct to assure their policy and procedures embrace the idea of virtual connectivity, and to publish guidelines for acceptable and appropriate uses of technology. By providing guidance to their members, institutions can encourage them to utilize online tools in a socially responsible manner, without squelching innovative uses of technology. Just as institutions use codes of conduct to ensure the safety and rights of each member on campus, they can utilize those same codes in the online extension. By conceptualizing online spaces as an integral part of institutions' physical and temporal community, codes of conduct can be applied in a manner that respects privacy and individual rights, while allowing innovation and security for all participants.

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This work was previously published in Collective Intelligence and E-Learning 2.0: Implications of Web-Based Communities and Networking, edited by H. H. Yang; S. C. Chen, pp. 27-43, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 8.6
Modeling Cognitive Agents for Social Systems and a Simulation in Urban Dynamics

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ABSTRACT

Multi-agent systems have been used to model complex social systems in many domains. The entire movement of multi-agent paradigm was spawned, at least in part, by the perceived importance of fostering human-like adjustable autonomy and behaviors in social systems. But, efficient scalable and robust social systems are difficult to engineer. One difficulty exists in the design of how society and agents evolve and the other difficulties exist in how to capture the highly cognitive decision-making process that sometimes follows intuition and bounded rationality. We present a multi-agent architecture called CASE (Cognitive Agents for Social Environments). CASE provides a way to embed agent interactions in a three-dimensional social structure. It also presents a computational model for an individual agent's intuitive and deliberative decision-making process. This chapter also presents our work on creating a

DOI: 10.4018/978-1-60566-236-7.ch008

multi-agent simulation which can help social and economic scientists use CASE agents to perform their tests. Finally, we test the system in an urban dynamic problem. Our experiment results suggest that intuitive decision-making allows the quick convergence of social strategies, and embedding agent interactions in a three-dimensional social structure speeds up this convergence as well as maintains the system's stability.

INTRODUCTION

In social environments, people interact with each other and form different societies (or organizations or groups). To better understand people's social interactions, researchers have increasingly relied on computational models [16, 40, 41, 42]. A good computational model that takes into consideration both the individual and social behaviors could serve as a viable tool to help researchers analyze or predict the complex phenomena that emerge from the interactions of massive autonomous agents, especially for the domain that often requires a long time to evolve or requires exposing real people to a dangerous environment. However, efficient, scalable, and robust social systems are difficult to engineer [3].

One difficulty exists in modeling the system by holding both the societal view and the individual agent view. The societal view involves the careful design of agent-to-agent interactions so that an individual agent's choices influence and are influenced by the choices made by others within the society. The agent view involves modeling only an individual agent's decision-making processes that sometimes follow intuition and bounded rationality [29]. Previous research in modeling theory of agents and society in a computational framework has taken singly a point of view of society or agent. While the single societal view mainly concentrates on the centralist, static approach to organizational design and specification of social structures and thus limits system dynamics [12, 16, 35], on the other hand, the single agent view focuses on modeling the nested beliefs of the other agents, but this suffers from an explosion in computational complexity as the number of agents in the system grows.

Another difficulty in modeling theory of agent and society exists in quantitative or qualitative modeling of uncertainty and preference. In the case of quantitative modeling, the traditional models like game theory and decision theory have their own limitations. Game theory typically relies on concepts of equilibria that people rarely achieve in an unstructured social setting, and decision theory typically relies on assumptions of rationality that people constantly violate [27]. In the case of qualitative modeling, there are three basic models: prescriptive, normative and descriptive [31, 37]. A prescriptive model is one which can and should be used by a real decision maker. A normative model requires the decision maker to have perfect rationality, for example, the classical utility function belongs to this category. Many normative theories have been refined over time to better "describe" how humans make decisions. Kahneman and Tversky's Prospect Theory [18, 34] and von Neuman and Morgenstein's Subjective Utility Theory [36] are noted examples of normative theories that have taken on a more descriptive guise. One of the central themes of the descriptive model is the idea of Bounded Rationality [29], i.e., humans don't calculate the utility value for every outcome; instead we use intuition and heuristics to determine if one situation is better than another. However, existing descriptive methods are mostly informal, therefore there is a growing need to study them in a systematic way and provide a qualitative framework in which to compare various possible underlying mechanisms.

Motivated by these observations, we have developed a cognitive agent model called CASE (Cognitive Agent in Social Environment). CASE is designed to achieve two goals. First, it aims to model the "meso-view" of multi-agent interaction by capturing both the societal view and the agent view. On one hand, we keep an individual perspective on the system assumed by the traditional multi-agent models, i.e. an agent is an autonomous entity and has its own goals and beliefs in the environment [5, 43]. On the other hand, we take into account how agent's decisions are influenced by the choices made by others. This is achieved by embedding agents' interactions in three social structures: group, which represents social connections, neighborhood, which represents space connections and network, which span social and space categories. These three structures reproduce the way information and social strategy is passed and therefore the way people influence each other. In our view, social structures are external to individual agent and independent from their goals. However, they constrain the individual's commitment to goals and choices and contribute to the stability, predictability and manageability of the system as a whole.

Our second goal is to provide a computational descriptive decision model of the highly cognitive process wherein an individual agent's decision-making. The descriptive theory assumes agents undergo two fundamental stages when reaching a final decision: an early phase of *editing* and a subsequent phase of *evaluation* [19]. In the editing phase, the agent sets up priorities for how the information will be handled in the subsequent decision-making phase and forms heuristics which will be used during the decision-making process, i.e. the agent only acts with bounded rationality. In the evaluation phase, there exist two generic modes of cognitive function: an *intuitive* mode in which decisions are made automatically and rapidly, and a controlled mode, which is *deliberate* and slower. When making decisions, the agent uses *satisfying* theory [30], i.e. it takes "good enough" options rather than a single "best" option.

The rest of the chapter is organized as follows. Section 2 introduces the related work. In Section 3, we give an overview to cognitive models for social agents, from both the societal view and individual agent view, and introduce preliminary contextual information. Section 4 presents CASE from the perspective of the societal view, i.e. how an agent's decision affects another. Section 5 presents CASE from the perspective of the individual agent's view, i.e. an intuitive and deliberative decision-making mechanism. Section 6 is a simulation supporting CASE agents that provides an integrated environment for researchers to manage, analyze and visualize their data. Section 7 reports the experiments and Section 8 concludes the chapter.

RELATED WORK

Multi-agent systems have been widely used to model human behaviors in social systems from the computational perspective. There have been many successful systems addressing this issue. Due to the lack of space, we limit this discussion to several of the most relevant systems. We review them from two categories: agent modeling and agent simulation.

Agent Modeling

COGnitive agENT (COGENT) [6] is a cognitive agent architecture based on Rasmussen's integrated theory of human information processing [28] and the Recognition Primed Decision (RPD) model [21]. It provides the decision-aiding at multiple levels of information processing, ranging from perceptual processing and situation feature extraction through information filtering and situation assessment, and not a direct process of real human social behaviors.

COgnitive Decision AGEnt (CODAGE) [20] is an agent architecture that derived its decision model from cognitive psychological theories to take bounded rationality into account. However, CODAGE does not consider an agent's influence on other agents and there is no communication between agents. We consider communication important since it permits individuals to expand their spheres of interest beyond the self. Moreover, CODAGE is a centralized system where only one decision maker makes decisions for each agent, while CASE is a distributed system where each agent makes their own decisions.

PsychSim [27] is a multi-agent simulation for human social interaction. In order to represent agents' influence on each other, PsychSim gives each agent full decision models of other agents. In PsychSim, bounded rationality is implemented as three limitations on agents' beliefs: 1) limiting the recursive nested-belief reasoning process to a certain level, 2) limiting the finite horizon of the agents' look-ahead, and 3) allowing the possible error in the agents' belief about others. However, we treat bounded rationality as a human tendency to anchor on one trait or piece of information when making decisions (the detail of this can be found in Section 5).

Construct-Spatial [24] combines an agent's communication and movement simultaneously. It aims to simulate many real world problems that require a mixed model containing both social and spatial features. They integrate two classical models: Sugarscape [7], a multi-agent grid model, and Construct [2], a multi-agent social model, and run virtual experiments to compare the output from the combined space to those from each of the two spaces. Our model is similar in that we also capture multi-dimensional interactions between agents. We embed agents' interactions in three social structures: group, which represents social connections, neighborhood, which represents space connections and network, which span social and space categories. These three structures reproduce the way information and social strategy is passed and therefore the way people influence each other.

Hales and Edmonds [14] introduce an interesting idea of using "tag" mechanisms for the spontaneous self-organization of group level adaptations in order to achieve social rationality. Their idea is to use agents that make decisions based on a simple learning mechanism that imitates other agents who have achieved a higher utility. This research reminds us that sometimes the simplest of techniques can have the most far-reaching results. However, agents in their system need a relatively large number of tag bits (32 tag bits for a population of 100 agents) for all agents to reach a socially rational decision. In this chapter we use a different approach for generating socially rational behaviors. We embed social interaction into three social structures and provide a model for diffusing one agent's strategy to others.

Jiang and Ishida [17] introduce an evolution model about the emergence of the dominance of a social strategy and how this strategy diffuses to other agents. Our model is similar in that it includes multiple groups and allows for diffusion of strategy. But our model differs in two aspects. First is in how the groups are defined. Jiang and Ishida define a one to one relationship between groups and strategies, i.e. for every one strategy there exists one group and each agent belongs to the group that has their strategy. However, in our model, an agent can belong to multiple groups at one time. The second difference exists in whether or not the group's strategy is dynamic. Because Jiang and Ishida define a one to one relationship between groups and strategies, there must always exist one group for every possible strategy. This means group strategies are static and will not change over time. In our model, we model the dynamics between the group and the agent, so both the group's strategy and the agent's may be changed with time.

Agent Simulation

RePast[1], perhaps one of the most feature filled packages, provides templates for easy construction of behavior for individual agents and integrates GIS (Geographic Information System) support, which is a feature that our simulations will need. It is also fully implemented on all systems. The multi agent system named MASON[2] is a lightweight system with a good amount of functionality. It has the ability to generate videos and snapshots as well as charts and graphs. JADE[3] is a project that we looked at for its ability to be distributed across multiple machines that do not need to be running on the same operating system, which is a feature of our system. It also allows configuration of a distributed model to be controlled by a remote GUI, which is also a feature we implement in our package. Cougaar[4], developed for use by the military is influential in that it allows for huge scaling of projects to simulate many agents working together, which is a very appealing feature for our simulations. JAS[5] (Java Agent based Simulation) library is a package that supports time unit management by allowing the user to specify how a system will operate in terms of hours, minutes or seconds. This is helpful for spatial modeling and simulations. SWARM[6], developed at the Santa Fe Institute, allows for users to write their own software. It also allows for development on a variety of systems. The package is open source and has a large community of developers as well. EcoLab[7] allows for the user to generate histograms and graphs but is only able to be implemented on a limited amount of systems. It provides a scripting language which can access the model's methods and instance variables, allowing experiments to be set up dynamically at runtime. This is good for the user without programming skills. Breve[8] allows the user to define agent behavior in a 3D world. It also allows for extensive use of plug-ins that fit seamlessly with user generated code.

COGNITIVE MODELS FOR SOCIAL AGENTS: AN OVERVIEW

According to social scientists, social behavior is behavior directed towards, or taking place between, agents of the same societies [26]. Understanding the emergence and nature of social behavior is necessary prior to the design of a computational framework. Social behaviors are complex phenomena, which may be better examined at two different levels: the society level and the individual agent level. These two levels are not independent but are intimately related and often overlap.

The Society

Any society is the result of an interaction between agents, and the behavior of the agents is constrained by the assembly of societal structures [9]. For this reason, a society is not necessarily a static structure, that is, an entity with predefined characteristics and actions. If societies such as public institutions or companies possess an individuality of their own which distinguishes them from the assembly created by the individualities of their members, it is not necessarily the same for simpler collective structures such as working groups or herds of animals. Even though societies are considered as being complex, such as colonies of bees or ants, they should not necessarily be considered as individuals in their own right if we wish to understand their organization and the regulation and evolution phenomena prevailing them there. Therefore, in our view, a society is the emergence of properties of individual interactions, without it being necessary to define a specific objective which represents such an outcome[9].

While decision rules were developed for the purpose of understanding decision-making on the individual level, it is not illogical to think that such a theory could be expanded to account for decision-making made by a group of individuals. There are generally two alternative methods of extending interest beyond the self. Both of these ways, however, present some problems.

The first method is to define a notion of social utility to replace individual utilities [4]. Such a concept is problematic, because, as put by Luce and Raiffa, the notion of social rationality is neither a postulate of the model nor does it appear to follow as a logical consequence of individual rationality [22]. Pareto optimality provides a concept of group interest as a direct attribute of the group, but this falls short of a viable solution for the concept of individually rational decision makers since no player would consent to reducing its own satisfaction simply to benefit another – it is not self-enforcing. Adopting this view would require the group to behave as a "super player", who can force agents to conform to a concept of group interest that is not compatible with individual interests. Therefore, there is a clear demand for keeping self-enforcement as the baseline of decision-making for agents behaving under social context [32, 33].

The second method is to incorporate the utility of other agents into the creation of individual utility, such as the RMM (Recursive Modeling Method) model [10]. The problem of this method is that the nesting of these agent models is potentially unbounded. Further, people rarely use such a deep recursive model although infinite nesting is required for modeling rational behavior [19]. Many multi-agent models of human decision-making made reasonable domain specific limitations to the number of nested levels and gains in computational efficiency [27]. But there is an inherent loss of precision. To better understand and quantify how people influence each other, Hogg and Jennings [15] introduce a framework for making socially acceptable decisions, based on social welfare functions which combine social and individual perspectives in a unified manner. It seems that the notion of the social welfare function, which represents the combination of individual and social interests, is especially useful for modeling social influence so that an individual agent's behavior is affected by others but is still able to maintain its individual goal and utility.

The Agent

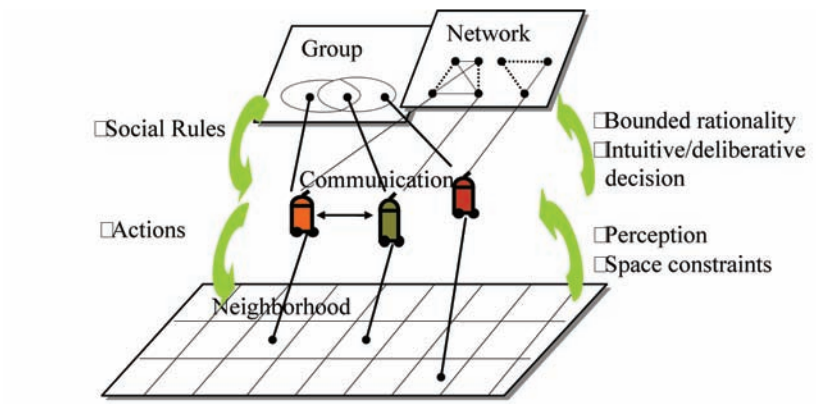
From a human cognitive psychological perspective, a person's behaviors can be viewed as the outcome of his/her decision-making process [25, 11]. Kahneman and Tversky suggest that a person's decision-making processes follow intuition and bounded rationality [19]. Further, the knowledge that a person has learned through his/her life experience can be viewed as the extension of his/her intuitions [25]. In psychology, intuition has broad meaning encompassing both one's ability to identify valid solutions to problems and to quickly select a workable solution among many potential solutions. For example, the RPD model aims to explain how people can make relatively fast decisions without having to compare options [21], the Prospect Theory captures human intuitive attitudes toward risk, and the Multi-Attribute Decision-Making model [1, 39] draws intuition in terms of qualitative information.

First introduced by Simon, bounded rationality presents an alternative notion of individual optimization in multi-agent settings to the classic utility theory [29, 23]. Agents are only bounded rationally and use the satisfying theory to make decisions. The idea of the satisfying theory is to reconstruct utility around preferences, rather than actions. It basically states that the only information we can draw from are the preferences of individuals. This concept is an important one, since it reminds us not to ascribe spurious qualities to the individuals studied and abstracted by a utility function; such a function is a mere representation and may contain aspects that do not actually reflect the individual's nature. Stirling's satisfying game theory also shows that people do not judge the utility based off analysis of desired results, but based off their preferences [30].

AGENT-SOCIETY DUALITY

The agent/society duality, shown in Figure 1, characterizes the processes that take place between the agents and the societies which result from them. We are dealing with dynamic interaction, the logic of which depends simultaneously on the capabilities of individual agents and the dynamic interactions between them. On one hand, agents

Figure 1. Agent-Society Duality



have their own goals and are capable of performing various actions. On the other hand, according to social scientists, agents interact with each other and the interactions are embedded in three social structures [13, 26]:

1. **Group:** represents social connections,
2. **Neighborhood:** represents space connections, and
3. **Network:** represents connections that span the social and space categories.

The purpose of these structures is to reproduce the way information and social strategy are passed and the way people influence each other. A group is a collection of agents who "think alike", or make similar decisions. It allows for a diffusion of social strategies through social space. An agent can belong to multiple groups at a time and can change groups over time. Each agent also has its own neighborhood and network. A neighborhood includes the agents whose behaviors this agent can observe within a predefined physical distance. It allows for a diffusion of information through physical space. One agent only has one neighborhood which includes the agents that it can directly observe. However, these neighbors can be different at every step because the agent moves. A network includes the agents that this agent chooses to communicate and interact with. Agents can't choose who is in their neighborhood but they can choose who they want to interact with. Therefore, the network connection allows for selective diffusion of information. Each agent also only has one network but its members can change over time. For example, if the agent has not heard from one agent over a certain step, the communication connection to that agent will be dropped.

Agent-Society Evolvement

Let agent $a \in A$ where A is the set of all agents. Each agent has a social strategy. This social strategy can be either ordinal or cardinal. We denote the social strategy for agent *a* by S_a.

Let $g \in G$ where G is the set of all groups. Each group also has a social strategy, denoted by S_g. Groups are formulated on the basis of a common preference. Each agent identifies itself with any group such that the agent's strategy falls within some threshold of the group's strategy.

$$\forall a \in A \text{ and } g \in G,\ a \in g \text{ if } \mathrm{diff}(S_a, S_g) < d \quad (1)$$

where $\mathrm{diff}(S_a, S_g)$ is the difference between the agent's strategy S_a and the group's strategy S_g, and d is the threshold. It can be seen that agent *a* can belong to more than one group at a time and can belong to different groups over time.

When an agent joins a group they are given a rank in that group. An agent will have one rank for every group they belong to. The agent's rank can be evaluated based on the agent's importance, credibility, popularity, etc. Rank defines how much the agent will influence the group as well as how much the group will influence them. A high-ranking agent influences the group, and therefore its members, more than a low ranking agent and at the same time is influenced more than a low ranking agent. An agent's rank is specific to the domain and may change over time.

Each time step, every group will update their strategy. The update is determined by its members' strategy and the percentage of the total group rank they hold.

$$S_g = \sum_{a \in g} S_a \times \frac{R_a^g}{\sum_{b \in g} R_b^g} \qquad (2)$$

where R_a^g denotes agent a's group rank. This allows for groups to be completely dynamic because both their members and their strategy can change each time step.

Just like an agent's rank in it groups, an agent also has a rank in its neighborhood and network. Each agent keeps track of the agents in its neighborhood and the agents it communicates with. Every time an agent observes another agent in his neighborhood, that agent's neighborhood rank will increase. Also, each time an agent communicates with another agent, that agents communication rank increases. Therefore every agent will have a rank value for every agent it interacts with, and a separate rank for every agent he communicates with. When an agent updates its strategy, it will take into account these ranks. Agents with a high rank relative to the other agents will have a stronger influence. Therefore the longer two agents are near each other, the more they will influence each other. The same is true for communications. Below is the update function for the neighborhood's strategy and the network's strategy.

$$S_n = \sum_{a \in n} S_a \times \frac{R_a^n}{\sum_{b \in n} R_b^n} \qquad (3)$$

$$S_w = \sum_{a \in w} S_a \times \frac{R_a^w}{\sum_{b \in w} R_b^w} \qquad (4)$$

where S_n is the strategy for neighborhood n, P_w is the strategy for network w, R_a^n is agent a's neighborhood rank and R_a^w is agent a's network rank.

Each time step, every agent also updates their strategy. An agent's update function is defined as:

$$S_a` = \alpha \times S_a + \beta \times S_g + \gamma \times S_n + \lambda \times S_w \qquad (5)$$

where $\alpha, \beta, \gamma, \lambda \in [0, 1]$ and $\alpha+\beta+\gamma+\lambda = 1$. These values represent what percentage of influence the agent takes from itself, its group, its neighborhood and its network. This allows for multiple agent types. For example, (1, 0, 0, 0) represents a selfish agent because it cares nothing about the whole society, and (0, 0.33, 0.33, 0.34) represents a selfless agent who cares about the three social structures equally. Our system is fully distributed and uses discretized time. At each time step, every agent has an execution cycle, shown in Figure 2.

TWO-PHASE DECISION-MAKING PROCESS

Kahneman and Tversky suggest a two-phase decision model for descriptive decision-making: an early phase of editing and a subsequent phase of evaluation. In the editing phase, the decision-maker constructs a representation of the acts, contingencies and outcomes that are relevant to the decision. In the evaluation phase, the agent assesses the value of each alternative and chooses the alternative of highest value. Our decision model incorporates their idea and specifies it by the following five mechanisms:

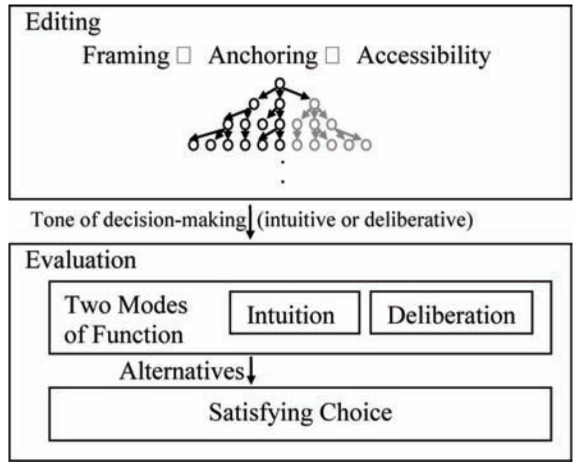
Figure 2. Agent execution function

```
/* The function is executed independently by
   each agent, denoted agent a below.*/
execute(KBa, Sa, env, mQueue, t)
  inputs: KBa is the knowledge base for agent a
          Sa, the strategy of agent a
          env, the environment
          mQueue, the message queue for agent a
          t, the current step
  // making decision
          observation(env);
          update(KBa);
          check(mQueue);
          M = situation_assess(KBa);
          action = decision(KBa, Sa, M);
  // performing the output of decision-making
          do(action);
          inform_resource_synchronize(env);
          update(env);
          inform_server_synchronize(masterserver);
  // updating society's strategy
          update_group_strategy();
          update_neighborhood_strategy();
          update_network_strategy();
  // updating agent's strategy
          update_agent_strategy();
  // moving to next step
          t++;
```

- Editing
  - **Framing:** The agent frames an outcome or transaction in its mind and the utility it expects to receive.
  - **Anchoring:** The agent's tendency to overly or heavily rely on one trait or piece of information when making decisions.
  - **Accessibility:** The importance of a fact within the selective attention.
  - Evaluation
  - **Two modes of function:** Intuition and deliberation.
  - **Satisfying theory:** Being good enough.

Figure 3 shows the two-phase decision-making process. Next we discuss each phase in a subsection.

Figure 3. Two-phase decision-making process



Editing Phase

One important feature of the descriptive model is that it is reference based. This notion grew out of another central notion called **framing** where agents subjectively frame an outcome or transaction in their minds and the utility they expect to receive is thus affected. This closely patterns the manner in which humans make rational decisions under conditions of uncertainty.

Framing can lead to another phenomenon referred to as **anchoring**. Anchoring or focalism is a psychological term used to describe the human tendency to overly or heavily rely (*anchor*) on one trait or piece of information when making decisions. A classic example would be a man purchasing an automobile, the client tends to "anchor" his decision on the odometer reading and year of the car rather than the condition of the engine or transmission.

Accessibility is the ease with which particular information come to mind. The concept of accessibility is applied more broadly in this research than in common usage. The different aspects and elements of a situation, the different objects in a scene, and the different attributes of an object, all can be described as more or less accessible for an individual agent exposed to a certain decision situation. As it is used here, the concept of accessibility subsumes the notions of stimulus salience, selective attention, and response activation or priming.

The editing phase gives us the main ideas that have been incorporated practically into the next phase, evaluation, to make quick intuitive decisions.

Evaluation Phase

In the evaluation phase, there exist two modes of cognitive function: an **intuitive** mode in which decisions are made automatically and rapidly, and a **deliberative** mode, which is effortful and slower. The operations of the intuition function are fast, effortless, associative, and difficult to control or modify, while the operations of the deliberation function are slower, serial, and deliberately controlled; they are also relatively flexible and potentially rule governed. Intuitive decisions occupy a position between the automatic operations of perception and the deliberate operations of reasoning.

Intuitions are thoughts and preferences that come to mind quickly and without much reflection. In psychology, intuition can encompass the ability to know valid solutions to problems and decision making. For example, the RPD model aimed to explain how people can make relatively fast decisions without having to compare options [21]. Klein found that under time pressure, high stakes, and changing parameters, experts used their base of experience to identify similar situations and intuitively choose feasible solutions. Thus, the RPD model is a blend of intuition and deliberation. Intuition is the pattern-matching process that quickly suggests feasible courses of action. Deliberation is a conscious reasoning of the courses of action.

We adopted a different approach from the RPD model to handle the intuitive and deliberative decision-making process. For our purpose, what becomes accessible in the current situation is a key issue in determining the tone of decision-making, i.e. intuitive or deliberative. Accessibility is determined in the editing phase by three factors.

- First, an agent utilizes prior knowledge of previous states to frame potential outcomes for its current state. In framing these potential outcomes, an agent ascribes reference based expected utility functions to them. Here, information anchoring or bias becomes a positive force as it leads to the agent's ability to make reference based utilities for each potential outcome.
- Second, when an agent makes decisions, it does not have to search all of its knowledge base. Instead, it concentrates on the relevant and important information.
- Third, a decision which was chosen before receives more attention (or high accessibility) than other alternatives and tends to be more positively evaluated before it is chosen again.

Based on the above analyses, we compile an information list. In addition to physical properties such as size and distance, the list keeps track of an abstract property called accessibility. The accessibility represents the relevance, similarity or importance of the information. At the beginning, this fact is known to the designer. It will be dynamically updated along with system processing. For example, the deliberation process may increase the accessibility because this information is important; if this information has been used in a previously successful decision, its accessibility will be increased, but if the previous decision was not successful, the accessibility will be decreased. The accessibility of all information is normalized and compared with a threshold for triggering the intuitive function for decision-making.

When making decisions, agents use the **satisfying theory**, i.e. they will take the good enough choice rather than the best one. We model the decision-making as a Multi-Attribute Decision-

Making problem [1, 39], which includes a finite discrete set of alternatives which is valued by a finite discrete set of attributes i. A classical evaluation of alternatives leads to the aggregation of all criteria into a unique criterion called value function V of the form:

$$V(\alpha) = w \cdot v(\alpha) = f_{i \in I}(w_i v_i(\alpha)) \quad (6)$$

where α is an action, $V(\alpha)$ is the overall value for action α, w_i is a scaling factor to represent the relative importance of the i^{th} attribute, $v_i(\alpha)$ is a single attribute value with respect to attribute index $i \in I$ and f is the aggregation function. Function f normally is domain dependent, for example, it can be an additive value function for preference independence, a discounted value function when there is reward for different preferences, or a Constant Absolute Risk Aversion function for risk-averse decision-making. The action being finally selected is the first action whose value reaches a predefined desire value D:

$$\varepsilon(\alpha) = \exists \alpha \ s.t. \ V(\alpha) > D \quad (7)$$

Figure 4 shows the two-phase decision-making algorithm.

A SIMULATION FOR CASE AGENTS

We have developed a simulation for the above agent system. Our system is capable of scaling huge simulations, to be capable of being deployed on many machines with the ability to control what is happening in the simulation through the use of a single GUI running on one machine, and it is able to process large amounts of data and perform operations on that data.

Figure 4. Two-phase decision-making algorithm

```
decision(KBa, Sa, M)
  inputs: KBa, the knowledge base for agent a
          Sa, the strategy for agent a
          M, the current situation

  //editing phase
    anchors = getAnchor(M);
    topAccessibleMemory = query(KBa, anchors);

  //evaluation phase
    //intuitive decision-making
    if (topAccessibleMemory is enough)
    rebuild individual tree
      return satisfyingDM(topAccessibleMemory, Sa);

    //deliberative decision-making
    else
      wholeMemory = query(KBa, M);
      if (wholeMemory is enough)
          return satisfyingDM(wholeMemory, Sa);
      else
          ask(network, anchors);
```

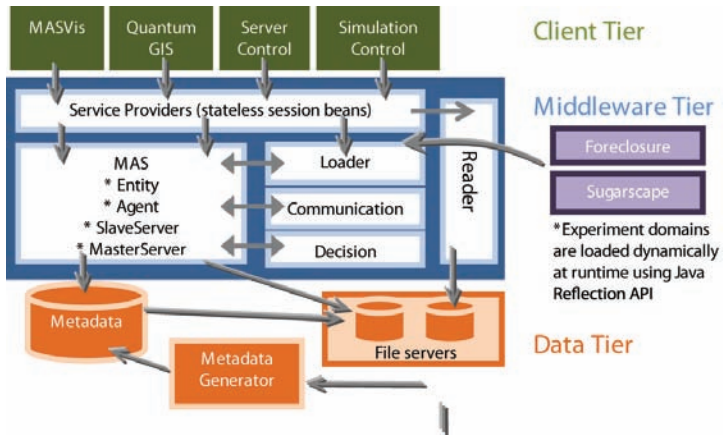
Service-Oriented Architecture

The Service-Oriented Architecture (SOA) [8] is a design pattern commonly used in many large corporations, such as NASA. It provides a flexible and stable architecture for large scale software systems. For this reason we felt it would be a good fit for the distributed multi agent system we were developing.

SOA requires that services should be "loosely coupled", in other words encapsulated and have as few dependencies on other services as possible. This allows for services to be easily swapped and their implementation to be easily upgraded. One service could easily be swapped out for another service that accomplishes the same result.

For our system we use a three tier approach as seen in Figure 5, which consists of:

Figure 5. A three tier SOA diagram



- The client tier
- The middleware tier
- The data tier

The *client tier* consists of the user interface. As defined by the nature of the SOA design pattern, the user interface maintains service encapsulation and could theoretically be used with any core system. All that would need to be ensured was that the core followed the service contract as far as how to communicate with the client tier. The first two services that the interface provides are server control and simulation control. This allows the user to set up their own system distribution and experiment. The other two services the interface provides are MASVis and Quantum GIS. MASVis is a data analysis and visualization package we developed for social simulations. It is built on the fundamental design of having data sources that connect through multiple filters to process elements of data and which can be plotted to display the data. Our simulation also supports GIS. The GIS system we use to display our data is Quantum GIS[10]. Quantum GIS is suitable for our needs because it allows for reprogramming. It is quite light and allows for plug-ins so it is easily expandable. It also requires few resources, being able to run on very little RAM and consume little processing power, which is necessary for our simulations since our simulations use the processor heavily. Further, it is completely compatible on all operating systems and has a very large community of active developers. Both MASVis and Quantum GIS are still works in progress.

The *middleware tier* consists of the core CASE agent system as described earlier. The core system is made up of the collection of master and slave servers as well as the CASE agents that occupy them. The middleware tier will also consist of the service providers that help the middleware tier communicate with both the client tier as well as the data tier. We have developed two experimental domains: Sugarscape and Foreclosure. Sugarscape is a classical test-bed for growing agent-based societies [7]. Foreclosure is a domain we developed for helping social scientists to analyze the nationwide "foreclosure crisis" problem (refer to section 4 for more details).

The *data tier* helps encapsulate the data, and stores it separately from the simulation running in the core system; this could entail having the data tier on a separate server. Not only does this help ensure the stability of the data, it also allows for the use of metadata. In our simulation, the data tier records its data using XML specifications specifying important meta information such as date, author, simulation, etc. This allows for a more robust data system, which can easily be searched using filters, such as range of dates or author.

Using these three tiers will help ensure that our simulation is robust enough to allow for any part of it to be updated with little or no difficulty. Also the modular nature of the SOA allows for other researchers to use only the parts of the system that they find to be appropriate for their own project.

Next, we explain in detail the middleware tier which focuses on the system distribution and the client tier which describes the user interface.

System Distribution

For the system to be effective at dealing with the large number of agents required for social research, it has to be highly distributed both in processing as well as in memory. To achieve this we developed a Master/Slave system, as showed in Figure 6.

The system has a single master server in charge of initializing and synchronizing the other servers (slaves). The master's responsibilities include initializing each step, facilitating agent communication and agent movement from one server to another, and most importantly load balancing all of the servers to ensure optimal performance. The slave is originally initialized with a given bounds and a set of agents. The slave's responsibility is to update all of its agents each step, this is a two step process:

- First it updates all of the agents' knowledge for what they perceived that step
- Secondly it has each of its agents implement its decided action for that step.

The agents are run in the maximum number of threads the server can handle; this ensures optimal performance through parallelization.

To ensure effective load balancing the master keeps track of the rest of the server by using a KD tree. The KD tree works by splitting the bounded region of the simulation on a different axis each time, until there is a single leaf per slave server, as seen in Figure 7. Splitting the region up in this manner allows the master server to go in and shift these splits one way or the other to balance the load between slaves. By shifting a KD split, the master server reduces the amount of the region and the amount of agents that a slave server is responsible for, and by doing so alleviates that server's load. Figure 8 is a screenshot of the server control interface.

Figure 6. Master/Slave relationship

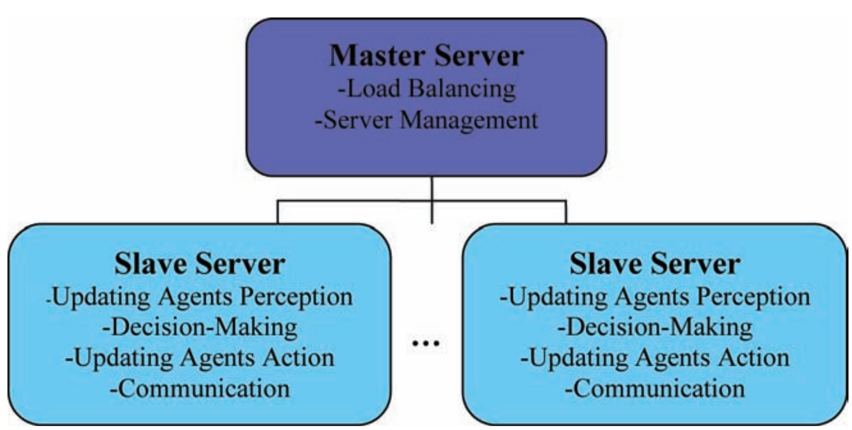
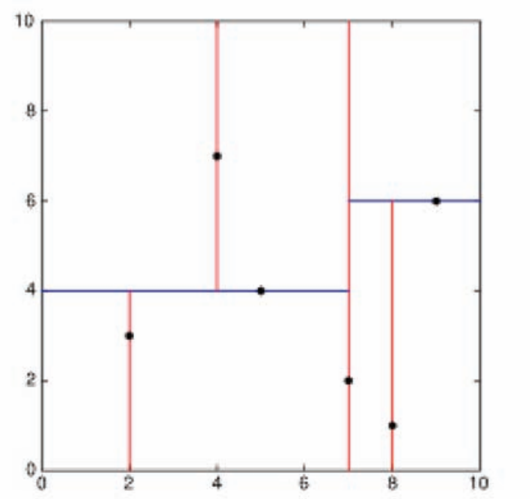


Figure 7. A graphical representation of the KD tree

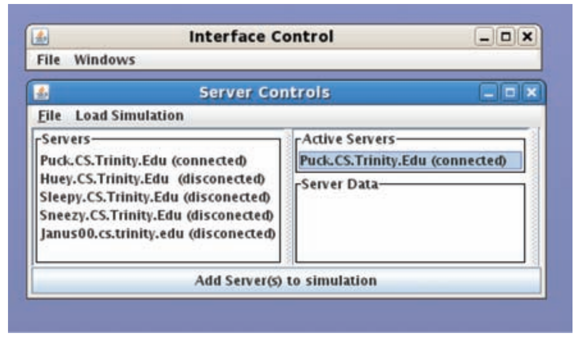


User Interface

In creating the user interface, the primary consideration is that users will not be concerned with all of the system's features at once. Furthermore, there will not be enough screen space to conveniently and aesthetically portray all of these features, specifically the settings, server, data, graphical, and simulation windows, at once. To house each element of the system's features in detached windows, able to be hidden and then restored whenever needed, is therefore clearly plausible and arguably necessary for such an open-ended agent simulation. This can be argued for each individual element of the system's features.

Once a user calibrates the appropriate settings for his simulation implementation, he may not need to keep these settings in focus throughout the running of the simulation; rather, the user may be more focused on the system's output and the results of the simulation. To keep these settings on the screen for the duration of the simulation would force the user to work with cluttered space, constantly having to move windows around in order to see and collect data. To house all of the simulation settings in a detached window, able to be hidden and then restored whenever needed, is, therefore, clearly plausible and arguably necessary for such a wide-breadth multi-agent simulation.

Figure 8. A screenshot of the server control interface



This same logic can apply to the server window, where server hosts can be added, managed, or booted. Clearly, server management is not the primary focus of any type of simulation. While servers need to be added at the beginning of a simulation and monitored and/or booted throughout the duration of the simulation, the server window need not be opened and visible the entire time. Again, the detached and hide-able window system works effectively in this situation.

This detached-window argument can also be applied to output-based elements of the simulation user interface. Consider when a user is focused on only the raw textual data output of a simulation. Clearly, any visual representation of the data in question, whether it is a graphical representation of this data or a step-by-step visualization of the individual agents in the system, would be extraneous and unneeded in the given situation.

Obviously, this scenario can be flipped into a situation in which the user is only focused on visuals, in which case the raw textual data output would be unneeded. Similar to the case of the settings window, housing both graphical data representations and textual data output in detached, escapable and restorable windows, is a necessary feature.

To keep almost every aspect of the simulation in separate, hide-able windows requires the use of a main menu, or a master controller, that cannot be closed. This controller handles not only the core, system-wide commands for MASVis but also the hide and restore functions for all other windows, while still remaining as small as possible and preserving screen space.

Without a doubt, users of MASVis have an advantage with a user interface system with separate, moveable, hide-able windows. Such a system allows for a maximization of the valuable resource of screen real estate and also puts the system's focus on what currently matters to the user. Figure 9 is a screenshot of the Sugarscape interface.

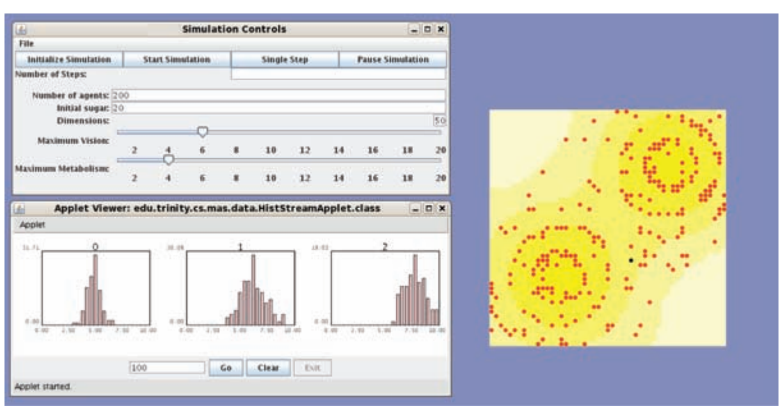
EXPERIMENT

Multi-agent systems are increasingly used to identify and analyze the social and economic problems of urban areas and provide solutions to these problems [9]. We tested the CASE architecture in the urban dynamics field. We did not use the classical benchmarks such as Santa-Fe Artificial Stock Market (SF-ASM) which is commonly used by the Agent-Based Simulation (ABS) community of social science and economics. This is because such classical testing domains were originally designed for game theory, which uses reactive agents and relies on the concept of equilibrium that is rarely seen in real-world environments, and decision theory, which was grounded on the level of a single individual with a lack of social interests.

Our simulation in urban dynamics focuses on the nationwide "foreclosure crisis" problem. With more than 430,000 foreclosure filings reported nationwide, the nation's rate of foreclosure is at an all time high[11]. This experiment simulated mortgage default in San Antonio, Texas. "San Antonio is dominated by predominately young Hispanic families. In the last decade the city's young and dynamic population has seen median household income grow significantly as childhood poverty declined rapidly. Unemployment remains fairly low, however, due to a lag in higher educational attainment the bulk of the city's households earn only low-to-meddle incomes. Despite this and other factors there was a considerable rise in homeownership as the growing population began to move into neighborhoods in both the metro and suburban areas of the city."[12] By the first quarter 2007, San Antonio's rate of foreclosures is nearly twice the national average and is among the top 20 cities with the highest foreclosure rates in the U.S.[13].

Based on the above observation, we choose to model San Antonio's "foreclosure crisis" as a

Figure 9. A screenshot of the Sugarscape Interface



multi-agent system. This chapter reports our initial experiment. We modeled a simple housing market where agents purchase and sell homes. The agents need to carry out three tasks: selecting a home to purchase, obtaining a loan to purchase that home and making monthly payments on that loan. Each agent selects a home that is feasible for it to purchase based on its individual annual income, credit score and current interest rates. On the first time step each agent attempts to purchase a home and continues to do so each time step afterwards until it finds a suitable match. Throughout the simulation the interest rates and additional monthly expenses as signed to each agent are subject to change and no agent is given prior knowledge of the schedule or degree of these changes. Once an agent has purchased and occupied a home for one time step, that agent must begin making payments on the loan it initially took out to purchase that home. If during one time step an agent can not make its monthly mortgage payment (i.e. its annual income is less than the sum of its monthly expenses and mortgage payment) then that agent is forced into a situation of default. In remaining time steps that agent may attempt to purchase another home of equal or lesser value but this is made rather difficult as its credit score has dropped significantly. This is done to reflect the difficulty in reality of obtaining a new home after a foreclosure.

The purpose of this simulation is to examine the relationship between an individual agent's strategy, and the diffusion of those strategies to its society (groups, neighborhood and network), and finally the overall foreclosure rate of the city. Our initial simulation used only 100 homeowners (agents) and 100 homes that were both randomly generated within several carefully selected statistical parameters to reflect demographic realities of the city along the following lines: housing values, homeownership history, FICA (Federal Insurance Contributions Act) scores and household income. We ran the system for 100 steps with each single step simulating one month in reality.

We defined two groups of agents within the system: an *aggressive group* and a *conservative group*. Agents that are members of the aggressive group are more adapt to "over-extend" their credit lines and purchase a home that may or may not be within their budget. While agents who are members of the conservative group are more apt to purchase a home that is well within their budget. Initially each agent is given their own strategy that falls within some statistical range of one of the two groups. This initial strategy defines an agent's propensity to join one of the two groups. As time passes, agents are influenced in a variety of ways: either through members of their own groups, their neighbors who may or may not belong to the same group, and their extended social network. An agent's neighborhood is a direct function of its observability, i.e. the amount of agents it can observe at a given time. An agent's network is not a physical construct, but rather a meta-physical medium constructed from the agents it decides to frequently communicate with. Hence as the size of an agent's neighborhood, social network, and group membership grows its strategy becomes more dominant within society as a whole.

We use three teams as defined in Table 1. Except for the decision rules, conditions of all teams were exactly the same.

We report three experiments. Experiment 1 involves only the Reactive Team. These agents do not utilize any social structure (neighborhoods, groups or networks) and hence have no ability to learn through time or adapt to environmental changes. Figure 10 is the result of the reactive team. It shows that the foreclosure rate is extraordinarily high (~%60) and is rather unstable, moving up and down 15 points between some time steps. These large variations in the foreclosure rate are a product of both the agent's simplistic decision making mechanisms and their inability to diffuse successful strategies to other agents. Indicative of the fact that we do not see this high variable of foreclosure rates in reality is the underlying fact that humans utilize

Table 1. Three teams

Team	Feature	Purpose
Reactive Team	Reactive Agents	The base team
ID Team (Intuition + Deliberation)	Keep every condition in Reactive Team Replace Reactive rule by Intuitive & Deliberative decision rule	Test the effectiveness of pure I&D decision rule
IDS Team (Intuition + Deliberation + Society)	Keep every condition in I&D Team Add the three social structures to it (group, neighborhood and network)	Test the effectiveness of combined social structure and I&D decision rule

a much more complex and sophisticated means for making decisions.

Experiment 2 tests the ID Team. Figure 11 illustrates the results of adding only this intuition and deliberation capability to reactive agents. The upper line shows the number of agents who use intuitive decision-making. At the beginning of the simulation, this number is quite low. But agents are able to quickly learn from the decisions they made before and use them to make new decisions. The low line is the number of foreclosures. It is lower than the Reactive Team in Experiment 1 as the agents are able to recognize recurring instances of potential default and avoid them if possible. However, this adaptability is limited only to an individual agent and there are no mechanisms for one agent to diffuse its successful strategy onto other agents. This limitation is indicated by the presence still of variability in the foreclosure rate. The inability of individual agent leads to decreased stability of the system as a whole.

To further explore this, in experiment 3 we test the IDS Team. We add the three social structures (neighborhood, group and network) on top of the existing individual agent decision-making mechanisms. In doing so we allowed the agents to diffuse their successful strategies through physical (neighborhood) and non-physical (group and social network) space. As Figure 12 indicates, we see the same adaptability present in Experiment 2 as the knowledge base of the individual agents expands, allowing them to better predict future events based on past experiences, in addition to an increased level of stability (measured by less variability in the foreclosure rate) as the successful strategy is diffused through various social structures. Experiments 2 and 3 confirm our hypothesis that human decision-making is "embedded" in a social context.

Figure 10. The result of the reactive team

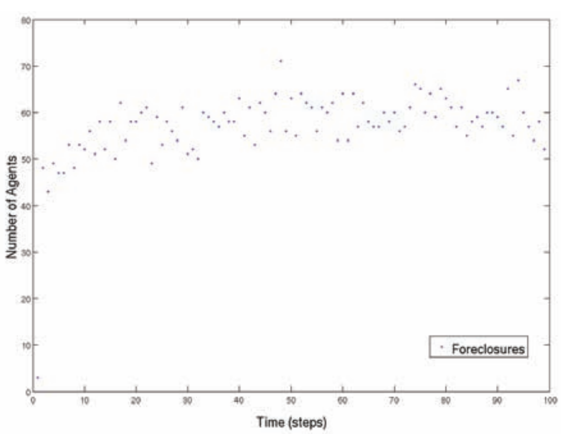


Figure 11. The result of the ID Team

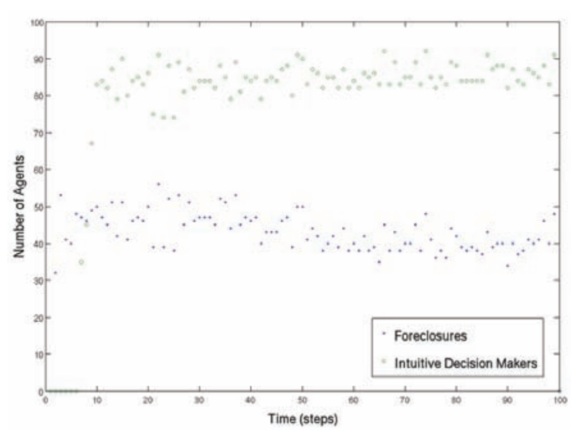
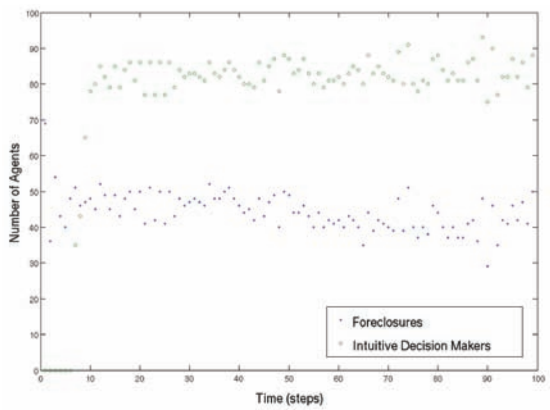


Figure 12. The result of the IDS team



CONCLUSION

In this paper, we have presented CASE, a multi-agent architecture for supporting human social interaction as well as the intuitive and deliberative decision-making process. This approach allows us to observe a wide range of emergent phenomena of complex social systems and analyze their impact. The chapter also reports our first step in developing a robust and flexible multi-agent simulation that can be used by social scientists and economists.

Within CASE, there are many issues awaiting our research team. We are currently expanding CASE in four directions. The first direction is toward agent modeling. Our current agents use a simple memory structure for intuitive decision-making. The problem with this is it is not very adaptive to the dynamic environment. We are currently analyzing different situation assessment and learning technologies and will incorporate them into our agents. Another ongoing project is to theoretically study the emergent patterns in the interplay between the multi-dimensional relations (group, neighborhood and network) in the behavior of agents.

Second, we will add a range of technologies for the simulation. The purpose of the simulation is to provide an integrated environment for social scientists and economists to manage, analyze and visualize their data. Therefore it is important to provide a user friendly interface and a low programming-skill-required environment. We will continue simplifying the task of setting up different testing domains and develop a rich charting package for MASVis that will further simplify the creation of visualizations.

Third, we will continue investigating various data structures and algorithms of load balancing to better distribute CASE agents on clusters of computers or different types of grids. This development will further simplify and speed up the simulation by reducing the computing load and memory load in a single machine.

Fourth, we are also expanding the scale of the foreclosure experiment in order to draw more conclusions to the question regarding the social and economic factors that affect the "foreclosure climate" of a city. The questions that we will investigate include: 1) Where are the foreclosures occurring? 2) Are they clustered or isolated events? 3) Who is being foreclosed upon and do they share common characteristics? 4) What social and economic factors are driving an increase in the foreclosure rate? and 5) Could we predict the likelihood and location of future foreclosures?

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ENDNOTES

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7 http://ecolab.sourceforge.net/
8 http://www.spiderland.org/
9 Conversely, this does not mean that it is impossible or useless to represent societies as entities in their own right. We can of course design a society in the form of an agent, and thus consider MASs as packages of agents and societies, like what has been done in [35].
10 http://www.qgis.org
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12 "San Antonio In Focus: A Profile from the Census 2000 " ©2003 Brookings Center on Urban and Metropolitan Policy.
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This work was previously published in Handbook of Research on Agent-Based Societies: Social and Cultural Interactions, edited by G. Trajkovski; S. Collins, pp. 104-124, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.7
Embedding an Ecology Notion in the Social Production of Urban Space

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ABSTRACT

This chapter defines, explores and Illustrates research at the intersection of people, place and technology in cities. First, we theorise the notion of ecology in the social production of space to continue our response to the quest of making sense of an environment characterised by different stakeholders and actors as well as technical, social and discursive elements that operate across dynamic time and space constraints. Second, we describe and rationalise our research approach, which is designed to illuminate the processes at play in the social production of space from three different perspectives. We illustrate the application of our model in a discussion of a case study of community networking and community engagement in an Australian urban renewal site. Three specific interventions that are loosely positioned at the exchange of each perspective are then discussed in detail, namely: Sharing Stories; Social Patchwork and History Lines; and City Flocks.

DOI: 10.4018/978-1-60566-152-0.ch012

INTRODUCTION

The intersection of urban and new media studies is a dynamic field of practice and research. There are a number of reasons why this is so. Technically these are both highly innovative domains, and the rate of change is significant and challenging. Urban life and media platforms are both in the midst of paradigm shifts. Theoretically, both fields can be understood as sites of signification and structuration of the social field—and because they both evidence such change they are potent laboratories for advancing understanding. The pragmatic corollary is that policy makers and corporate investors are also highly engaged in the intersection.

Apart from the complexity of maneuvering through the often differing agendas of researchers and practitioners and of private and public sector agencies that operate at this intersection, the objective of advancing understanding is also challenged by a plethora of different and sometimes differing theories. Yet, universally useful contributions to knowledge can be achieved if urban cultural studies, urban sociology, urban technology and human-computer interaction, urban architecture and planning, etc., overcome language and conceptual barriers. A cross-disciplinary approach requires effort to create models which help to overcome phenomenologically isolated attempts at explaining the city. Such models would ideally be cross-fertilised by the findings and insights of each party in order to recognise and play tribute to the interdependencies of people, place and technology in urban environments. We propose the notion of ecology (Hearn & Foth, 2007) as a foundation to develop a model depicting the processes that occur at the intersection of the city and new media.

In the context of the field of urban planning and development, the promise of digital content and new media has been seen as potentially serving new urbanist visions of developing and supporting social relationships that contribute to the sustainability of communities. As Carroll et al. (2007) have argued, recent critiques of assumptions underpinning this vision have pointed to the following outcomes as 'most in demand', and simultaneously most difficult to deliver:

- Community (Anderson, 2006; DeFilippis, Fisher, & Shragge, 2006; Delanty, 2000; Gleeson, 2004; Willson, 2006);
- Diversity (Talen, 2006; Wood & Landry, 2007);
- Participation (Hanzl, 2007; Sanoff, 2005; Stern & Dillman, 2006);
- Sustainability (Gleeson, Darbas, & Lawson, 2004; Van den Dobbelsteen & de Wilde, 2004);
- Identity (Al-Hathloul & Aslam Mughal, 1999; Oktay, 2002; Teo & Huang, 1996);
- Culture and History (Antrop, 2004; Burgess, Foth, & Klaebe, 2006; Klaebe, Foth, Burgess, & Bilandzic, 2007).

It is critical that the emergence of urban informatics as a multidisciplinary research cluster is founded on a theoretical and methodological framework capable of interrogating all these relationships and the assumptions that currently underpin them. As Sterne has warned in relation to research pertaining to the field of technology more generally,

> *the force of the 'preconstructed'—as Pierre Bourdieu has called it—weighs heavily upon anyone who chooses to study technology, since the choice of a technological object of study is already itself shaped by a socially organized field of choices. There are many forces in place that encourage us to ask certain questions of technologies, to define technology in certain ways to the exclusion of others, and to accept the terms of public debate as the basis for our research programs. (Sterne, 2003, p. 368)*

In this respect, if we are to promote an analytical focus on the capacities and possibilities of digital content and new media to meet the challenges of community, participation, sustainability, identity and so on, it is important to employ frameworks that permit systematic study of these relationships. We agree with Grabher (2004) who points to analytical advantages in resisting assumptions around passive adaptation to environments, and permitting a focus on networks, intricate interdependencies, temporary and permanent relationships and diverse loyalties and logics. We propose that these qualities are best integrated in an ecological model which we will develop in this chapter.

This chapter defines, explores and exemplifies our work at the intersection of people, place and technology in cities. First we introduce the notion of ecology in the social production of space to continue our response to the challenge of making sense of an environment characterised by different stakeholders and actors as well as technical, social and discursive elements that operate across dynamic time and space constraints (Foth & Adkins, 2006). Second we describe and rationalise our research approach which is designed to illuminate the processes at play from three different perspectives on the social production of space. We illustrate the application of our model in a discussion of a case study of community networking and community engagement in an Australian urban renewal site—the Kelvin Grove Urban Village (KGUV). Three specific interventions that are loosely positioned at the exchange of each perspective are then discussed in detail, namely: *Sharing Stories*; *Social Patchwork* and *History Lines*; and *City Flocks*.

THEORETICAL FRAMEWORK

Our theorisation is conscious of the extent to which technical, social and discursive elements of urban interaction work across (1) online and offline communication modalities; (2) local and global contexts; and (3) collective and networked interaction paradigms (Foth & Hearn, 2007; Hearn & Foth, 2007). The distinction between online and offline modes of communication—and thus, online and offline communities—is blurring. Social networks generated and maintained with the help of ICTs move seamlessly between online and offline modes (Foth & Hearn, 2007; Mesch & Levanon, 2003). Additionally, studies of Internet use and everyday life have found that the modes of communication afforded by Internet applications are being integrated into a mix of online and offline communication strategies used to maintain social networks (Wellman & Haythornthwaite, 2002).

Urban communicative ecologies operate within a global context increasingly dominated by Web 2.0 services (eg., search engines, instant messenger networks, auction sites and social networking systems). The notion of 'glocalization'—introduced by Robertson (1995) and later re-applied by Wellman (2001; 2002)—is useful here because it emphasises the need to develop locally meaningful ways of using this global service infrastructure rather than trying to compete with existing global sites and content. Studies have highlighted a range of opportunities for the development of local (and location-aware) services as well as locally produced and consumed content (Boase, Horrigan, Wellman, & Rainie, 2006; Burgess et al., 2006).

The similarly increasing ease with which people move between collective and networked community interaction paradigms hints at opportunities for new media services that can accommodate both kinds of interaction and afford the user a smooth transition between the two. Collective interactions ('community activism') relate to discussions about place; for example, community events, street rejuvenation initiatives and body corporate affairs. Networked community interactions ('social networking') relate to place-based sociability and features that for example, seek to raise awareness of who lives in the neighbourhood, provide opportunities for residents to find out about each other, and initiate contact.

In the introduction we pointed to the complexities of the relationships that need to be captured in understanding the role of information and communication technologies in the vision underpinning contemporary urban villages. Specifically it responds to recent calls for a more nuanced understanding of the patterns of relationships underpinning their uses in urban contexts. As Crang et al. (2006) observe, research in this area requires a more specific focus on the everyday uses of ICTs and the interactions of multiple technologies in everyday practices. In this respect, we argue that an ecological model enables a conceptualisation that opens up the possibility of diverse adaptations to a specific environment, and the different logics, practices and interdependencies involved. However, Crang is equally emphatic about the salience of social difference in the use of ICTs in urban contexts, pointing to research that underlines the episodic and instrumental use of them in contexts of deprivation and pervasive use in wealthier households (Crang et al., 2006). In this respect, we must provide for the possibility that different ecological configurations are related to the positioning of social agents in the field of urban life.

What is required, then, is a model that can capture ecological relationships in the context of the production of social difference in urban contexts. We extend previous conceptual work on ecological models (Adkins, Foth, Summerville, & Higgs, 2007; Dvir & Pasher, 2004; Foth & Adkins, 2006; Foth & Hearn, 2007; Hearn & Foth, 2007) by exploring Lefebvre's (1991) model in *The Production of Space*. It provides some conceptual tools to locate these ecologies as occurring in the context of different levels of space production. A central differentiation in his model is between 'representations of space' and 'representational spaces'. Representations of space refers to, "conceptualised space: the space of scientists, planners, urbanists, technocratic subdividers and social engineers [...] all of whom identify what is lived and what is perceived with what is conceived". Representational spaces on the other hand refers to, "space as directly lived through its associated images and symbols, and hence the space of the 'inhabitants' and 'users'" (Lefebvre, 1991, p. 38). In terms of this conceptual distinction the object of knowledge in the study of urban space,

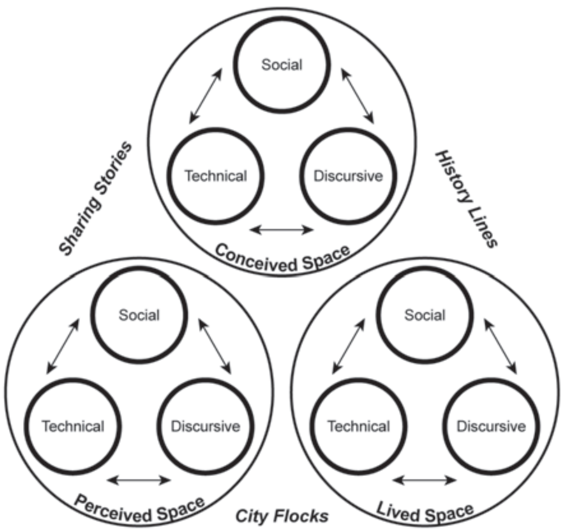
> *is precisely the fragmented and uncertain connection between elaborated representations of space on the one hand and representational spaces [...] on the other; and this object implies (and explains) a subject—that subject in whom lived, perceived and conceived (known) come together in a spatial practice. (Lefebvre, 1991, p. 230)*

The model thus provides a context in which urban experience can be understood in terms of differential levels and kinds of power and constraint in the production of space and the relationships between them. Inequities can then be understood as involving different configurations of these relationships. Ecologies of ICT use in this framework are then understood in terms of the adaptations and interdependencies occurring in specific contexts underpinned by relationships of spatial use.

It is now possible to locate the vision of contemporary master-planning projects pertaining to, for example, 'community', 'identity' or 'culture and history', as produced at the level of the way space is conceived through planning and development practices, at the level of the way space is perceived through marketing material and spatial practice, and at the level of everyday experiences of residents as well as in the interrelationships between them (see Figure 1). This provides a framework in which the meaning of these visions can vary across different kinds of residents and can conflict with the conceived meanings of planners and developers. Studying ecologies of the use of new media and ICT from this perspective promises to illuminate the conceptual connections between these technologies and the field of urban life.

In the following part of the chapter, we discuss three initiatives that combine research and community development goals. They are positioned to facilitate a conceptual exchange between the three ecological domains of conceived, perceived and lived space, that is, *Sharing Stories*, *History Lines* and *City Flocks*. However, before we start, we introduce the emerging space of our study.

Figure 1. Embedding an ecology notion in Lefebvre's triad



THE URBAN VILLAGE

The Kelvin Grove Urban Village (KGUV) is the Queensland Government's flagship urban renewal project. Through its Department of Housing, and in partnership with Queensland University of Technology, this 16 hectare master-planned community (see Figure 2) seeks to demonstrate best practice in sustainable, mixed-use urban development. By 'linking learning with enterprise and creative industry with community', the KGUV is designed to evolve as a diverse city fringe neighbourhood. Situated 2 km from Brisbane's CBD, it is based on a traditional village design, with a town centre and shops on the main streets. Since planning for the Village started in 2000 and construction started in 2002, AUD 1 billion had already been committed to deliver a heterogeneous design that brings together infrastructure with educational, cultural, residential, health, retail, recreational and business facilities within one precinct.

The following numbers and statistics illustrate the progress and development trajectory of the KGUV:

- When completed, there will be over 8,000 sqm (GFA) of retail space and in excess of 82,000 sqm (GFA) of commercial space located throughout KGUV.
- In 2007, there were 375 residential units (including 7 townhouses and 155 affordable housing units) in the KGUV. This is anticipated to exceed 1,000 two-bedroom equivalent

Figure 2. Aerial view courtesy of the Kelvin Grove Urban Village development group

units once the Village is complete (including student and senior accommodation).
- In 2007, there were 10,800 students and 1,800 staff based at the Kelvin Grove campus of QUT, and a total of 1,663 students and approx. 150 staff at Kelvin Grove State College.
- In 2006, 22,000 people attended exhibitions and performances at QUT's Creative Industries Precinct. Additionally, the KGUV-based theatre company has presented 137 performances to 40,000 patrons, plus there were various other events and productions in 2007.

Technical connectivity is established by a 'triple play' (ie., phone, TV, data) fibre-to-the-home and fibre-to-the-node network operated by a carrier within the KGUV. The services can include low or nil cost large bandwidths (for example, Internet Protocol at 100 Mbits/s) within and between points in the KGUV, fibre or wireless network access and quality of service management for multimedia over Internet Protocol. Internet and world wide web access are at commercial broadband speeds and prices. Wireless hotspots allow users to access the Internet in parks, cafés and other locations around the Village. The implementation of the AUD 700,000 infrastructure investment started in 2005. These pipes, wires, ducts and antennas provide the technical connectivity, yet the majority of the infrastructure and certainly the social effect is invisible or unnoticeable. The communication strategies and policies in the KGUV master plan call for ideas and strategies to enable, foster and showcase the social benefits of this infrastructure 'beyond access' (Foth & Podkalicka, 2007).

Our diverse research interests are positioned under the collective umbrella of *New Media in the Urban Village*. The Department of Housing acknowledges that the strategic design of the built environment and access to the ICT infrastructure are necessary but not sufficient neither to ensure 'effective use' (Gurstein, 2003) nor social sustainability. Therefore the master plan calls for the research and development of appropriate interventions, measures and systems which can provide mechanisms to help link the people and businesses that 'live, learn, work and play' at the KGUV, including residents of the KGUV and nearby areas (including affordable housing residents, seniors and students); university staff and students living or studying in the KGUV and nearby areas; businesses and their customers; and visitors. Our suite of research projects are aimed at responding to this call. We now introduce some of these projects, how they respond to the objectives of the KGUV master plan and how they are guided by and feed back into our theoretical underpinnings.

NEW MEDIA IN THE URBAN VILLAGE

The three initiatives discussed hereafter form part of a larger research project that examines the role of new media and ICT in place making efforts to ensure social sustainability of a master-planned urban renewal site. Apart from the projects presented in the following section, a number of affiliated studies are also underway, for example, an international exchange of experiences studying urban social networks (Foth, Gonzalez, & Taylor, 2006), an exploration of health communication to understand the link between the design of the built environment and residents' well-being (Carroll et al., 2007), and a design intervention to display visual evidence of connectivity (Young, Foth, & Matthes, 2007). New research trajectories are about to start examining ways to use new media to digitally augment social networks of urban residents (Foth, 2006) and the role of narrative and digital storytelling to inform urban planning (Foth, Hearn, & Klaebe, 2007).

Sharing Stories

What about just the ordinariness of everyday life not being thought of as important? People move on and then no one is there to take ownership for it. So there are no custodians of the evidence. How can we change that? (Gibson, 2005)

Sharing Stories (Klaebe & Foth, 2007) exemplifies how traditional and new media can work effectively together and in fact complement each other to broaden community inclusion. This multi-layered public history became a research vehicle used to expand the social interaction far beyond that of a community-based history project alone, so as to include the possibilities of global networks using new media applications. Leveraging opportunity, while negotiating and embracing a multidisciplinary new media approach proved rewarding for participants and local residents.

Kelvin Grove has always been a gathering point. While never densely populated, the land was once a meeting place for Indigenous clans, and in the last century, significant military and educational institutions were located there. In 1998 with the closure of the military barracks, the land was purchased by the Queensland Department of Housing. Together with QUT, planning began to transform the site into a creative urban village, lucratively located only two kilometres from the CBD that would include a mix of commercial, retail, university and residential land use. A triple bottom line approach was embraced as core to the master plan—incorporating economic, environmental and social sustainability.

Genuine creativity involves the capacity to think problems afresh or from first principles; to discover common threads amidst the seemingly chaotic and disparate; to experiment; to dare to be original; the capacity to rewrite rules; to visualise future scenarios; and perhaps most importantly, to work at the edge of one competences rather than the centre of them. (Landry, 2001)

The *Sharing Stories* history project was designed as a social engagement strategy that would become a longitudinal component of the development site from the outset. Its purpose was to collate the history of the site itself, to give a reference point and a context to future residents, to capture 'history in the making' as the ethos of the development was cutting edge. Furthermore, it was also essential to embrace the communities adjacent to the site, so they too were taken on the journey as their physical surroundings were to change so dramatically.

New technologies in communication are altering both the form and the content possible for historical discourse, with the processes of transmission arguably becoming less conventionally text-based, and instead offering visual and progressively more individuated options. Increasingly, visual life-story alternatives are being explored. *Sharing Stories* is predominantly an exercise in augmenting a participatory public history. This type of project and online visual display of the content created is still a relatively new approach to local community history and even more groundbreaking as a social engagement strategy to be incorporated in urban development. *Sharing Stories* engaged with the community using 'on the ground' interaction, seeking to be as inclusive as possible with its approach to participatory involvement. By accessing existing local social networks (schools, clubs, alumni groups, etc.) the profile of the project was raised and then promoted through public broadcasting coverage (local television and newspaper stories throughout the three year period)—all of which contributed to a ripple effect that continually drew more interest and contributions to the project as a whole.

Digital storytelling (Burgess, 2006; Klaebe et al., 2007; Lambert, 2002) was an innovative, alternative way of using new media to engage community in the *Sharing Stories* project. In the context of this project, digital storytelling is a combination of a personally narrated piece of writing (audio track), photographic images and sometimes music (or other such aural ambience) unified to produce a 2-3 minute autobiographical micro-documentary film. Traditionally, digital stories are produced in intensive workshops and this was the strategy employed for this project in 2004. Commonly, the thinking behind advocating this type of approach to create digital stories is to allow participants without access to new media the opportunity of using the technology in a hands-on way, so as to become part of the production team that produces their aesthetically coherent, broadcast quality story to a wider, public audience.

A one-to-many strategy included staging regular public events, so as to take the community on the journey of change in their locale, as the urban development process commenced. The primary aim of the *Sharing Stories* project was to capture the history and so a website was created to house content, as an evolving 'living archive' that would be accessible to interested parties locally and beyond. Fragments of the oral history and photographic collection, together with short story narratives produced from the historical research that was concurrently underway was seen as a strategic approach to keeping the community interested, informed and involved over the subsequent years of the development. Public events could be promoted online and afterwards, portions could be archived on the website. Public events held included: professional and local school visual art exhibitions, digital storytelling screenings and photographic exhibitions.

Throughout the *Sharing Stories* project it was noted that both 'real' and 'virtual' contact and exposure were critical in producing an effective participatory public history. The website stimulated interest in the public participating in the project and attendance at public exhibitions and similarly, the locally produced 'on the ground' activities created content and interest in the online representation. The project is thus an example of an initiative which combines opportunities for research data collection and analysis with community development outcomes. It was funded at the planning and development stages as a vehicle to inform the representations of space whilst preserving the history and heritage of KGUV. The local and historical knowledge that *Sharing Stories* produced has informed the marketing and public relations material and technical documentation of KGUV, but has also found its way into tangible representations of space in the form of for example, plaques embedded in the foot paths and other signage with historic anecdotes and citations.

History Lines

With the Web, you can find out what other people mean. You can find out where they are coming from. The Web can help people understand each other. (Berners-Lee, 2000)

An urban development does not occur overnight. A locale undergoing reformation rapidly changes shape. While the *Sharing Stories* phase concluded in December 2006, a new phase of rejuvenation is already beginning to occur. It was only in the latter months of 2006 for instance that new residents began to reside in the Kelvin Grove Urban Village. Thousands more are expected over the next few years, all of which will be living in apartment style accommodation. Research around social sustainability in urban developments turned its attention to capturing the migrational churn of the people coming into the neighbourhood. What are their stories? Where are they from and why are they moving to an inner-city location? And more importantly for some researchers, how can new media applications be used to engage the incoming population, so that the locale becomes *their* story and *their* emerging history?

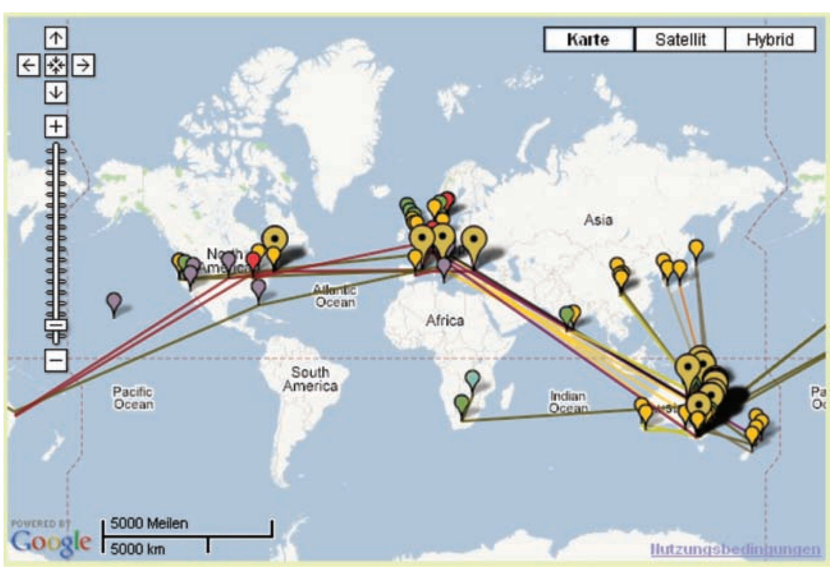
As the new population grows, the Kelvin Grove Urban Village attracts researchers who are grappling with these issues. Their backgrounds diversely combine to possess sociology, anthropology, history, education, health, IT, media/communication, and cultural studies. These researchers work together informally to share ideas and data, as well as to conduct joint workshops and focus groups, reducing 'research fatigue' of new residents. Applications developed by some of these researchers (Klaebe et al., 2007) in the 'Social Patchwork' project, include *History Lines* and *City Flocks* as two examples which we discuss here.

The *Social Patchwork* project involves translating narratives into formats that are Web 2.0 amenable. Researchers aim to develop applications that are useful in the urban development, as well as build historically orientated prototypes that encourage socially sustainable community engagement, to build and strengthen local communities and identities within community. Narrative based applications for example that can support intercreativity, as opposed to conventional interactivity (Meikle, 2002). New media approaches, guided by interpretive narratives, can utilise shared networks, shared interests and can be linked to measure the migrational churn of the suburb.

History Lines brings a cross section of new residents together in an activity using narratives, digital maps and location markers pinpointing where they have lived during the course of their life (see Figure 3). Participants can map their life journey thus far by recording personal narratives of place, while also narrating their relationship with past communities. When stories and locations are collated together, overlapping and common lines of location emerge. The material can be used anonymously as content for an exhibition, as well as a link on a neighbourhood portal to stimulate interest in community networking.

Weyea & Geith, in chapter IV of this book, call for research to 'identify effective information tools to enable citizens to shape what their communities look like' and 'use community data, locative media and social software to enable effective local action'. Our objective with *History Lines* aligns with this research agenda in that it can be an aid in measuring the migrational churn of participating residents and become a tool for urban planners to give them a better understanding of why and where people have lived throughout their lives. Our experimental design is positioned to feed experiences of the lived space into the planning and development process of the conceived space. We think it can deliver a better understanding of

Figure 3. History lines



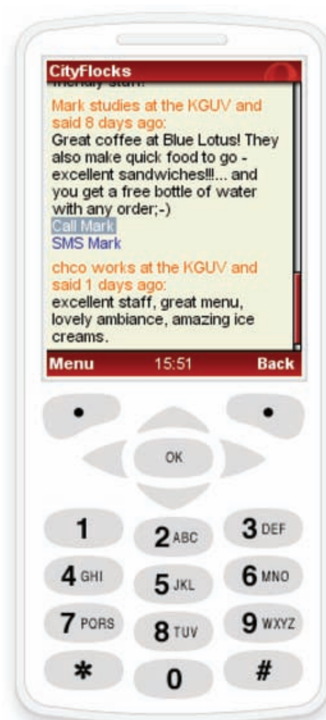
the role of narrative-based new media innovations in support of a more participatory urban planning process (Foth, Hearn et al., 2007; Foth, Odendaal, & Hearn, 2007).

City Flocks

City Flocks—developed by Mark Bilandzic (Bilandzic, Foth, & De Luca, 2008)—is a mobile information service for public urban places. The system is managed by local urban residents and is designed to tap into their tacit social knowledge. *City Flocks* (see Figure 4) allows participants to operate their mobile phones or computers to leave and access virtual recommendations about community facilities, making them easily accessible for other people employing user-generated tags. Residents can also voice-link to other residents, as participants can choose to nominate the mode of contact and expertise they are willing to share. *City Flocks* also allows users to plot their life's journey, but is primarily a rich resource for travellers and/or new residents to an urban location.

Both *History Lines* and *City Flocks* share networks and these shared interests can be linked using folksonomy tagging as opposed to traditional taxonomy directories (Beer & Burrows, 2007) so that they can be utilised by participants both globally and locally. Each application can also be used to encourage connections in the 'real' world. For instance *City Flocks* encourages users to contact fellow residents who have local knowledge of their neighbourhood and are happy to be contacted by newcomers either by email, SMS or by telephoning in order to gain first-hand tacit advice 'in person'. Groups that share 'history', for instance participants who have lived in Sydney and now live at Kelvin Grove, can find and contact each other to meet socially at a local café, thus using virtual connections creatively to meet in the 'real' world. This application is similar to many other social networking applications including *peuplade.fr*, *placebase.com*, *communitywalk.com*, *theorganiccity.com*, *urbancurators.com*

Figure 4. City flocks screen



and *nearbie.com*. However, *City Flock*'s focus is to broaden the scope of the interface to include mobile devices and encourage users to interact directly with each other, rather than mediated via a website. Within the conceptual framework of the social production of space, we see *City Flocks* as a tool to link and balance the spatial practices in the perceived space of KGUV with the actual experiences of the lived space.

CONCLUSION

While both *History Lines* and *City Flocks* are in early stages of development, feedback from focus groups, urban developers and social planners has been encouraging. Whether this kind of online narrative-based testimony will be historically significant in the future is unclear; what is clear however is the fresh inter-creative way in which participants can freely leave their virtual 'mark' on a geographical location. *Sharing Stories* represents an exercise in interactivity, both on and offline. The content created offline could be later used and reflected upon in an online environment. *City Flocks* and *History Lines* comparatively demonstrate online and offline intercreativity, but in these examples the offline connection experience can augment more local, personal or face-to-face interaction. Communicative ecologies are both the enabler and outcome of the capacity to share interests, to 'find each other' and continue a virtual connection in reality. The use of these applications represents new configurations of online and offline relationships enabled by ICT that enhance the capacity of residents to appropriate represented space through their own representational practices. Together, however, they raise the question of the extent to which different kinds of users are able to assert their role in representational space and assert a level of agency over the represented space of the village. There is a key role for communicative ecologies to investigate the extent to which these services are amenable to use by people from different kinds of backgrounds—pervasive or episodic users, for example (Crang et al., 2006)—drawing attention to the configuration of relationships and interdependencies that enable people to assert a position in representational space.

We employed the notion of ecology to establish a holistic framework which allows us to differentiate interdependencies between forms of social interaction, technologies used by urban residents, as well as contextual and discursive aspects whilst at the same time keeping the bigger picture in mind. The design goal of the Urban Village to achieve and maintain a steady-state equilibrium of social sustainability requires further analytical and empirical work. Are there some features that are necessary and sufficient to maintain a socially sustainable equilibrium in a communicative ecology? Are there other factors which are detrimental and cause a gradual withering away of social relations and connective tissue? The interpretation of the various 'ingredients' which make up the Urban Village invokes a coming together of people, place and technology in an urban environment which is an inbetween, that is, not solely random, serendipitous, accidental, yet not solely master-planned and socially engineered development site either. The ecology notion points at an organic process which Gilchrist (2000) describes as 'human horticulture'.

In the introduction we chalked out a field of 'difficult to deliver' desires surrounding community, diversity, participation, sustainability, identity, culture and history. Reflecting back on these challenges, the ecology notion and the associated interventions which we trialled in this study prompt a critical and ongoing rethinking of the concept 'community' and its relation and contribution to the desired image of an 'Urban Village'. It is imperative to unpack the facets of the term 'community' and their individual meaning for different stakeholders and purposes at different times and places. One of the principles which guided the design of our interventions was the consideration of the diversity of the urban environment, both in socio-cultural as well as built environment terms. Rather than attempting an umbrella approach which would have regarded the residents of the Urban Village as a collective group united by their collocation, we tried to draw on their diversity, history and individual ability to express themselves creatively. Our preliminary observations and experiences allow us to argue that nurturing individual identities in this manner does support a local culture of participation, interaction and engagement conducive to engendering a sense of an urban village atmosphere. This culture of shared experiences combines some traditional place making efforts (Walljasper, 2007) with novel ideas employing new media, digital storytelling and social networking fosters the emergence of a socially sustainable urban development.

ACKNOWLEDGMENT

This research is supported under the Australian Research Council's Discovery Projects funding scheme (project number DP0663854) and Dr Marcus Foth is the recipient of an Australian Postdoctoral Fellowship. Further support has been received from the Queensland Government's Department of Housing. The authors would like to thank Mark Bilandzic, Jaz Choi, Aneta Podkalicka, Angela Button, Julie-Anne Carroll, Nicole Garcia, Peter Browning for supporting this research project and the anonymous reviewers for valuable comments on earlier versions of this chapter.

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KEY TERMS AND DEFINITIONS

Communicative Ecology: As defined by Hearn & Foth (2007), comprises a technological layer which consists of the devices and connecting media that enable communication and interaction. A social layer which consists of people and social modes of organising those people—which might include, for example, everything from friendship groups to more formal community organisations, as well as companies or legal entities. And a discursive layer which is the content of communication—that is, the ideas or themes that constitute the known social universe that the ecology operates in.

Collective Interaction: Characterised by a shared goal or common purpose, a focus on the community rather than the individual. The interaction is more public and formal than private and informal, and resembles many-to-many broadcasts. The mode of interaction is often asynchronous, permanent and hierarchically structured. Technology that supports collective interaction includes online discussion boards and mailing list.

Digital Storytelling: Refers to a specific tradition based around the production of digital stories in intensive collaborative workshops. The outcome is a short autobiographical narrative recorded as a voiceover, combined with photographic images (often sourced from the participants' own photo albums) and sometimes music (or other sonic ambience). These textual elements are combined to produce a 2-3 minute video. This form of digital storytelling originated in the late 1990s at the University of California at Berkeley's Center for Digital Storytelling (www.storycenter.org), headed by Dana Atchley and Joe Lambert.

Local Knowledge: Knowledge, or even knowing, is the justified belief that something is true. Knowledge is thus different from opinion. Local knowledge refers to facts and information acquired by a person which are relevant to a specific locale or have been elicited from a place-based context. It can also include specific skills or experiences made in a particular location. In this regard, local knowledge can be tacitly held, that is, knowledge we draw upon to perform and act but we may not be able to easily and explicitly articulate it: "We can know things, and important things, that we cannot tell" (Polanyi, 1966).

Master-Planned Communities: Urban developments guided by a central planning document that outline strategic design principles and specifications pertaining to road infrastructure, building design, zoning, technology and social and community facilities. They are usually built on vacant land and thus in contrast with the type of ad-hoc organic growth of existing city settlements.

Networked Interaction: Characterised by an interest in personal social networking and a focus on individual relationships. The interaction is more private and informal than public and formal, and resembles a peer-to-peer switchboard. The mode of interaction if often synchronous, transitory and appears chaotic from the outside. Technology that supports networked interaction includes instant messengers, email and SMS.

Triple Play infrastructure: Combines broadband Internet access, television reception and telephone communication over a single broadband connection, usually a fibre optic network. It is a marketing term which refers to a business model offering a bundle package of all three services accessible over the same network infrastructure.

This work was previously published in Handbook of Research on Urban Informatics: The Practice and Promise of the Real-Time City, edited by M. Foth, pp. 179-194, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.8
Affective Goal and Task Selection for Social Robots[1]

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ABSTRACT

Effective decision-making under real-world conditions can be very difficult as purely rational methods of decision-making are often not feasible or applicable. Psychologists have long hypothesized that humans are able to cope with time and resource limitations by employing affective evaluations rather than rational ones. In this chapter, we present the distributed integrated affect cognition and reflection architecture DIARC for social robots intended for natural human-robot interaction and demonstrate the utility of its human-inspired affect mechanisms for the selection of tasks and goals. Specifically, we show that DIARC incorporates affect mechanisms throughout the architecture, which are based on "evaluation signals" generated in each architectural component to obtain quick and efficient estimates of the state of the component, and illustrate the operation and utility of these mechanisms with examples from human-robot interaction experiments.

DOI: 10.4018/978-1-60566-354-8.ch005

INTRODUCTION

Effective decision-making under real-world conditions can be very difficult. From a purely decision-theoretic standpoint, the optimal way of making decisions – rational choice – requires an agent to know the utilities of all choice options as well as their associated likelihoods of succeeding for the agent to be able to calculate the expected utility of each alternative and being able to select the one with the maximum utility. Unfortunately, such rational methods are in practice often not applicable (e.g., because the agent does not have reliable or sufficient knowledge) or feasible (e.g., because it is too time-consuming to perform all necessary calculations).

Psychologists have long hypothesized that humans are able to cope with time, knowledge and other resource limitations by employing *affective evaluations* (Clore et al., 2001) rather than rational ones. For affect provides fast, low-cost (although often less accurate) mechanisms for estimating the value of an object, event, or situation for an agent, as opposed to longer, more complex and more computationally intensive *cognitive evaluations* (e.g., to compute the expected utilities) (Kahneman et al., 1997). Humans also rely on *affective memory*, which seems to encode implicit knowledge about the likelihood of occurrence of a positive or negative future event (Blaney, 1986). Finally, affect also influences human problem-solving and reasoning strategies, leading to global, top-down approaches when affect is positive, and local, bottom-up approaches when affect is negative (Bless et al., 1996).

For (autonomous) social robots that are supposed to interact with humans in natural ways in typically human environments, affect mechanisms are doubly important. For one, such robots will also have to find fast solutions to many of the same kids of difficult problems that humans ordinarily face, often with the same degree of uncertainty–if not more. Hence, affect mechanisms in robotic architectures might help robots cope better with the intrinsic resource limitations of the real world. The second reason why affect mechanisms are essential for social robots is grounded in their intended role as *social agents* interacting with humans. For those interactions to be *natural* (and effective), robots need to be sensitive to *human affect*, both in its various forms of expression and in its role in human social interactions.

We have started to address affect mechanisms that can serve both functions in our DIARC architecture (Scheutz et al., 2006, Scheutz et al., 2007). DIARC is a "distributed integrated affect cognition and reflection" architecture particularly intended for social robots that need to interact with humans in natural ways. It integrates cognitive capabilities (such as natural language understanding and complex action planning and sequencing) (Scheutz et al., 2007, Scheutz et al., 2004, Brick and Scheutz 2007) with lower level activities (such as multi-modal perceptual processing, feature detection and tracking, and navigation and behavior coordination, e.g., see Scheutz et al., 2004, or Scheutz and Andronache 2004) and has been used in several human subject experiments and at various AAAI robot competitions (Scheutz et al., 2005, Scheutz et al., 2006, Schermerhorn et al., 2008, Schermerhorn et al., 2006). Most importantly, DIARC incorporates affect mechanisms throughout the architecture, which are based on "evaluation signals" generated in each architectural component, which effectively encode how "good" something (e.g., the current state of the world) is from the perspective of the component.

In this chapter, we will describe DIARC's mechanisms for affective goal and task selection, and demonstrate the operation of these mechanisms with examples from human-robot interaction experiments.

1. MOOD-BASED DECISION-MAKING

A perfectly rational agent with perfect information can make optimal decisions by selecting the action A with the highest expected utility

$$EU = \arg\max_{A}(p_A \cdot b_A - c_A)$$

where is the probability of action A succeeding, the benefit of A succeeding, and the cost of attempting A. If the agent knows the costs and benefits of each alternative and also the probabilities of each action succeeding, it cannot be wrong about which is the most profitable choice. In reality, however, costs and benefits are only approximately known. More importantly, real-world constraints can make it difficult to estimate accurately the probabilities of success and failure and, moreover, the dependence of the probabilities on other factors (e.g., past successes and failure).

Rational approaches probabilities that are often not available to robots. Without knowledge of the probabilities of failure and success associated with each potential alternative, it is not possible to calculate expected utility. Humans, on the other hand, are subject to the same kinds of real-world constraints, yet are able to make good evaluations, which are hypothesized to involve affective states ("gut feelings") in important ways (e.g., to help them prioritize goals).

Let an agent's overall affective state – its "mood" – be represented by two state variables, one which records positive affect (A_P), and the other of which records negative affect (A_N) (Sloman et al., 2005). and are reals in the interval [0,1] that are influenced by the performance of the agent's various subsystems (e.g., speech recognition). When a subsystem records a success, it increases the level of positive affect, and when it fails, it increases the level of negative affect. Specifically, success increases A_P by $\Delta A_P = (1- A_P) \cdot inc$ (failure updates analogously), where *inc* is a value (possibly learned) that determines the magnitude of the increase within the available range. This update function ensures that remains in the interval [0,1]. Both affective states are also subject to regular decay, bringing their activations in the absence of triggering events back to their rest values (i.e., 0): $\Delta A_P = (1- A_P) \cdot dec$ (Scheutz 2001). Given that affective states can encode knowledge of recent events (e.g., the success or failure of recent attempts), they can be used to estimate probabilities (that take past evidence into account without the need for prior knowledge of the probabilities involved).

Consider, for example, a case in which the robot is deciding whether to ask for directions to some location. The robot does not know that it is in a noisy room where speech recognition is problematic. All else being equal (i.e., with both affect states starting at rest and no affect triggers from other sources), the value of *inc* determines how many failed communication attempts the agent will make of before giving up. With greater *inc*, the value of A_N rises faster, leading the agent to reduce its subjective assessment of the expected benefit (i.e., to become "pessimistic" that the benefit will be realized).

The agent makes online choices based on the expected utility of a single attempt, using the affect states A_P and A_P to generate an "affective estimate" of the likelihood of success . Examples presented below define *f* as follows:[2]

$$f(A_P, A_N) = \frac{1}{2} + \frac{(1 + A^{+2} - A^{-2})}{2}$$

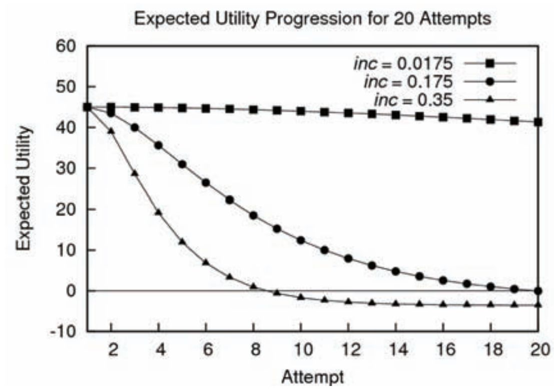
This value is then used in the calculation of the expected utility of an action: $u{=}a{\cdot}b{-}c$.

The effect of positive and negative affect is to modify the benefit the agent expects to receive from attempting the action. When both A_P and A_N are neutral (i.e.,), the decision is based solely on a comparison of the benefit and the cost. However, given a history of actions, the agent may view the benefit more optimistically (if $A_P > A_N$) or pessimistically (if $A_P < A_N$), potentially making decisions that differ from the purely rational choice (overestimating true benefits or costs).

We can now demonstrate with a simple example of how overall mood states could be used in a beneficial way in the agent's decision making. Figure 1 depicts for the communication example the effect of various values of *inc* on estimates of utility: one that is too optimistic, willing to continue into the foreseeable future; one that is too pessimistic, stopping fairly early; and one that is more reasonable, stopping at about the point where the costs will outweigh the benefits. This suggests that the value of *inc* could be defined as a function of *b* and *c* to improve the likelihood that A_N will rise quickly enough to end the series of attempts before costs exceed potential benefits, for example. The agent could employ reinforcement learning to determine the value of *inc* for individual actions.

While the activation of each affective state is subject to decay, the rate of decay is slow enough

Figure 1. The expected utilities calculated at each attempt by the agent for various values of inc.

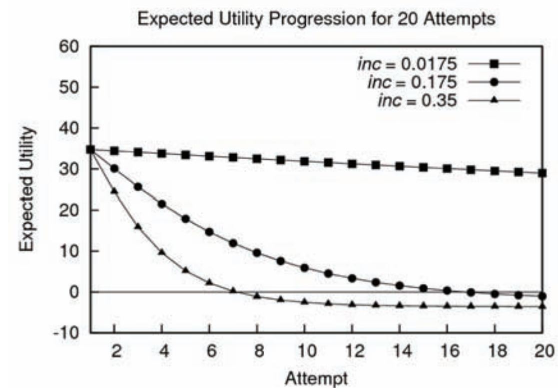


that they can serve as *affective memory*, carrying the subjective estimates of the likelihood of success and failure ahead for a period after the events that modified the states. Returning again to the robot example, after a series of failures leading to the agent deciding not to attempt to ask directions again, the activation of A_N begins to decay. If, after some period of time, the agent is again faced with the choice of whether to ask for directions, any remaining activation of A_N will reduce the likelihood that it will choose to do so. In this way, the agent "remembers" that it has failed recently, and pessimistically "believes" that its chances of failing again are relatively high (e.g., because it has likely not left the noisy room it was in). Figure 2 shows the expected utility of asking for directions calculated by an agent 100 cycles after a series of failed attempts (e.g., Figure 1). The increased "pessimism" leads the evaluation to drop below zero earlier, potentially saving wasted effort on fruitless attempts.

2. AFFECT REPRESENTATIONS IN ARCHITECTURAL COMPONENTS

We now show how the above decision-making process inspired by roles of human affect, where "affect states" are used to implicitly encode the

Figure 2. The expected utilities calculated at each attempt by agent for various values of inc, after an extended series of 20 failures and 100 decay cycles, demonstrating the role of affective states as memory



history of positive and negative events from the agent's perspective, can be incorporated into an architecture at the level of functional components, where each component maintains its own "affective state". A primary determinant of the affective state of a component is its own performance, but in some cases the affective states of other functional components (e.g., those upon which it depends to function properly) or the occurrence of certain external events (e.g., a loud unexpected noise) can influence affect.

Specifically, we associate with each component of the architecture two state variables, one which represents *positive affect* (A_P), and the other which represents *negative affect* (A_N). A_P and A_N are reals in the interval [0,1] and define the "affective evaluation" of that component $a=f(A_P,A_N)$. Examples presented below define f as follows: $f(A_P,A_N)=1+A_P^2- A_N^{-2}$. The value of a is used by the component when making decisions about how to perform its function.

A component's affective state values can be passed on to other components to influence the calculation of their respective affect states. Associated with each affective state A_P is an increment variable inc^+ that determines how much a positive event changes positive affect. Specifically, success increases A_P by $\sphericalangle A_P = (1 - A_P)\sphericalangle inc^+$ (this update function ensures that A_P remains in the interval [0,1]; failure updates A_N analogously). The value of inc^+ is computed based on the affective evaluation of connected components: $inc^+ = \sum_{i=1}^{n} w_i (A_i^{+2} - A_i^{-2})$, for $f(A_P, A_N) > 1$, where w_i is the weight assigned to the contribution of component i.

Similarly, for $inc^- = \sum_{i=1}^{n} w_i (A_i^{-2} - A_i^{+2})$, for $f(A_P, A_N) < 1$. Hence, positive affective evaluation of associated architectural components increases the degree to which positive outcomes influence positive affect A_P for a component, while negative affective evaluation of those components does the same for A_N. Affective states are also subject to regular decay, bringing their activations in the absence of triggering events back to their rest values (i.e., 0): $\sphericalangle A_P = (1 - A_P)\sphericalangle dec$.

The *affective goal manager* (AGM) prioritizes competing goals (i.e., those whose associated actions require conflicting resources) based on the expected utility of those goals and time constraints within which the goals must be completed. Each goal is assigned an *affective task manager* (ATM), which is responsible for action selection and dispatch. The AGM periodically updates the priority associated with each goal's ATM. These goal priorities are used to determine the outcome of conflicts between ATMs (e.g., resource conflicts, such as when each wants to move in a different direction). A goal's priority is determined by two components: its importance and its current urgency. The importance of a goal is determined by the cost and benefit of satisfying the goal. The affective evaluation a of the goal manager influences the assessment of a goal's importance: $u = a \cdot b - c$. The resulting u is scaled by the urgency component g, which is a reflection of the time remaining within which to satisfy the goal:

$$g = \frac{Time_{elapsed}}{Time_{allowed}} \cdot (g_{max} - g_{min}) + g_{min}$$

where g_{max} and g_{min} are upper and lower bounds on the urgency of that particular goal. The goal's priority p, then, is simply: $p = u \cdot g$. When there is a conflict over some resource, the ATM with the highest priority is awarded the resource. This formulation allows goals of lower importance, which would normally be excluded from execution in virtue of their interference with the satisfaction of more important goals, to be "worked in" ahead of the more important goals, so long as the interrupted goal has sufficient time to satisfy the goal after the less important goal completes (i.e., so long as the urgency of the more important goal is sufficiently low).

The ATM uses affect states similarly to select between alternative actions in service to a single goal. Each potential action has associated with it (in long-term memory) affect states A_P and A_N that result from positive and negative outcomes in past experience with that action, along with (learned) inc^+ and inc^{--} that determine how further experience influences the affect state that determine how further experience influences the affect states. The ATM makes online choices based on the expected utility of a single attempt of an action, using $a = f(A_P, A_N)$ as an "affective estimate" of the likelihood of success for the attempt in the utility calculation $u = a \cdot b - c$. The alternative with the highest expected utility is selected in service of the goal associated with the ATM.

The effect of positive and negative affect, then, is to modify the benefit the agent expects to receive from attempting the action. That is, the AGM/ATM implements a decision making process that can operate without exact knowledge of the prior and conditional distributions. When both and are neutral (i.e., $A_P = A_N = 0$), the decision is based solely on a comparison of the benefit and the cost. However, given a history of outcomes, the agent may view the benefit more optimistically (if $A_P > A_N$) or pessimistically (if $A_P < A_N$), potentially leading it to make decisions that differ from the purely "rational" decision strategy, as mentioned before.

The following two examples presented below focus on AGM and the ATM as they are currently implemented in our robotic architecture. For presentation purposes, simplified scenarios have been chosen to highlight the functionality and benefits of affect in decision-making.

2.1. Prioritizing Goals

The affective goal manager is responsible for prioritizing goals to determine the outcomes of resource conflicts. Priorities are recalculated periodically to accurately reflect the system's affect states and time-related goal urgencies. In this example, the AGM maintains priorities for two goals, *Collect Data* and *Report*. The *Collect Data* goal requires a robot to acquire information about a region by moving through the environment and taking readings (e.g., for the purpose of mapping locations of interest in the region). There is a limited time within which to gather the data before the robot needs to return with the data. The *Report* goal requires the robot to locate and report to the mission commander once the information is collected *or* when something goes wrong.[3]

One approach to accomplishing these two goals would be to explicitly sequence the *Collect* and *Report* goals, so that when the former was achieved, the latter would be pursued. The appropriate response to problems could similarly be explicitly triggered when problems were detected. However, the AGM allows for a more flexible unified approach in which both goals are instantiated at the start and the AGM's prioritization function ensures that the robot does the right thing at the right time. Figure 3 depicts the evolution of the two goals' priorities throughout a sample run of this scenario. Initially, the AGM's A_P=0 and A_N=0. The benefit associated with *Collect* (b_c) is 1800, while its cost (c_c) is 1200. The benefit associated with *Report* (b_r) is 200 and the cost (c_r) is 25. Both goals require the use of the robot's navigation system, but only one may do so at a time.

At the start, both goals have very low priorities due to the very low urgency (very little time had elapsed). *Collect* has a higher priority due to its greater net benefit ($b - c$); because the AGM's affect is neutral, there is no modification of the benefit component. As time passes, both priorities rise with the increasing urgency until an external event disturbs the system–the impact of an unknown object knocks out a sensor, causing a sharp increase in A_N for the AGM (this could be construed as a fear-like response to the impact event). The AGM output for time step 56 immediately preceding the impact was:

AGM A+: 0.0
AGM A-: 0.0
Collect PRIORITY 16.83
Report PRIORITY 5.89

Immediately following the impact event, the priorities have inverted:

AGM A+: 0.0
AGM A-: 0.5
Collect PRIORITY 1.71
Report PRIORITY 4.28

Both priorities were reduced due to the influence of A_N on the benefit component b, but because the reduction of relative to b_c was so much greater than relative to c_c, *Report* was given a higher priority. This allowed the robot to respond to the unexpected impact by seeking the mission commander, who would, presumably, be able to resolve the problem (e.g., by repairing the damage or redirecting the robot). Before the *Report* goal is achieved, however, the priorities were once again inverted (at time step 265), and *Collect* regained control of the navigation resources:

AGM A+: 0.0
AGM A-: 0.45
Collect PRIORITY 21.75
Report PRIORITY 21.73

Figure 3. Priorities calculated by the affective goal manager for the goals Collect Data and Report during a sample run

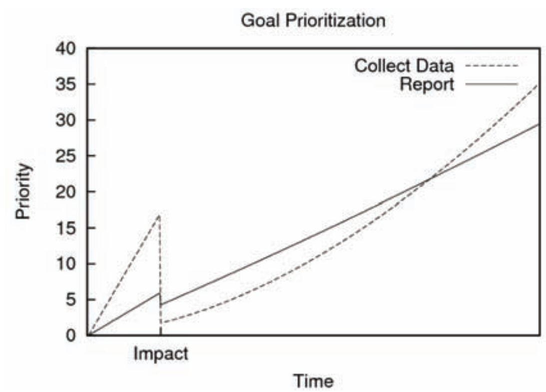
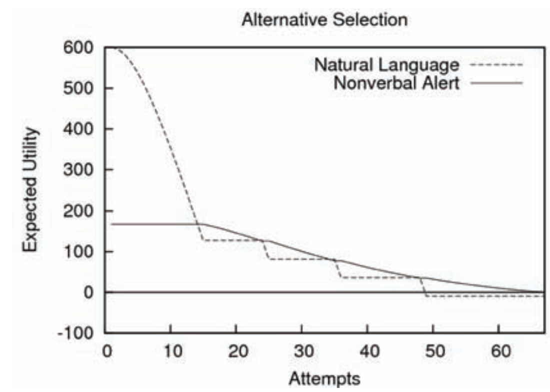


Figure 4. Expected utility of the two alternative actions Natural Language and Nonverbal Alert through a series of failed communication attempts



This switch is attributable to the decay of A_N in the AGM. No further impacts (or other negative events) occurred and the impact did not cause a catastrophic failure, so negative affect was gradually returning to zero. This (in addition to rising urgency) caused the priorities of both goals to rise, but the priority of *Collect* climbed faster, so that it eventually overtook *Report* and the robot was able to continue pursuing its "primary" goal.[4]

2.2. Choosing between Alternatives

The affective task manager (ATM) component selects and executes actions on behalf of a goal, as priority allows. When an action completes, the ATM is also responsible for updating the affect states associated with the completed action (based on its completion status, success or failure), in addition to updating its own affect states. The following example is extracted from a sample run in which the robot has noticed a problem and needs to communicate it to a human user. There are two modes of communication available: *Natural Language*, in which the robot attempts to explain the problem using natural language, and *Nonverbal Alert*, in which the robot uses "beep codes" to try to convey the message. *Natural Language* has a greater benefit (b_l=1800) than *Nonverbal Alert* (b_a=200), due to the ability to communicate more information about the problem, but also has a greater cost (c_l=1200 vs. c_a=25). Based on past experience, *Nonverbal Alert* has A_N (perhaps because of poor results trying to communicate failures using this method). This sample run depicts a series of failed attempts to communicate the problem to the human user (Figure 4).[5] At the beginning of the run, the ATM output is as follows:

Natural Language A-: 0.0
Natural Language UTILITY 600.0
Nonverbal Alert A-: 0.2
Nonverbal Alert UTILITY 167.0

The ATM selects *Natural Language* due to its higher expected utility. In the course of the next 14 attempts, u_l (the expected utility of *Natural Language*) falls, while u_a (the expected utility of *Nonverbal Alert*) remains unchanged:

Natural Language A-: 0.49
Natural Language UTILITY 173.70
Nonverbal Alert A-: 0.2
Nonverbal Alert UTILITY 167.0

After one more failure of *Natural Language*, $u_l < u_a$, so the ATM begins trying *Nonverbal Alert* instead:

Natural Language A-: 0.51
Natural Language UTILITY 127.54
Nonverbal Alert A-: 0.2
Nonverbal Alert UTILITY 167.0
Nonverbal Alert is repeated through attempt 23, and u_a is reduced:
Natural Language A-: 0.51
Natural Language UTILITY 127.54
Nonverbal Alert A-: 0.47
Nonverbal Alert UTILITY 130.96

After attempt 23, the increase in A_N for *Nonverbal Alert* causes its expected utility to fall below *Natural Language*, which is selected on attempt 24:

Natural Language A-: 0.51
Natural Language UTILITY 127.54
Nonverbal Alert A-: 0.50
Nonverbal Alert UTILITY 125.84

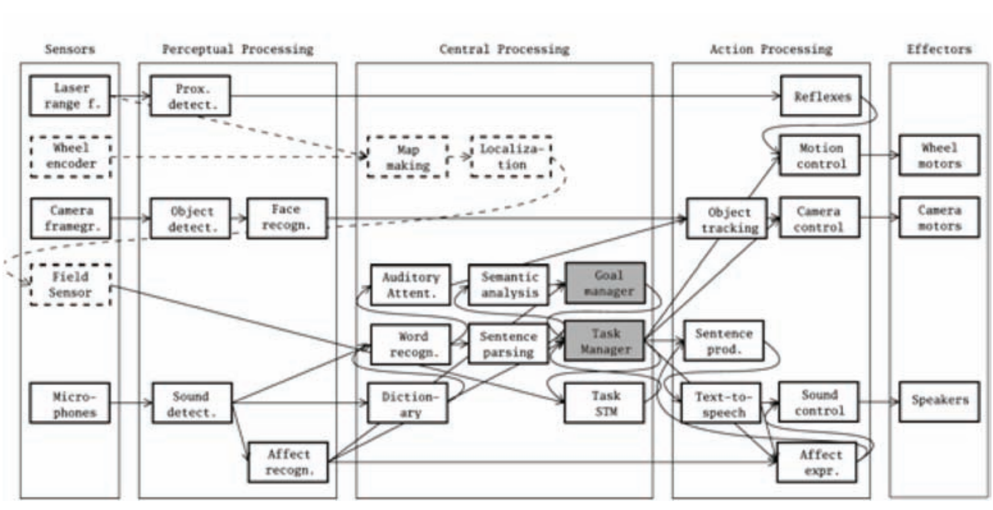
Natural Language is attempted only once before the ATM switches back to *Nonverbal Alert*, and the cycle begins again, with the robot occasionally attempting *Natural Language* before reverting to *Nonverbal Alert*, producing the "stair-stepping" effect seen in Figure 4.

3. HUMAN-ROBOT INTERACTION EXPERIMENTS WITH DIARC

Here we briefly give an example of an application of DIARC for studying affective human-robot interactions (Figure 5 shows the relevant components of the architecture for the given task).

In Scheutz et al., (2006), we reported an experiment that was intended to examine subjects' reactions to affect expressed by the robot. Subjects were paired with a robot to perform a task in the context of a hypothetical space exploration scenario. The task was to find a location in the environment (a "planetary surface") with a sufficiently high signal strength to allow the team to transmit some data to an orbiting spacecraft. The signal strength was detectable only by the robot, so the human had to direct it around the environment in search of a suitable location, asking it to take readings of the signal strength during the search and to transmit the data once a transmission

Figure 5. The (reduced) DIARC architecture as used in the human-robot interaction experiments



point was found. There was only one location in the room that met the criteria for transmission, although there were others that represented local peaks in signal strength; the "signal" was simulated by the robot, which maintained a global map of the environment, including all points representing peaks in signal strength. When asked to take a reading, the robot would calculate the signal based on its proximity to these peaks. The goal of the task was to locate a transmission point and transmit the data as quickly as possible; time to completion was recorded for use as the primary performance measure (see Scheutz et al.,, 2006 for further details).

Subjects were asked to respond to a series of survey items prior to beginning the interaction with the robot, in order to gauge their preconceived attitudes toward robots (e.g., whether they would think that it was useful for robots to detect and react to human emotions or whether they thought that it would be useful for robots to have emotions and express them). They were given a chance to interact with the robot for a short practice period before the actual experimental runs were conducted. The subjects and the robot communicated via spoken natural language. In order to evoke affective responses from subjects (and to impose an artificial time limit of three minutes on the task), a simulated battery failure was used. There were three points at which the robot could announce problems related to the battery, depending on whether the subject had completed the task or not. One minute into the experimental run, the robot announced that the batteries were "getting low." After another minute, it would follow with a warning that there was "not much time remaining" due to the battery problem. After three minutes (total), the robot would announce that the mission had failed.

We employed a 2x2 experimental design, with the first dimension, *affect expression*, being *affective* vs. *neutral* and the second, *proximity*, being *local* vs. *remote*. In the neutral affect expression condition, the robot's voice remained affectively neutral throughout the interaction, while in the affective condition, the robot's voice was modulated to express increasing levels of "fear" from the point of the first battery warning until the end of the task. Subjects in the local proximity condition completed the exploration task in the same room as the robot, whereas those in the remote condition interacted with the robot from a separate "control" room. The control room was equipped with a computer display of a live video stream fed from a camera in the exploration environment, along with a live audio stream of the robot's speech (using the ADE robot infrastructure, we were able to redirect the robot's speech production to the control station). Hence, the only difference between the two proximity conditions was the physical co-location of the robot and the subject. Most importantly, the channel by which affect expression is accomplished (i.e., voice modulation) was presented locally to the subject in both conditions–subjects in the remote condition heard the same voice in exactly the same as they would have if they had been next to the robot.

Subsequent analysis of the objective performance measure (i.e., time to completion) pointed to differences between the local and remote conditions with regard to the effect of affect. A 2x2 ANOVA for *time to completion* with independent variables *affect expression* and *proximity* showed no significant main effects ($F(1,46)=2.51, p=.12$ for affect expression and $F(1,46)=2.16, p=.15$ for proximity), but a marginally significant two-way interaction ($F(1,46)=3.43, p=.07$) due to a performance advantage in the *local* condition for *affect* over *neutral* ($\mu=123$ vs. $\mu=156$) that was not present in the *remote* condition ($\mu=151$ vs. $\mu=150$). The difference in the local condition between affect and no-affect groups is significant ($t(22)=2.21, p<.05$), while the difference in the remote condition is not significant ($t(16)=.09, p=.93$).

Affect expression provides a performance advantage in the local condition, but not in the remote condition. Given that the medium of affect expression (speech modulation) was presented identically in both proximity conditions, it seems unlikely that the remote subjects simply did not notice the robot's "mood" change. In fact, subjects were asked on a post-questionnaire to evaluate the robot's stress level after it issued the low-battery warning. A 2x2 ANOVA with with *affect expression* and *proximity* as independent variables, and *perceived robot stress* from the post-survey as dependent variable and found a main effect on affect ($F(1,44)=7.54, p<.01$), but no main effect on proximity and no interaction.[6] Subjects in the *affect* condition tended to rate the robot's behavior as "stressed" ($\mu=6.67$, $\sigma=1.71$), whereas subjects in the *neutral* condition were much less likely to do so ($\mu=5.1$, $\sigma=2.23$). Hence, subjects recognized the affect expression as they were intended to, and the lack of any effect or interaction involving proximity indicates that both conditions recognized the affect equally well. This, combined with the results of the objective performance task, strongly suggests that affect expression and physical embodiment play an important role in how people internalize affective cues.

A currently still ongoing follow-up study examines dynamic robot autonomy and how affect expression, as described above, influences subjects' responses to autonomy in the exploration task. The experimental setup is similar (Scheutz et al.,, 2006), but with an additional "distractor" measurement task included to induce cognitive load in the human team member concurrent to the exploration task. The measurement task consists of locating target "rock formations" (boxes) in the environment and "measuring" them (multiplying two two-digit numbers found on a paper in the box) to determine whether they were above a given threshold.

Dynamic robot autonomy is achieved via three goals in the AGM: *Commands*, which requires the robot to obey commands from the human team member, *Track*, which requires the robot to locate and stay with the transmission location, and *Transmit*, which requires the robot to gather and transmit data about the measurements. The priorities and costs were chosen to allow the tracking and transmission goals to overtake the commands goal at specific times. Obeying commands is originally given the highest priority, so that the other goals cannot acquire the resource locks for motion commands, etc. Hence, the autonomy condition starts out exactly as the non-autonomy control condition, with the robot taking commands from the subject related to searching the environment for the transmission location. Then, for example, when the tracking goal's priority surpasses the command goal's (Figure 6), the robot will no longer cooperate with commands that interfere with the robot's autonomous search for the signal peak. These transitions occur at approximately 150 seconds into the task for the tracking goal and 195 seconds for the transmission goal. This assumes that both and are in their rest states. Figure 7 shows the evolution of priorities for a case in which the robot begins the task with A_P =.25 and A_N=0 (e.g., as might be the case if the robot had recently detected positive affect in the voice of the human team member).[7] The elevated positive affect leads to an "optimistic" assessment of the benefit of following commands (relative to taking over and searching for the transmission location, for example), so the point at which the other goals take over is pushed back (by about ten seconds in either case). An analogous example of the impact of negative affect (A_P =0 and A_N=.25) is shown in Figure 8, which shows the "pessimistic" assessment hastening the takeovers by tracking and transmission by approximately 20 and 15 seconds, respectively.

The experimental design includes the *Autonomy* dimension and the *Affect Expression* dimension. This design allows us to explore the degree to which subjects are willing to accept robot dynamic autonomy, and how affect expression on the part of the robot influences the acceptability of autonomy. For example, it seems likely that the robot's expression of stress as a part of normal speech interactions will provide subjects with some context explaining *why* the

Figure 6. The priority evolution of the dynamic autonomy experiment with neutral starting affect

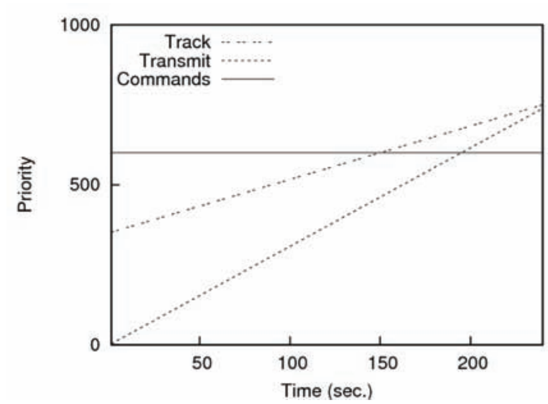


Figure 7. The priority evolution of the dynamic autonomy experiment with positive starting affect

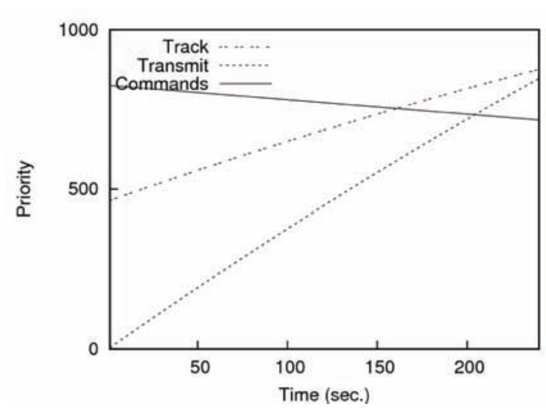
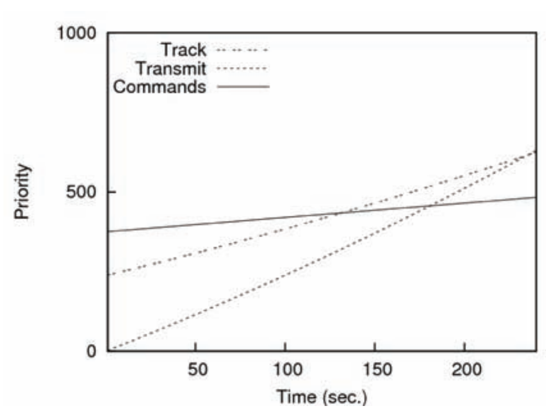


Figure 8. The priority evolution of the dynamic autonomy experiment with negative starting affect



robot has stopped following commands, which could facilitate acceptance. We are currently conducting experiments and analyzing the results, having completed the first phase of experiments in a remote condition. As reported in (Scheutz and Schermerhorn under review), even without affect expression, subjects are positive with regard to dynamic autonomy in a robotic teammate, to the extent that they even characterize the robot in the autonomy condition as more cooperative than the robot in the non-autonomy condition, despite the fact that the autonomous version disobeyed in the later phase of the task, whereas the non-autonomous version obeyed throughout. We are currently analyzing the remaining data to determine if and how affect expression alters the picture.

4. RELATED WORK

While different forms of affective and deliberative processes (like reasoning or decision-making) have been in simulated agents (e.g., El-Nasr et al.,, 2000; Eliott, 1992; Gratch and Marsella, 2004), most robotic work has focused on action selection (e.g., Moshkina and Arkin, 2003, Murphy et al.,, 2002; Parker, 1998; Scheutz, 2002) using simple affective states, often times without explicit goal representations. Yet, complex robots (e.g., ones that work with people and need to interact with them in natural ways, Scheutz et al.,, 2007) will have to manage multiple, possibly inconsistent goals, and decide which to pursue at any given time under time-pressure and limited resources.

The two closest affective robotic architectures in terms of using emotion (a form of affective state) for internal state changes and decision-making on robots are (Murphy et al.,, 2002) and (Breazeal et al., 2004). In (Murphy et al.,, 2002) emotional states are implemented with fixed associated action tendencies (e.g., HAPPY–"free activate", CONFIDENT–"continue normal activity", CONCERNED–"monitor progress" and FRUSTRATED–"change current strategy") in a service robot as a function of two time parameters ("time-to-refill" and "time-to-empty" plus two constants). Effectively, emotion labels are associated with different intervals and cause state transitions in a Moore machine, which produces behaviors directly based on perceptions and emotional states. This is different from the explicit goal representation used in our architecture, which allows for the explicit computation of the *importance* of a goal to the robot (based on positive and negative affective state), which in turn influences goal prioritization and thus task and action selection.

The architecture in (Breazeal et al.,, 2004) extends prior work (Breazeal, 2002) to include natural language processing and some higher level deliberative functions, most importantly, an implementation of "joint intention theory" (e.g., that allows the robot to respond to human commands with gestures indicating a new focus of attention, etc.). The system is intended to study collaboration and learning of joint tasks. The mechanisms for selecting subgoals, subscripts, and updating priorities of goals are, however, different in our affective action interpreter, which uses a dual representation of positive and negative affect that is influenced by various components in the architecture and used for the calculation of the importance, and consequently the priority, of goals.[8]

5. CONCLUSION

In this chapter, we introduced the idea of integrating affect representations and processing mechanisms throughout a robotic architecture based on psychological evidence that affect permeates the human cognitive system. We present the specific mechanisms integrated in our DIARC architecture, with focus on DIARC's goal and task managers. We showed with several examples that these mechanisms can lead to effective decisions for robots that operate under time, computation, and knowledge constraints, especially given their low computational cost and knowledge requirements. As such, they can improve the functioning and level of autonomy of social robots. Moreover, we also demonstrated that DIARC can be used for systematic empirical studies that investigate the utility of affect mechanisms for social robots. Specifically, we described results from human-robot interaction experiments where affect expression by the robot in the right context could significantly improve the performance of joint human-robot teams. We also pointed at the potential of DIARC and its affective goal and task management mechanisms for further investigations of the interactions between affect and robot autonomy. Current experiments suggest that these interactions will be particularly important for robots that have to collaborate with humans.

While DIARC has already proven its robustness and applicability in real-world settings, it is still very much "work-in-progress". We investigating criteria for situations in which good values for some of the parameters (i.e., the increment and weight values in the affect update equations) can be found. We are also examining ways of making these parameters dependent on goal and task contexts, thus allowing for multiple context-dependent values (which can be learned using reinforcement learning techniques) to overcome the shortcomings of a single value.

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KEY TERMS

Affect: stating how emotions moves us in order to start actions action selection, Procedures to decide which action is more proper to a certain context goal management, Procedures and algorithms to sort the goals on a system according to the priorities that emerge from the context affective architecture, Constructing systems able to take decision based on simulations of the affective processes human-robot interaction Discipline that studies how humans and robots can interact, and finding ways to improve this interaction.

ENDNOTES

1 This material is based upon work supported by the National Science Foundation under Grant No. 0746950 and by the Office of Naval Research under MURI Grant No. N000140711049.

2 A_P and A_N are squared to amplify the difference between the two, which amplifies the effect of the dominant state on the agent's decision process.

3 This example is taken from the hypothetical space scenario that we have repeatedly used in human-robot interaction experiments (Scheutz et al., 2006), see also Section 3.

4 Note that there is nothing explicit in the architecture that makes *Report* primary; it is simply the relative costs and benefits of the two goals that make it the preferred goal in the zero-affect state.

5 Because there are no successful attempts, is not incremented for either action and remains zero throughout the run.

6 Two subjects had to be eliminated from the comparison since they did not answer the relevant question on the post-survey.

7 Note that the lines curve slightly due to the built-in decay of affect states.

8 The details for reprioritization of goals were not provided in (Breazeal et al.,, 2004).

This work was previously published in Handbook of Research on Synthetic Emotions and Sociable Robotics: New Applications in Affective Computing and Artificial Intelligence, edited by J. Vallverdú; D. Casacuberta, pp. 74-87, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.9
Using Ambient Social Reminders to Stay in Touch with Friends

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ABSTRACT

Social interactions among a group of friends will typically have a certain recurring rhythm. Most people interact with their own circle of friends at a range of different rates, and through a range of different modalities (by email, phone, instant messaging, face-to-face meetings and so on). When these naturally recurring interactions are maintained effectively, people feel at ease with the quality and stability of their social network. Conversely, when a person has not interacted with one of their friends for a longer time interval than they usually do, a situation can be identified in that relationship which may require action to resolve. Here we discuss the opportunities we see in using ambient information technology to effectively support a user's social connectedness. We present a social network visualisation which provides a user with occasional recommendations of which of their friends they should contact soon to keep their social network in a healthy state. [Article copies are available for purchase from InfoSci-on-Demand.com]

INTRODUCTION

When modelling the social interactions among a group of friends, certain recurring rhythms are identified between participants. Within this group, a single person may have a range of different rhythms with each of their friends, due to the similarity of their schedules, the differing strengths of those friendships, and a range of other social factors (Viegas et al., 2006). When these rhythms are maintained well—that is, the person interacts with each friend at the regularity that they normally do—the health of that friendship will feel natural. If on the other hand the friendship falls out of rhythm, through neglect or unfortunate circumstance, and the two people do not see each other or otherwise interact, this gap will be felt, though perhaps not always understood.

We refer to this as a person's social rhythm, and it describes the rate and regularity with which they interact with the various people they know. It is an intuitive, fuzzy metric; if asked how often you interact with a certain friend of yours, you may reply with "about twice a week" or "most days", not something more specific like "once every 37 hours." These frequencies will differ among subgroups of a social network: interactions with family members may have a different regularity than with work colleagues, and some friends may have special significance and be seen much more often. Still others may have a very low level of engagement—only being seen at annual events like birthdays or academic conferences.

A person's ability to effectively regulate their own social rhythm relies on their perception of time running like clockwork, but the human mind's perception of the passage of time is capricious at best (Harrison et al., 2007). Numerous studies have pointed to the fallibility of this ability, due to stress, anxiety, caffeine intake and a range of other factors (Chavez, 2003). Without external prompts, keeping up with friends—especially peripheral friends, who are not part of one's close social circle—can become a matter of chance and circumstance. Because social interactions are inherently vague and intuitive, there is no single point in time at which one is motivated to rekindle a relationship in decline. We believe that explicit cues based on historically observed rhythms will help alleviate this problem, just as they have been shown to support a user's health in other studies (Consolvo et al., 2008). We will discuss these issues in depth in the next section.

Intuitively, you may have experienced a digital or physical artefact that you come across arbitrarily which spurs you into thinking of a friend and then contacting them. For example, seeing a photograph of you and a friend may prompt you to send them a message to talk about a shared experience. Similarly, hearing a friend's name or reviewing past correspondences with them may remind you to contact them (Viegas et al., 2004). It is along these lines that we seek to provide subtle reminders of a friend at the right time, to induce a user into re-establishing contact. We have developed a visualisation for this purpose, which we present in section 4.

ATTENTION AND AWARENESS IN SOCIAL NETWORKS

One aspect of human memory is the remembrance of past experiences, known as "retrospective memory." A second form of memory, "prospective memory", works in the opposite direction and can be thought of as remembering to remember something (a task or object) at a certain time in the future (Winograd, 1988). For example, remembering to call a friend after work at 6 o'clock, or remembering to bring a book you have borrowed with you when going to visit a colleague.

Though the workings of prospective memory are not yet fully understood, the cognitive process is thought not to require external artefacts to trigger a memory (Meier et al., 2006), but can certainly be aided by such objects, like shopping lists. Setting an alarm on a phone or other device that is triggered at a certain time of the day is also effective, as it takes the burden of remembering when to do a task off the person's mind.

Facebook, a prominent social networking website[1], offer a feature they call a "news feed", which is a way to keep track of activity within your network of friends. The news feed presents a reverse-chronological list of events, such as photos being uploaded, public messages being exchanged, or status messages being updated. This gives the user a constant stream of activity and information about the members of their social network, though as the number of friends in your network increases, this list offers a view of a decreasing subset of your friends' activity on the website.

The first problem this brings up is that at any time, a user watching the activity on their news feed are mostly kept updated on the latest and loudest of their friends. Those friends who post status updates about every detail of their day will be featured much more frequently than those friends who broadcast information about themselves less frequently or not at all, even though it is quite likely that it is these quiet friends that are most likely to fall off a user's mental radar.

Second, none of the popular online social networks implement any concept of a friendship's inherent strength. All friends are presented equally, despite some presumably being more important than others to the person at the centre of the network. With many people having identified hundreds of friends on the website (Ellis et al., 2006), many of whom may be peripheral to them in everyday life (Fogg et al., 2008), it is easy for some more important friends to be lost among the throng. Indeed, a user may end up receiving many updates from friends whom they would be happy to hear from much less frequently.

Together, these factors have the effect of selectively emphasising a person's friends in proportion to their engagement with the social networking website, rather than in proportion to how frequently a user personally interacts with that friend. The phrase "out of sight, out of mind" describes the deleterious effects of this vicious cycle: as a friend is remembered less frequently, they become less likely to be contacted in future.

Previous studies have analysed social rhythms in socio-technical systems, although the focus of these studies was on the general trends of social rhythms apparent on a very large scale. Golder et al. studied interactions between college students on Facebook, and found that students' social calendars were heavily influenced by their school schedule (Golder et al., 2007). Leskovec et al. analysed all conversations conducted over Microsoft's Messenger instant messaging service in the month of June 2006, and concluded that users of similar age, language and location were most likely to communicate frequently (Leskovec et al., 2007).

Online social networking sites are used in part to maintain social connections which were originally forged offline (Ellison, 2007). "Dunbar's number" is a proposed upper bound to the number of people an individual can maintain stable social relationships with. Though we may suppose that this number would be a function of our circumstances and available free time, it is in fact related to the size of the neocortex. Among humans, this bound stands at approximately 150, and is due to the cognitive overheads involved in remembering and being able to meaningfully interact with others (Dunbar, 1992). Although social networking applications have long allowed users to have many more than this number of "friends" identified within the system (Boyd, 2007), it is unlikely that a user would report that they are friends with all of these people in the traditional sense (Boyd, 2006).

Despite the large number of friends identified by the average Facebook user, a person's social network cannot be described by data from any one source. Though the majority of a user's friends may indeed be present in an online social networking website, they will also have friends that they interact with purely offline, or mostly by phone or email. These ongoing social interactions are equally valid in characterising a user's circle of friends.

Because of the range of communication options available to us, reactivating links between people is relatively easy, if we are prompted at the right time. These social networking websites in particular present a low-cost way for people to evolve, maintain and reinforce a wide network of friends and acquaintances. The issue becomes one of identifying which friends are core to the network, and capturing information about the historical regularity of contact with all friends, so that we can accurately deliver helpful recommendations to the user.

Our application provides the user with suggestions of actions they can take to maintain the stability of their social network through a visual interface. This encourages users to contact their friends regularly, but also helps them to identify problems with certain friends early, so that they can take steps to correct a deviation before it becomes more pronounced. Thus, if a user tends their network well, they will have stronger ties with a wider and more diverse set of friends.

VISUALISING SOCIAL INTERACTIONS

There have been many visualisations generated of social networks, particularly since the rise of social networking websites and the rich data sets they present. Many visualisations use a familiar node-link diagram of a graph (Heer et al., 2005). Visualisations in this style will often present the graph from an "ego-centric" perspective, where the user being analysed is shown at the centre of the view, with their friends arrayed around them. In this project, because we are not interested in the network links that exist among friends, we can dispense with this network view, and focus on the strength of the connections between a user and their immediate network of friends, and therefore allow them to answer questions about the health of their network at a glance.

As with the social networking websites, a weakness we have identified with existing social network visualisations is that they frequently treat all edges in the network as being weighted identically. That is, an edge is either present or not present; there is no gradation to the strength of each link, and all links are drawn with equal length. In real life, we know that friendships do not behave like this. The social links between people become weaker over time and grow stronger through positive interactions. Representing this dynamism requires additional sources of data.

DATA SOURCES

Ambient systems can leverage the vast amounts of data available from the physical and virtual worlds. We now leave digital traces of most of our social interactions: all of our email is archived on a server somewhere, our instant messages are logged locally and remotely, posts to social network profiles are publicly visible, and so on. Even co-location data can be recorded if the users have a capable mobile device, allowing the identification of events like two people meeting in a bar or at a sports event.

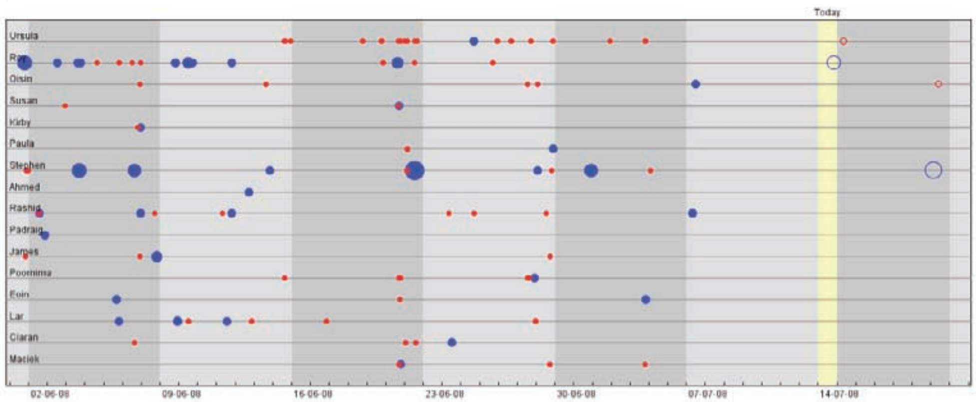
Though all of this data is attractive, for this initial version of our application, we decided to focus on records of mobile phone interactions, which we are able to download as a spreadsheet from our telecommunication provider's website. These records gave us access to traces of a user's incoming and outgoing phone calls, as well as SMS text messages for the preceding month. We manually relate each phone number in the records to the corresponding friend from the user's Facebook network, which allows us to refer to each friend by name in the display.

The software has been built to be agnostic to the nature of the interactions, so adding support for emails in future, for example, is a matter of writing a client to connect to the user's inbox and find mails that they have sent or received from their friends. These, along with other discrete interactions like instant messaging conversations or comments left on eachother's Facebook pages, can then be entered into the system.

VISUALISATION OF SOCIAL RHYTHMS

Figure 1 shows a visualisation that we generated from the phone data combined with the user's

Figure 1. Our visualisation of a single user's social network, showing a record of their interactions with a subset of their friends over the course of six weeks. Blue circles are phone calls; the size of the circle reflects the length of the call. Red circles are SMS text messages. Suggested future social interactions are indicated by hollow circles on the right, giving the user time to act on those suggestions when it is convenient.



Facebook network information. Each row represents the social interactions a person has engaged in with one of their friends via their phone: blue dots indicate phone calls, with the size of the dot reflecting the length of the call, while red dots indicate text messages and are uniformly-sized. Weeks are delineated by differing background colours to provide users with an indication of their longer-term habits at a glance. Our visualisation is built using Processing (Reas et al., 2003), a Java-based visualisation framework.

The current day is highlighted, and the next week is visible on the right of the display. Cues for future interactions are displayed in this area as hollow circles. Their colour and size indicate the type of interaction suggested, based on a prediction algorithm that we have written for this purpose.

Predicted social interactions are drawn on the day that our algorithm has calculated to be most likely for them to occur, but the user can see them a week in advance. This gives the user several opportunities to act on the information being presented to them at an appropriate time. The intent is not to interrupt the user, but simply to plant the seed of memory so that they can act upon it when it is convenient.

If the user does not interact with their friend in any way before the suggested interaction , an "X" is marked at this position and this is counted as a "miss." The prominent marking of these events (or non-events, if you will) serve to draw the user's attention to these more critical cues. If the user then contacts the friend in question within a week of this event, the marker is removed and a regular blue or red marker is placed at this point.

PROPERTIES OF AMBIENT INFORMATION

Neely et al. have previously explored their hypothesis that some context sources are more applicable to being presented in an ambient manner than others (Neely et al., 2007). The reasons they described are precision, criticality, periodicity, interpretability and self-descriptiveness.

In addition, we propose three aspects of the reminders in our visualisation which make them appropriate for delivery by ambient information systems: they are passive, dynamic and simple. Passive means that changes in the information do not always require immediate attention; users can take note of reminders but choose not to act on them until later. Dynamic means that the data changes over time; if the display remains at the periphery of a person's attention, they can monitor for changes while concentrating on other activities. Simple means that the information can be digested easily; at a basic level, a reminder simply consists of the name of a friend whom they should contact soon. Other information may be present, such as a suggested contact time or medium, but this only serves to augment the primary information.

These three properties correspond well to the interaction, reaction and comprehension model proposed by McCrickard et al. (2003). Not all notification systems are as well-suited to an ambient implementation. Consider as a counterpoint the visualisation an air-traffic controller uses to direct planes at an airport, which satisfies none of the above criteria: the information requires immediate response, as planes must be given clearance to land or take off as quickly as possible; must be monitored constantly; and there are typically a huge number of variables to take into account for each notification, such as the plane's location, scheduled departure/arrival time, current velocity, etc. It would of course be possible to create an ambient display which delivers information about planes arriving and leaving an airport; while passengers might find this interesting and informative, air-traffic controllers would have no use for it.

AMBIENT APPLICATIONS

The implementation described above is used as both an interactive display, where a user filters the information processed by the system manually to achieve insights into their social trends, and as a passive information display, which allows a user to get a feel for the general health of their social environment in an instant. An implementation which more closely follows the traditional definition of an ambient display could adopt a similar presentation to the Whereabouts Clock developed at Microsoft Research (Sellen et al., 2006). This is a glanceable ambient display placed on a wall in a home, which displays the current location of all members of the family. A similar display which displays a collection of avatars representing some of the user's friends which harnesses the information traces we discussed previously would have an ideal marriage of these properties.

Since the critical information for the user—reminders indicating when a friendship is stagnating—is atomic and relatively simple, it could be used in conjunction with a number of lo-fi data delivery methods. The user could subscribe to receive suggestions as text messages on their mobile phone, or through email or twitter tweets, informing them of the person they need to catch up with.

One can imagine a future scenario where all devices in the home are connected, and digital photo frames could be updated on a frequency predicated by the requirement of the user to update that friendship. Facebook-enabled photo frames have already been released—it is simply the randomisation algorithm that needs to be more intelligent.

CONCLUSION

We have presented a visualisation of a user's interactions with members of their social network, and describe how this kind of information can help a user to keep their social network in a healthy state. Given sufficiently careful treatment, infrequent notifications can become a useful addition to an ambient information display. We have postulated that certain traits are desirable in an ambient reminder system; these are a long possible response time, variance in the timing and meaning of reminders, and simple, easy to interpret reminder information.

ACKNOWLEDGMENT

This work is supported by Science Foundation Ireland through an Undergraduate Research Experience and Knowledge grant (UREKA), and under grant number 03/CE2/I303-1, "LERO: the Irish Software Engineering Research Centre."

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ENDNOTE

[1] www.facebook.com

This work was previously published in International Journal of Ambient Computing and Intelligence, Vol. 1, Issue 2, edited by K. Curran, pp. 70-78, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 8.10
Leveraging Semantic Technologies Towards Social Ambient Intelligence

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ABSTRACT

These times, when the amount of information exponentially grows on the Internet, when most people can be connected at all times with powerful personal devices, we need to enhance, adapt, and simplify access to information and communication with other people. The vision of ambient intelligence which is a relevant response to this need brings many challenges in different areas such as context-awareness, adaptive human-system interaction, privacy enforcement, and social communications. The authors believe that ontologies and other semantic technologies can help meeting most of these challenges in a unified manner, as they are a bridge between meaningful (but fuzzy by nature) human knowledge and digital information systems. In this chapter, the authors will depict their vision of "Social Ambient Intelligence" based on the review of several uses of semantic technologies for context management, adaptive human-system interaction, privacy enforcement and social communications. Based on identified benefits and lacks, and on their experience, they will propose several research leads towards the realization of this vision.

DOI: 10.4018/978-1-60566-290-9.ch014

INTRODUCTION

These times, when the amount of information exponentially grows on the Internet, when most people can be connected at all times with powerful personal devices, users suffer from the growing complexity of the information society. Our use of technology is moving towards the vision of

"Ambient Intelligence", derived from the vision of "Ubiquitous computing" in which "the most profound technologies are those that disappear" (Weiser, 1991) . Thus, access to information is no longer limited to personal computers and the web browsing paradigm. This vision brings many technological and psychological challenges (Streitz & Nixon, 2005) that are considered in several research domains, including:

- Context-awareness: how to take one's context into account to improve his communication ?
- Multimodality: how to span user interfaces from a terminal into separate modal interfaces ? (e.g. various screens, input controllers, microphones, phones)
- Social networking: how to enhance and leverage social communication ?
- Privacy & Trust: how to ease one's life without delegating human control to machines ?

There is one transversal question yet to answer: is there a unified approach that could answer these challenges in a global way and that makes sense? Actually, a common approach exists that is considered in all these research domains, and in most corresponding works and has been shown as very promising. This approach is the use of semantic technologies.

In this chapter, we propose a review of research works relying on semantic technologies towards what we call "Social Ambient Intelligence", a social extension of ambient intelligence. The intention here is to identify the key technologies, approaches and issues that may be blended in order to build an optimal platform for a widescaled ubiquitous system that can support social applications. After defining the foundational terms of this chapter in the Background section, we will review several research works to identify their key technologies, approaches and issues in the State-of-the-Art section, then we will propose several research leads towards our vision of "Social Ambient Intelligence" in the Future Trends section, to finally conclude this chapter.

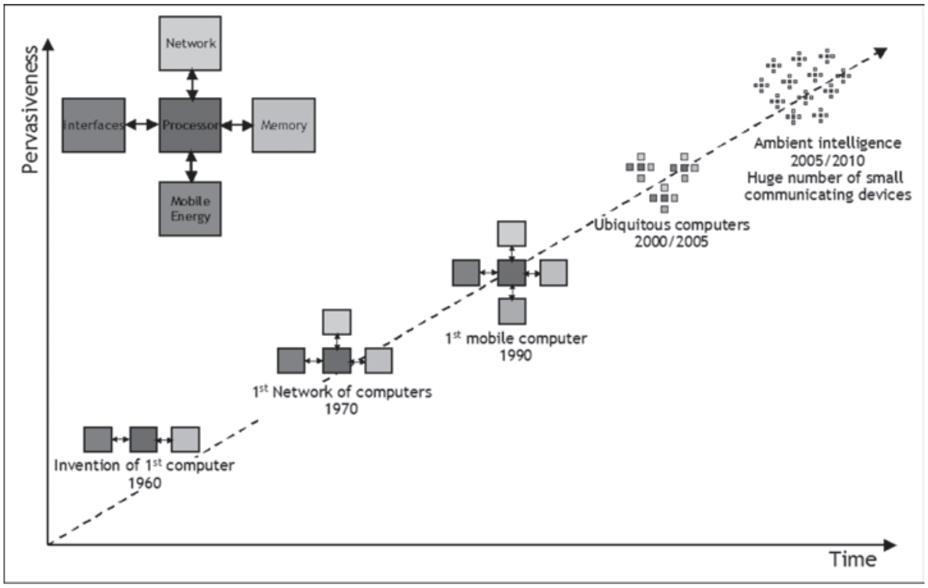
In this section, we propose and discuss the underlying definitions needed to set the foundations of this chapter: ubiquitous computing, context-awareness and semantic technologies.

Ubiquitous Computing, Ambient Intelligence and Context-Awareness

The phrase "ubiquitous computing" was proposed by Mark Weiser while working for the Xerox Palo Alto Research Center (PARC), to qualify a possible evolution of computers. "The Computer for the 21st century" (Weiser, 1991) has become a foundational paper for following works in this area. Indeed, it introduced a vision, in which "ubiquitous computers" are simple communicative devices and appliances that are suited for a particular task and are aware of their surrounding environment while fading into the background. For example, paper sheets could be replaced with flexible screens, bringing any information of the web as an independent element of a real desktop, an element that one could stack into piles, stick on a wall, lend to a colleague or take for lunch.

As depicted on Figure 1, the generation of ubiquitous computers has already arrived, as powerful and communicative computers are spread in many devices like watches, mobile phones, portable media players, game consoles, PDAs (Personal Digital Assistants), ticket machines, bike renting beacons and kids toys. Even though Mark Weiser's vision of interoperable and shared ubiquitous computers has not been reached yet, a significant research effort is done towards the vision of "Ambient intelligence". As such, "Ambient Intelligence" is considered as an evolution of "ubiquitous computing" in which networked devices can also be integrated in the environment (and thus not expecting any user intervention), can sense the environmental, personal and social situation to adapt the experience, and can anticipate

Figure 1. The evolution of computing, adapted from "Nano computing & Ambient intelligence" (Waldner, 2007), © 2007 Hermes Science Publishing. Used with permission.



forthcoming situations or actions in order to ease and enhance people lives.

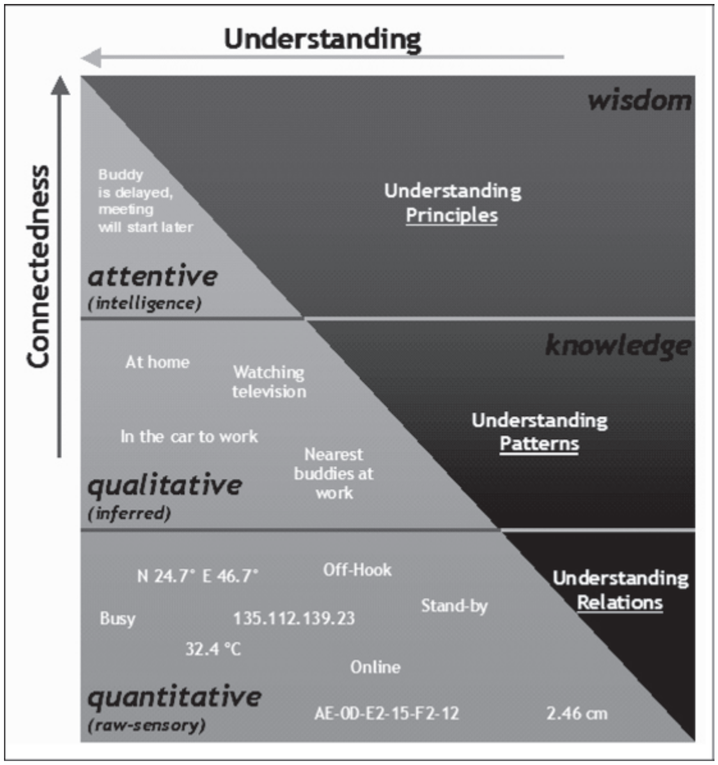
Firstly defined by (Schilit, Adams, & Want, 1994), context-awareness is a key research domain towards the vision of Ambient Intelligence. It consists in acquiring low-level context data (e.g. from sensors), inferring high-level knowledge from this data, and predicting context changes in order to clearly improve the user experience. As depicted on Figure 2, the low level of context contains current raw sensor data like GPS coordinates, IP address, surrounding Bluetooth MAC addresses or temperature. By combining and inferring on this knowledge, a meaningful position or activity like "in a meeting" or "watching TV" can be deduced to form a higher level of context. Then, after having learnt the habits of the user, predictions can be made about the actions that are probably going to happen next or about the exceptional cases that have occurred (e.g. the user is going to arrive late at work because he has not left home yet) in order to undertake relevant actions pro-actively (e.g. inform the colleagues that the meeting is delayed).

Context-awareness aims to make user interfaces automatically adapt to the user's environment and intents. It can enhance user inputs without requiring additional efforts from the user (Leong, Kobayashi, Koshizuka, & Sakamura, 2005) and also adapt outputs (Sadi & Maes, 2005). Although several works have been focusing on the implementation of context-awareness on mobile devices (Christopoulou, 2008; Korpipää, Häkkilä, Kela, Ronkainen, & Känsälä, 2004; Häkkilä & Mäntyjärvi, 2005), we will not specifically address mobile-based context-aware platforms in this paper.

Semantic Technologies: Ontologies, Knowledge Representation and Reasoning

In their study, (Strassner, O'Sullivan, & Lewis, 2007) define ontologies as « a formal, explicit specification of a shared, machine-readable vocabulary and meanings, in the form of various entities and relationships between them, to describe knowledge about the contents of one or more related subject

Figure 2. Levels of context (© Bell Labs. Used with permission.)



domains throughout the life cycle of its existence ». Semantic technologies, including ontologies and semantic description languages, are quite similar to human thinking and memorization: they allow the definition of concepts and instances (of these concepts) that are related with each other using semantically qualified links. They also allow to develop an inferred knowledge from the reasoning on this knowledge (Gruber, 1993). Applying such approach to information technologies enable machines to understand the actual meaning of data which is formulated using a distributed and evolving vocabulary. That way, ontologies fill the gap between ambiguous/fuzzy human thinking (e.g. in natural languages, a word can have different meanings) and formalized digital data (i.e. stored using specific formats and interpreted by specific applications for a specific purpose).

One of the benefits of using semantic languages is to allow progressive/incremental modeling of a system, reflecting the natural progression of conceptual understanding of domains. Ontologies can ease the communication between heterogeneous entities (i.e. using different languages/protocols) by matching similar portions of the semantic graph of the sender's knowledge with the recipient's knowledge.

On the other hand, we would like to prevent the reader to make the naïve assumption that semantic technologies are a magic solution to empower machines with autonomic intelligence. It may seem possible to model our universe as an ontology, allowing computers to understand the human world, but it is actually impossible. Indeed, modeling is always relative to a point of view, and integrating ontologies from experts of several domains would necessarily lead to inconsistencies. There is also a usual confusion about the so-called "Semantic Web" (Berners-Lee, Hendler, & Lassila, 2001). This expression does not mean that internet users will have to deal with semantic languages to communicate on the web, but it refers to a set of languages and tools that would allow web resources (i.e. web pages and services) to be described semantically in order to allow seamless processing of knowledge distributed among heterogeneous sites. Today, with the rise of the "Web 2.0" (O'Reilly, 2005), users are already able to create "mash-ups" relying on several components and data streams hosted on different sites. However, the next step is possibly to automatize (or, at least, to ease) the development of such mash-ups, assuming that web data and components are semantically described.

In the next section, we will investigate the use of semantic technologies in ubiquitous context-aware systems in order to identify the existing blocks that we will rely on to build our vision of "Social Ambient Intelligence".

STATE-OF-THE-ART

Previous studies (Strang & Linnhoff-Popien, 2004; Baldauf, Dustdar, & Rosenberg, 2007; O. Lassila & Khushraj, 2005) have identified ontologies as the most promising enabler for ubiquitous context-aware systems because they are heterogeneous and extensible by nature, and semantic technology enables « future-proof » interoperability. In this section, we will study the use of semantic technologies in four aspects of ambient intelligence: context management, human-system interactions, privacy enforcement, and social communications.

Semantic Context Management

According to (Dey, 2001), "a system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task". By context, Dey means "any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves".

(Gu, Wang, Pung, & Zhang, 2004) gave an introduction to context-awareness by proposing the following requirements: « An appropriate infrastructure for context-aware systems should provide support for most of the tasks involved in dealing with contexts - acquiring context from various sources such as physical sensors, databases and agents; performing context interpretation; carrying out dissemination of context to interested parties in a distributed and timely fashion; and providing programming models for constructing of context-aware services. »

The use of ontologies to store and manipulate context have an impact on other aspects of the underlying system: context knowledge exchange, learning, user interactions, security and applications. In this section we will review several semantic-based approaches for context management platforms and identify the most successful approaches and current lacks.

Review of Major Context-Aware Platforms

One of the first semantic context modeling approaches was the **Aspect-Scale-Context (ASC)** model proposed by (Strang, Linnhoff-Popien, & Frank, 2003). Compared to non-semantic models, ASC enabled contextual interoperability during service discovery and execution in a distributed system. Indeed, this model consists of three concepts:

- Aspects are measurable properties of an entity (e.g. the current temperature of a room)
- Scales are metrics used to express the measure of these properties (e.g. Celsius temperature)
- Context qualifies the measure itself by describing the sensor, the timestamp and quality data

Contexts can be converted from a scale to another using Operations, also described semantically, and can be mapped to an implemented service. This model has been implemented as the CoOL Context Ontology Language. The CoOL core ontology can be formulated in OWL-DL (Dean & Schreiber, 2004) and F-Logic (object-oriented). The CoOL integration is an extension of the core to inter-operate with web services. OntoBroker (Decker, Erdmann, Fensel, & Studer, 1999) was chosen for semantic inference and reasoning, supporting F-Logic as knowledge representation and query language.

With EasyMeeting, (Chen et al., 2004) proposed a pragmatic application to demonstrate the benefits of their semantic context-aware system called **CoBrA**, for Context Broker Architecture. This application assists a speaker and its audience in a meeting situation by welcoming them in the room, dimming the lights, and displaying the presentation slides, either by vocal commands or automatically. The underlying prototype that they developed is a multi-agent system based on JADE (Java Agent DEvelopment Framework) [http://sharon.cselt.it/projects/jade/] in which a broker maintains a shared context model for all computing entities by acquiring context knowledge from various sensors and by reasoning on this knowledge to make decisions, as depicted on Figure 3. In the EasyMeeting application, this broker can deduce the list of expected participants and their role in the meeting by accessing their schedule, and can sense their actual presence when the bluetooth-enabled mobile phone declared in their profile is detected in the room. That way, the system can notify the speaker about their presence, decide to dim the lights and turn off the music when he arrives. These decisions are made possible by reasoning on the context knowledge using rules defined by the EasyMeeting application. The context knowledge is represented as RDF triples relying on the COBRA-ONT OWL ontology that includes vocabularies from the SOUPA ontology (Chen, Perich, Finin, & A. Joshi, 2004) covering time, space, policy, social networks, actions, location context, documents, and events, as depicted on Figure 4. Inferencing on the OWL ontology is handled by JENA's API [http://jena.sourceforge.net] whereas the JESS rule-based engine [http://herzberg.ca.sandia.

Figure 3. Overview of CoBrA, © 2003-2008 Harry Chen. Used with permission.

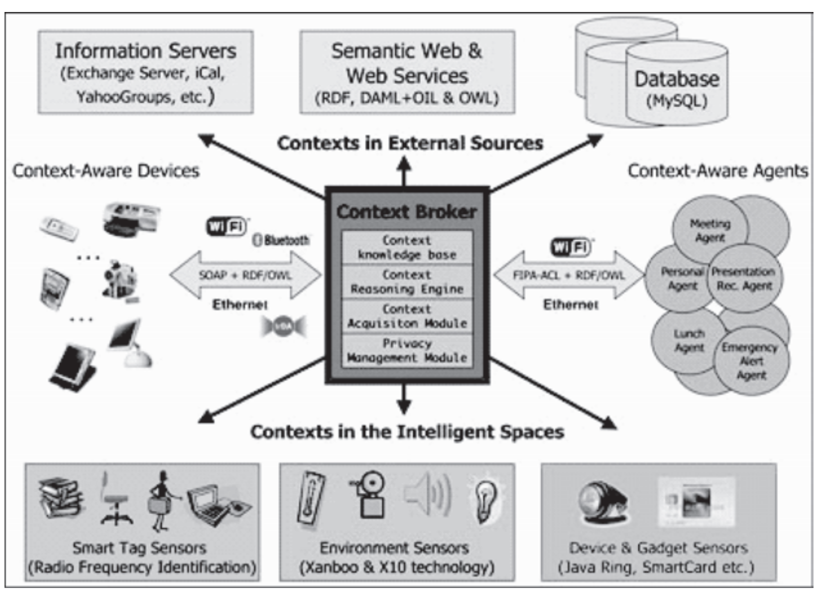
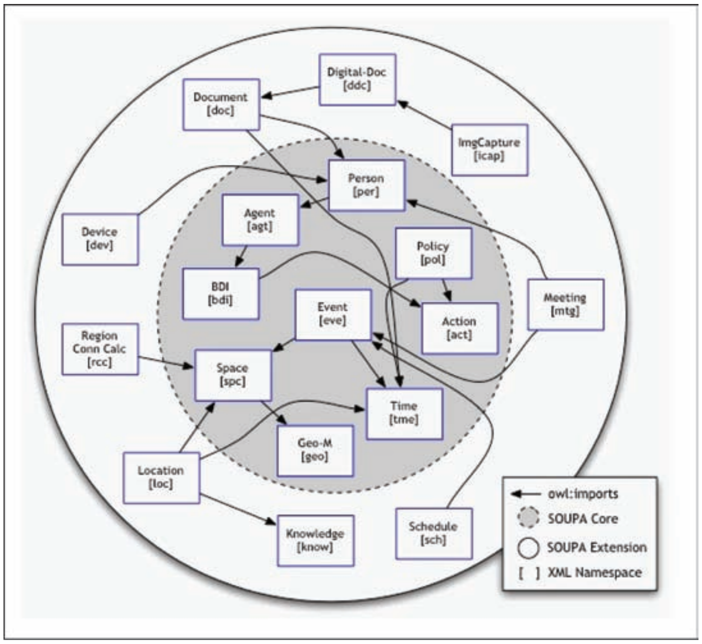


Figure 4. The SOUPA ontology, © 2003-2008 Harry Chen. Used with permission.



gov/] is used for domain-specific reasoning. The execution of rules (when results cannot be inferred from ontology axioms alone) uses the forward-chaining inference procedure of JESS to reason about contextual information. Note that, in this case, essential supporting facts must be extracted from RDF to JESS representation and the eventual results have to be injected in RDF to the knowledge base, which implies additional overhead in the process.

CoBrA's broker enforces privacy policies to define rules of behavior and restrict context communication. The enforcement of user-defined policies relies on the Rei role-based policy-reasoning engine (Kagal & T. A. Joshi, 2003) which does description logic inference over OWL. CoBrA also implements a meta-policy reasoning mechanism so that users can override some aspects of a global policy to define specific constraints at their desired level of granularity. However, they do not provide a tool for the user to express his/her privacy policy.

The **SOUPA** ontology proposed by (Chen et al., 2004) and used in CoBrA was a collaborative effort to build a generic context ontology for ubiquitous systems. Since 2003 it has been maintained by the "Semantic Web in Ubiquitous Comp Special Interest Group". The design of this ontology is driven by use cases and relies on FOAF, DAML-Time, OpenCyc (symbolic) + OpenGIS (geospatial) spatial ontology, COBRA-ONT, MoGATU BDI (human beliefs, desires and intentions) and Rei policy ontology (rights, prohibitions, obligations, dispensations). SOUPA defines its own vocabulary, but most classes and properties are mapped to foreign ontology terms using the standard OWL ontology mapping constructs (equivalentClass and equivalentProperty), which allows interoperability. In the core ontology in which both computational entities and human users can be modeled as agents, the following extensions are added: meeting & schedule, document & digital document, image capture and location (sensed location context of things).

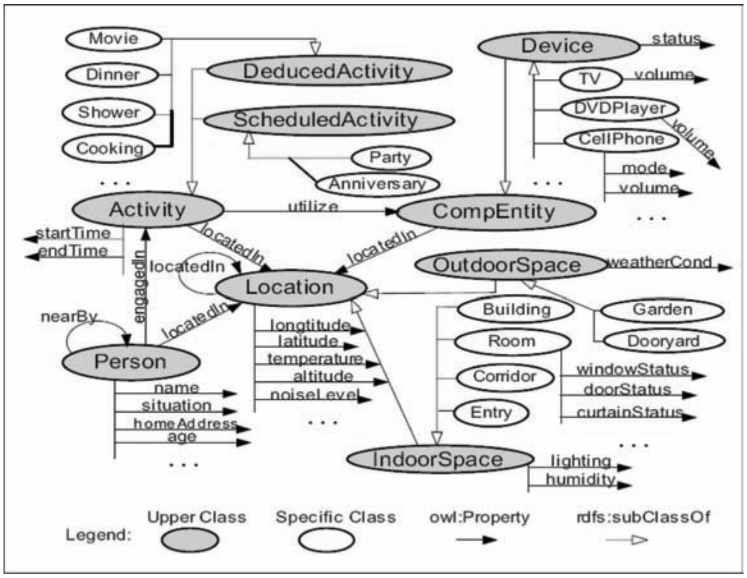
Like CoBrA, **MOGATU** (Perich, Avancha, Chakraborty, A. Joshi, & Yesha, 2005) is a context-aware system based on the SOUPA ontology. However, this decentralized peer-to-peer multi-agent system implements several use cases covering automatic and adaptive itinerary computation based on real-time traffic knowledge, and commercial recommendation. In this approach, each device is a semi autonomous entity driven by the user's profile and context, relying on a contract-based transaction model. This entity is called InforMa and acts as a personal broker that handles exchanges with other peers. The user profile semantically defines his beliefs, desires and intentions, following the BDI model that is part of the SOUPA ontology. Beliefs are weighted facts depicting user's knowledge and preferences such as his schedule and food preferences, whereas desires express the user's goals. Intentions are defined as a set of intended tasks that can be inferred from desires or explicitly provided. However no clues are given by the authors about how these beliefs and intentions are defined by the user or the system, which let us assume that this is still a manual process yet to be enriched with profiling mechanisms and a graphical user interface to edit the profile. Moreover, this work being apparently focused on trusted peer-to-peer exchange of information according to the BDI user profile, details on the actual reasoning process on context knowledge are not given. InforMa is able to process queries that can possibly involve other peers and advertise information to these peers in vicinity, relying on graph search and caching techniques. However no details were given on how pro-activity is made possible. Another lack identified in the underlying BDI model is that the representation of pre-conditions and effects of intentions are left to the applications, but we have found no clues on how applications fill this issue. Facing an important cost of network transmissions in the exchange process, it seems that this research group is focusing on peer-to-peer networking optimization and trusted exchanges more than on the actual context management. However, they suggested that preparing purpose-driven queries in advance and caching intermediate query results could improve the performance of their system, which is an interesting approach that should be considered in distributed context-aware systems.

The CORBA-based **GAIA** platform proposed by (Ranganathan, Al-Muhtadi, & Campbell, 2004) focuses on hybrid reasoning about uncertain context, relying on probabilistic logic, fuzzy logic and Bayesian networks. In their approach, context knowledge is expressed using predicates which classes and properties are defined in a DAML+OIL ontology (Horrocks, 2002). Predicates can be plugged directly into rules and other reasoning and learning mechanisms for handling uncertainty. This choice reduces the overhead of the CoBrA system relying on RDF triples. Rules are processed by the XSB engine [http://xsb.sourceforge.net/], which is described as a kind of optimized Prolog that also supports HiLog, allowing unification on the predicate symbols themselves as well as on their arguments. HiLog's sound and complete proof procedure in first-order logic is needed to write rules about the probabilities of context.

GAIA's authentication mechanism demonstrates the usefulness of fuzzy/uncertain context reasoning. It allows users to authenticate with various means such as passwords, fingerprint sensor or bluetooth phone proximity. Each of these means have different levels of confidence, and some user roles may require that the user authenticates himself on two of them to cumulate their confidence level up to the required level.

Although GAIA proposes a common reasoning framework, application developers have to define the expected context inputs and specify the reasoning mechanism to be used by providing Prolog/HiLog rules (for probabilistic/fuzzy logic) or Bayesian networks. A graphical user interface is provided to help developers construct rules, whereas MSBN (Microsoft's Belief Network) can be used to create Bayesian nets. Although Bayesian networks are a powerful way to perform probabilistic sensor fusion and higher-level context derivation, they need to be trained. Moreover, inference with large networks (more than 50 nodes) becomes very

Figure 5. Partial definition of the CONON ontology extended with the home domain (Wang, Zhang, Gu, & Pung, 2004), © 2004 IEEE. Used with permission.



costly in terms of processing and can result in scalability problems.

Based on previous works, (Gu et al., 2004) propose **SOCAM** (Service-Oriented Context-Aware Middleware), another OWL-based context-aware framework with the aim to address more general use cases by adding more qualitative information on acquired context. The classifiedAs property allows the categorization of context facts as Sensed, Defined, Aggregated or Deduced. The dependsOn property allows the justification of a deduced context based on other context facts. Another contribution is the possibility to qualify context information with parameters such as accuracy, resolution, certainty and freshness. The SOCAM framework was proven (Gu, Pung, & Zhang, 2004) to reason successfully on uncertain contexts using Bayesian Networks, but no performance results were given. The same group of authors have also carried out a performance experiment of the **CONON** ontology (Wang, Zhang, Gu, & Pung, 2004) depicted on Figure 5, which is the name that was given to SOCAM's context ontology. Their results show that the duration of the reasoning process exponentially increases with the number of RDF triples stored in the context knowledge base, which reveals that this approach is not scalable for a widespread context-aware system. Therefore two leads were proposed to increase performance:

- to perform static, complex reasoning tasks (e.g., description logic reasoning for checking inconsistencies) in an off-line manner.
- to separate context processing from context usage, so that context reasoning can be performed by resource-rich devices (such as a server) while the terminals can acquire high-level context from a centralized service, instead of performing excessive computation themselves.

Later works of that team were focused on the peer-to-peer architecture for context information systems.

Basing on the CONON ontology, (Truong, Y. Lee, & S. Y. Lee, 2005) proposed the PROWL language ("Probabilistic annotated OWL") to generalize fuzzy/probabilistic reasoning from applications to domains by mapping Bayesian Networks to ontology classes and properties. This approach must be experimented with various context-aware applications to prove its feasibility.

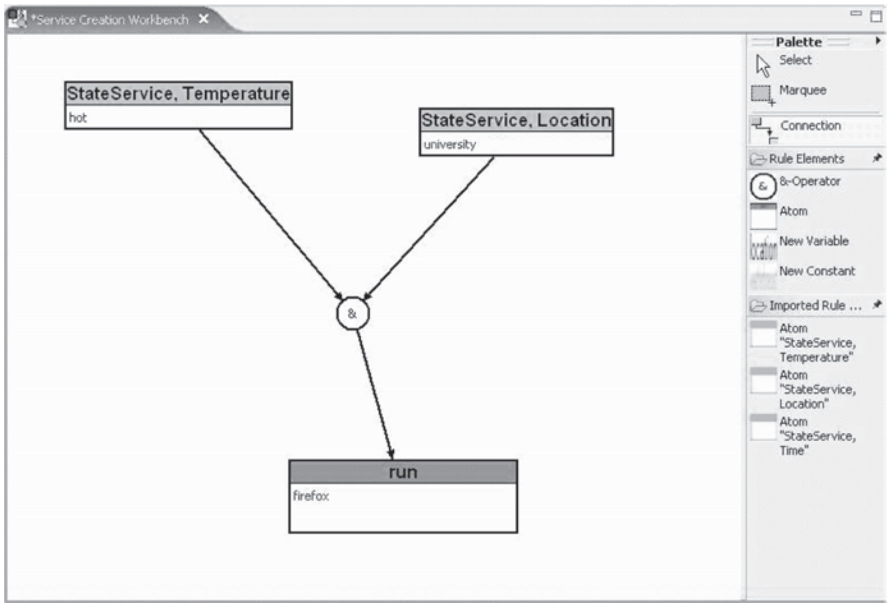
The FP6 IST project **SPICE** (Service Platform for Innovative Communication Environment) brought a fresh approach to ubiquitous system, considering them in a wider scope centered on semantic knowledge management for improved ubiquitous end-user services (SPICE, 2006) (SPICE, 2007). On its Knowledge Management Layer, SPICE proposes two different implementations of the context provisioning subsystem: the IMS Context Enabler (ICE) (M. Strohbach, Bauer, E. Kovacs, C. Villalonga, & Richter, 2007) and the Knowledge Management Framework (KMF). In ICE, the SIP protocol (Session Initiation Protocol) is leveraged to control the parameters of the exchange sessions (e.g. data sets to communicate, update trigger, update frequency) and to flexibly adjust the communication path based on the changes in network structure and available context information. Both KMF and ICE rely on a shared ontology called the Mobile Ontology which is freely downloadable on the Internet [http://ontology.ist-spice.org/], the most important difference being the interfaces: ICE uses SIP whereas KMF uses OWL over SOAP Web Services for exchanging context information. However, gateways are also provided so that context data can be converted from a format to the other. Therefore we will abstract these implementations and focus on the common knowledge model. Embracing the recommendations of the W3C, SPICE Mobile Ontology is defined in OWL and the context data is expressed in RDF. Inspired from the Dutch project Freeband Awareness, SPICE's Physical Space ontology has a finer granularity than any previous context ontology: it notably defines properties for connections between rooms and floors. Following the approach of the « Doppelgänger User Modeling System » (Orwant, 1995), SPICE's User Profile ontology supports domain-specific and conditional (situation-specific) submodels. In this approach, the profile contains subsets which are considered on certain conditions expressed with the form: Context Type, Operator, Value. This allows variations of the profile, depending on the user's context and/or the targeted application/service.

The Knowledge Management Layer also contains a Knowledge Storage module, a Profile Manager, a Service and Knowledge Push and Notification module and three kinds of Reasoners: a Predictor, a Learner and a Recommender. The reasoners can request past knowledge directly from context sources or from an external knowledge storage source. Both feedback-based and observation-based learning are supported, generating LearntRule and LearntRuleSet instances in OWL. The results can be leveraged to propose Recommendations to the user. Experimental results on the use of different learning techniques are to be published. Another interesting contribution of SPICE in the context-awareness domain is the use of a KnowledgeParameter class that is used to qualify context information with values defining their probability, confidence, timestamp, temporal validity and accuracy. However we have not found any mechanism that is similar to the "dependsOn" property supported by SOCAM to justify high-level context with lower-level facts from which it was inferred.

Another part of the SPICE project called the Distributed Communication Sphere (Kernchen et al., 2007) allows dynamic discovery of users' surrounding devices, networks and services. This part includes components that leverage context knowledge to enable multimodal interaction, content delivery, data synchronization and dynamic widgets on terminals, requiring a lightweight rule engine to be deployed on every terminal. SPICE also provides the End User Studio, an Eclipse-based GUI (Graphical User Interface) shown on Figure 6 that allows end users to create custom trigger-action rules visually.

One of the biggest identified issues in previously reviewed semantic context-aware systems

Figure 6. Creating a rule-based service using SPICE's End User Studio (SPICE 2007) © 2008 SPICE. Used with permission.



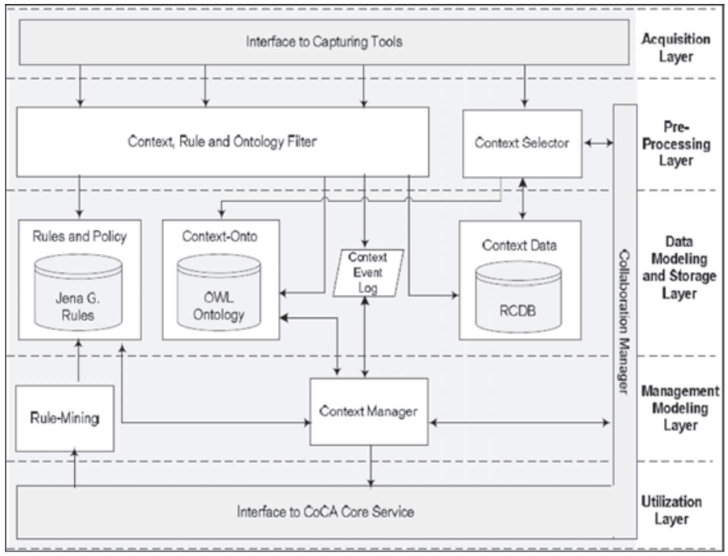
is the processing time required for reasoning on context knowledge. To answer this issue, (Ejigu, Scuturici, & Brunie, 2007) proposed an hybrid context management and reasoning system (HCoM) which relies on a heuristic-based context selector to filter the context data to be stored in the semantic context base for reasoning, the rest being stored in a relational database, as depicted on Figure 7. They report that this approach is more scalable than pure semantic context-awareness systems when the number of static context instances increases. (Lin, Li, Yang, & Shi, 2005) propose a similar approach but they filter context data according to their relevance to running applications instead of usage heuristics, in order to boost the reasoning performance.

(Tan, Zhang, Wang, & Cheng, 2005) propose to move from on-demand context reasoning to event-driven context interpretation so that reasoning on context data is processed as soon as it is received by the context management framework. However, in their distributed system, the performance is reduced because of increased communication overheads. Moreover, it does not support uncertainty yet.

Trends and Issues

In this section, we have reviewed several approaches addressing modeling, reasoning and distribution of contextual knowledge. Although semantic technologies have been shown as powerful tools to empower context-awareness, they also imply scalability problems, as the required processing time grows exponentially with the amount of knowledge, which is a major issue towards the realization of Ambient Intelligence. However, hybrid context management approaches leverage the assets of both relational and semantic context management, therefore they should be considered in the aim of building a powerful and scalable context-awareness system. Nevertheless, the selection/filtering of context data to be merged in the semantic database is not trivial and may need further research. Another track to consider is closer coupling or integration of rule

Figure 7. HCoM: Hybrid Context Management and reasoning system (Ejigu et al. 2007), © 2007 IEEE. Used with permission.



engines with knowledge bases in order to reduce processing overheads.

Semantics for Adapted Human-System Interactions

After context-awareness, another key aspect of Ambient Intelligence is how the user interacts with the digital world. Today, most internet-based interactions rely on the use of computers (i.e. a screen, a keyboard and a mouse). Whereas most people carry their own powerful mobile phone with them, most of the popular content and services are not adapted to general mobile devices with their constraints (small screen, no keyboard). Of course some of those have been adapted specifically to some popular platforms like the iPhone, but the vision of Ambient Intelligence is not only (i) to bring most of them to virtually any terminal according to its capabilities, but also (ii) to span various modalities of interaction over multiple interfaces (i.e. displays, inputs, speakers and other objects). Therefore, ambient services need to know the capabilities of every platform and interface they are used with, and they need to adapt the interaction to the user according to these capabilities. In this section we will review existing technologies for the discovery of devices and the description of their capabilities in order to enable rich user interactions and multimodality.

Semantic Discovery and Description of Interfaces

CC/PP (Composite Capabilities / Preferences Profile) (Klyne et al., 2004) is a recommendation from the W3C based on the Resource Description Framework (RDF) to create profiles that describe device capabilities and user preferences. It provides a syntax and tools to create terminal profiles and preference vocabularies, and thus can not be used as is. Indeed, the vocabulary of capabilities used for defining profiles is not in the scope of this recommendation and only structural rules and guidelines for interoperability are provided. However, the recommendation includes a pointer to the UAProf vocabulary as a referred example; we will review this vocabulary below. Among the features of the CC/PP syntax, allowed value types are listed, and the definition of default values is explained. The state-of-the-art of (SPICE, 2006) pointed out that conditional constraints are not supported in CC/PP. Moreover, the recommendation clearly informs that a CC/PP profile may include sensitive data, and delegates the enforcement of privacy to the application/system.

UAProf (User Agent Profile) (WAP Forum, 2001) is a CC/PP vocabulary for WAP (Wireless Application Protocol) enabled cell phones developed by the Open Mobile Alliance (OMA). The idea is that compliant cell phones have their capabilities described in a profile stored on a web repository so that adaptive services can gather this information in order to tailor content for embedded web browsers. This vocabulary is focused on software and hardware capabilities, and thus does not cover preferences.

WURFL (Wireless Universal Resource File) [http://wurfl.sourceforge.net/uaprof.php] is a collaborative effort to build an open XML file that describes device profiles based on fixes of their UAProf profiles. This promising initiative addresses several shortcomings of the original UAProf approach in which profiles can be inconsistent across providers, not up to date, or even do not exist.

The Foundation for Intelligent Physical Agents (**FIPA**) also proposed a device description ontology (FIPA, 2002) that can be used to reason and make decisions on the best device and modalities to create a user interface in multi-agent systems. Due to the nature of multi-agent systems, this approach differs from CC/PP in the manner of transmitting the profile. Instead of providing its complete profile on-demand, the terminal returns profile subsets adaptively to requests, allowing to set the granularity and scope of the required profile content in a gradual negotiation between agents. Whereas a CC/PP profile defines the capabilities for the software, hardware and the browser, FIPA Device Description supports the description of agent-related capabilities instead of the browser's. However, it is possible to use this ontology in a CC/PP profile, similarly to UAProf.

Even though this approach is not based on semantic technologies, the **UPnP** (Universal Plug and Play) discovery protocol (UPnP Forum, 2003) defines a XML language that can describe a physical device into a hierarchy of logical devices which map every hardware component of the device and thus its corresponding capability. A deeper study of UPnP is not in the scope of this chapter, but the modularity of this approach is interesting and should be considered in order to improve the re-usability of profiles, according to the fact that common hardware components are part of many devices.

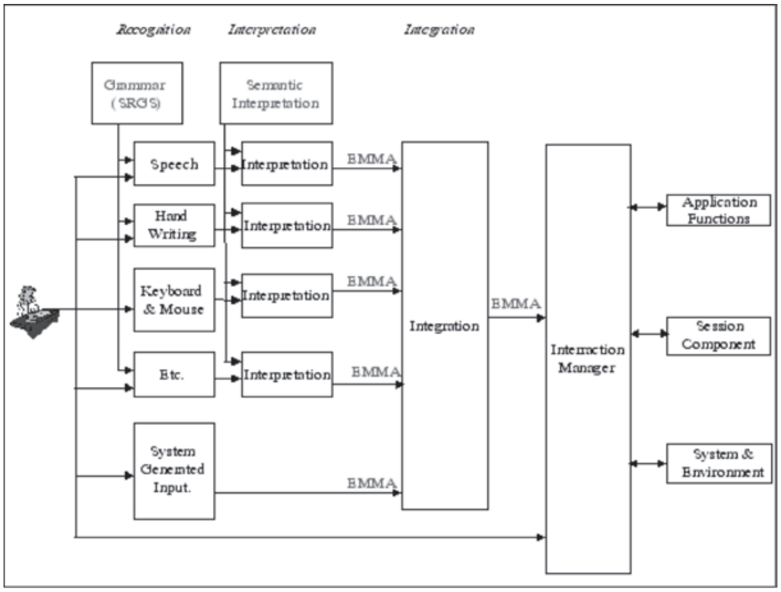
Semantics for Multimodality

When devices and their capabilities are discovered, their use for multimodal interaction requires additional negotiation and synchronization so that user interaction constraints and preferences are respected for a rich user experience. The constraints to validate cover the quality of rendering/sampling, the robustness of the connectivity, the privacy of exchanges (e.g. displaying emails on a public screen should be avoided), and also the environmental context and user preferences.

The members of the W3C Multimodal Interaction Working Group propose their specifications of a **Multimodal Interaction Framework** (W3C, 2003) based on a central Interaction Manager that connects user inputs (e.g. audio, speech, handwriting, keyboard…) and outputs (e.g. speech, text, graphics, motion…) to applications and on two other components, as shown on Figure 8:

- The Session Component, which handles the state management for application sessions that may involve multiple steps, multiple modality modes, multiple devices and/or multiple users.
- The System and Environment component, which handles the changes of device capabilities, user preferences and contextual/environmental conditions.

Figure 8. The input process of the Multimodal Interaction Framework (W3C 2003), © 2003 World Wide Web Consortium



The Interaction Manager coordinates data and manages the execution flow from various input and output modality components. It combines various user inputs for submitting meaningful actions to applications (multimodal fusion) and dispatches responses to the user through various output interfaces (multimodal fission).

Also proposed by the W3C Multimodal Interaction Working Group, the EMMA (Extensible MultiModal Annotation) markup language (W3C, 2007) is a XML markup language for describing the interpretation of user inputs. An example of input interpretation is the transcription of a raw signal into words, for instance derived from speech, pen or keystroke input, or a set of attribute/value pairs describing a gesture. The interpretations of user's input are expected to be generated by signal interpretation processors, such as speech and ink recognition, semantic interpreters, and other types of processors for use by components that act on the user's inputs such as interaction managers. As shown on Figure 8, user inputs are processed in two layers to generate EMMA data which is integrated for submission to the Interaction Manager. The two layers of input processing consist of:

- Recognition components, which capture natural input from the user and translate them into a form useful for later processing. (e.g. speech to text, handwritten symbols and messages to text, mouse movements to x-y coordinates on a two-dimensional surface…)
- Interpretation components, which further process the results of recognition components by identifying the meaning/semantics intended by the user. (e.g. pointing somewhere on a map would result in knowing the name of the corresponding country, nodding or saying "I agree" would both mean acceptation from the user…)

Recommended by the W3C, EMMA is probably going to become a standard for annotation of multimodal inputs. It has shown its usefulness especially for speech-based dialog in extensible multimodal applications (Reithinger & Sonntag, 2005; Manchón, del Solar, de Amores, & Pérez, 2006; Oberle et al., 2006).

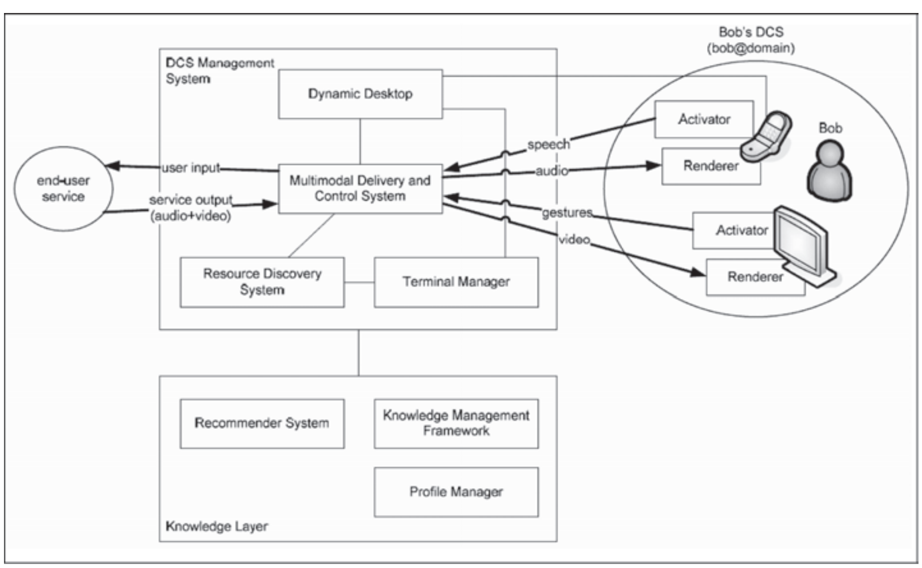
The IST project **Mobilife** proposed a solution (Kernchen, Boussard, Moessner, & Mrohs, 2006) to describe devices and modality services to form context-aware multimodal user interfaces. Their identified requirements include the deployment of a fission component implementing a rule-based algorithm on the device in order to adapt the user's mobile multimodal interface best to the current situation. In the SPICE project (Kernchen et al., 2007), the « Multimedia Delivery and Control System » depicted on Figure 9 has been developed as a part of the « Distributed Communication Sphere », is a multimodal platform relying on the W3C-recommended Synchronized Multimedia Integration Language (SMIL) (Ayars et al., 2000), that supports multimodal fusion and fission. First, the « resource discovery system » of the **MDCS** finds appropriate interfaces, then modalities are selected according to user preferences, context (e.g. Walking, driving), available resources in user's DCS and provision constraints. Modality, device and network recommendations are proposed by the knowledge management framework. This implementation is available as an open source project [https://sourceforge.net/projects/mdcs].

Trends and Issues

In this section, we have identified that semantic technologies have shown their usefulness to improve the discovery, description and exploitation of multimodal interfaces. Several collaborative efforts have been carried out to describe device capabilities. Besides, multimodal platforms are emerging with standardization support from the W3C. This progress leads to the interface-agnostic aspect of ubiquitous computing, but the state of the art of multimodality has still not been transferred from researchers to end-users.

The vision of ubiquitous computing, in which any screen can be used to display personal information, requires privacy enforcement mechanisms, especially if public screens are expected to be shared as well for this matter. In the next part, we will study how semantic technologies can help enforcing privacy in such systems.

Figure 9. SPICE Multimedia Delivery and Control System (Kernchen et al. 2007), © 2007 Ralf Kernchen. Used with permission.



Semantics for Privacy

The vision of ubiquitous computing in which personal information flows in a highly networked ecosystem requires privacy enforcement mechanisms, especially if public screens are expected to be shared for displaying such information as well as personal terminals. Although privacy is a very rich and specific research domain, in this part, we will study how semantic technologies can help to enforce privacy in ubiquitous systems by reviewing a few approaches that must be considered to enforce privacy in Social Ambient Intelligence systems.

According to (Damianou, Dulay, Lupu, & Sloman, 2001), the use of policies is an emerging technique for controlling and adjusting the low-level system behaviors by specifying high-level rules. Policies enforced using semantic rule engines are implemented in most secure semantic context-aware platforms studied earlier in this chapter. In their review of semantic web languages for policy representation and reasoning, (Tonti et al., 2003) explain that "the use of policies allows administrators to modify system behavior without changing source code or requiring the consent or cooperation of the components being governed". **KAoS and Rei** are both semantic policy languages: KAoS is an OWL-based language and uses Java Theorem Prover to support reasoning whereas Rei uses Prolog and RDF-S. They also propose different enforcement mechanisms: KAoS requires the enforcers to be implemented and integrated in the system entities to control, whereas the Rei's actions are to be executed outside the Rei's engine.

(Shankar & Campbell, 2005) propose an extension to the ECA (Event-Condition-Action) rule framework, called Event-Condition-PreCondition-Action-PostCondition (**ECPAP**). In this framework, actions are annotated with axiomatic specifications that enable powerful reasoning to detect conflicts and cycles in policies.

(Brar & Kay, 2004) propose "secure persona exchange" (SPE), a framework based on W3C's Platform for Privacy Preferences (P3P) for secure anonymous/pseudonymous personal data exchange. This framework allows users to negotiate agreements with services that declare their privacy practices and request personal data. The P3P defines such a semantic service description format whereas privacy preferences are described using the APPEL language (A P3P Preference Exchange Language). SPE addresses the following identified end-user requirements: purpose specification, openness, simple and appropriate controls, limited data retention, pseudonymous interaction and decentralized control.

Trends and Issues

We have identified three semantic models that can be used to enforce privacy in ubiquitous systems: rule-based policies, ECA-based policies and secure exchange negotiation according to privacy preferences. Although the last one is the only one to address the issue of secure exchange of personal information, these approaches are complementary and promising to enforce privacy in Social Ambient Intelligence systems.

Semantics for the Social Communications and Activities

In the era of social networking and the participative web, of always-connected chat messengers and virtual worlds, people communicate and exchange more and more over the Internet. If computers are expected to disappear, the communication and exchange paradigms must be adapted to take the context of the users into account and to leverage the social knowledge held in web platforms in order to improve the awareness (and thus, intelligence) of Social Ambient Intelligence systems. One of the key points of such communications is user presence, because being online does not mean paying attention to any discussion at anytime. The second point that we will discuss covers user profiling techniques and the expression of the social graph. Finally, promising technologies for augmenting social activities with the Internet in an interoperable way will be discussed.

User Presence and Communication

The major context information in a synchronous communication network is presence, which is information on reachability, availability, and status across all communication channels (e.g., networks, applications, transports over Internet, wireless and wireline).

Two major presence exchange formats are considered here. The first one is **SIMPLE** (Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions), an extension of the SIP protocol recommended by the Open Mobile Alliance (OMA) that supports new features such as: voice, video, application sharing, and messaging. Leveraging the communication and security of the IMS (IP Multimedia Subsystem) platform, SIMPLE extends the user's presence to take into account the user's willingness, ability and desire to communicate across all different kinds of media types, devices, and places. Even though it is not a semantic language, the Dutch project Freeband Awareness (Bargh et al., 2005) chose the SIP/SIMPLE protocol for realizing a context-aware network infrastructure with the focus on secure and privacy-sensitive context exchange between a core network owner (e.g. a cell carrier) and external entities. In other projects, the use of SIP can be limited to exchanges that imply an interaction with the user: notifications, confirmations… In the SPICE project (M. Strohbach, E. Kovacs, & Goix, 2007), SIP is used to share presence information with the IMS platform and exchange data with the communicating user. On another hand, SPICE's Mobile Ontology includes a presence ontology based on **PIDF** (Presence Information Data Format) which allows definitions of the user's input, mood, contact relationship, place characteristics, current activity, and service. Transformation templates are provided to switch from the internal semantic representation in RDF into PIDF, and the other way round.

SIP has a wide range of possible uses but is not an optimal solution for all kinds of exchange. (Houri, 2007) criticized the weakness of SIP/SIMPLE in domain scaling. Furthermore it appears (Saint-Andre, 2005) that SIP/SIMPLE does not support advanced messaging mechanisms like workflow forms, multiple recipients, reliable delivery and publish-subscribe which are useful for context-aware systems. PIDF has shown to be suitable for the SPICE project.

Profiling and Social Graph

Considering the user's profile and social graph is important to personalize access to information and communication means. At a time when silo web-based social networking sites rapidly spread, many initiatives try to free our social data from these platforms using interoperable formats.

FOAF (Friend-of-a-Friend) (Brickley & Miller, 2007) is a RDF vocabulary based on an OWL ontology to describe people profiles, friends, affiliations, creations and other metadata related to people. FOAF's vision is a decentralized and extensible machine-readable social network based on personal profiles. The profile contains descriptions of personal user data, possibly his/her work history, and links to his/her contacts and affiliated services. Each person has a unique identifier, usually a hash of the email address. The community of FOAF users being principally made of researchers and semantic web enthusiasts, it does not compete with popular social networks like LinkedIn [http://www.linkedin.com], Myspace [http://www.myspace.com] or Facebook [http://www.facebook.com]. Many tools have appeared, including FOAFexplorer [http://xml.mfd-consult.dk/foaf/explorer/] which can be used to visualize FOAF profiles. However, there is a potential privacy issue with this language because selective privacy-aware views of a FOAF file are not addressed. It may be interesting to evaluate a mechanism similar to the conditional profiles proposed in the SPICE project or to enforce selective distribution of content using a policy-based system.

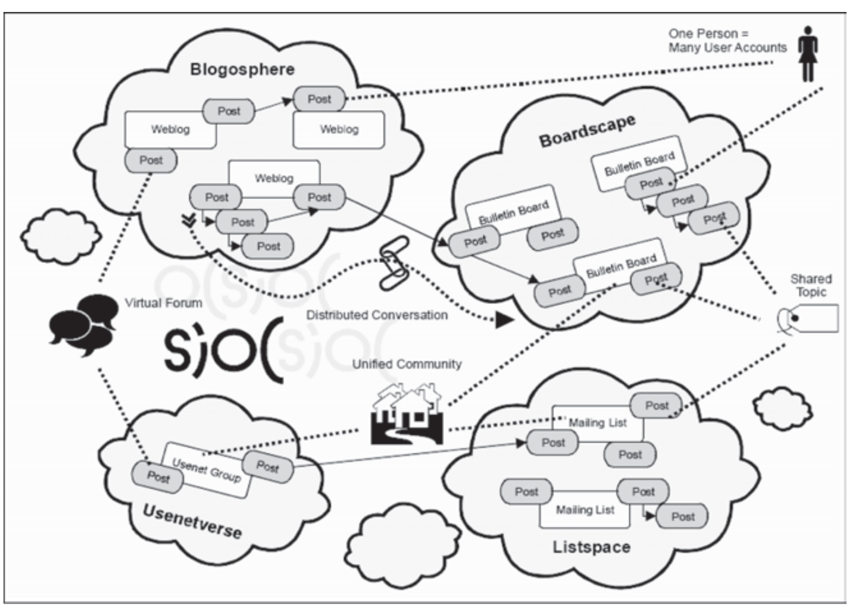
SIOC (Semantically-Interlinked Online Communities, http://sioc-project.org) represented on Figure 10 is an ontology-based framework aimed at interconnecting online community sites and internet-based discussions. The idea is to enable cross-platform interoperability so that conversation spanning over multiple online media (e.g. blogs, forums, mailing lists) can be unified into one open format. The interchange format expresses the information contained both explicitly and implicitly in internet discussion methods, in a machine-readable manner. A similar approach is proposed by the OPSN (Open Portable Social Network, http://www.opsn.net/) initiative which also covers notification and synchronization of contacts across platforms. However there is no existing implementation, and privacy control for personal published information seems not to have been addressed yet. DISO (distributed social networking, http://diso-project.org/), is yet another collaborative work to follow.

These initiatives would be a promising way to leverage consistent social relations, discussions and exchanges from various web platforms in order to build a more precise profile of user's interests, like with the **APML** language (Attention Profiling Mark-up Language, http://www.apml.org/), and qualify the types of relations in order to improve the social communication experience.

Social Interactivity

Social networking sites (SNSs) have become very popular communication platforms on the Internet, enabling new ways for people to interact with each other. Although the proposed interactions are similar on most SNSs, each of these sites were developed as silos, and thus their social graph (i.e. the list of "friends") and applications are not portable. We believe that consolidating SNS-based interactions is a key towards our vision of Social Ambient Intelligence, and that semantic technolo-

Figure 10. Overview of SIOC: Semantically-Interlinked Online Communities [http://sioc-project.org]. © 2006 John Breslin. Used with permission.



gies can help to solve this interoperability issue.

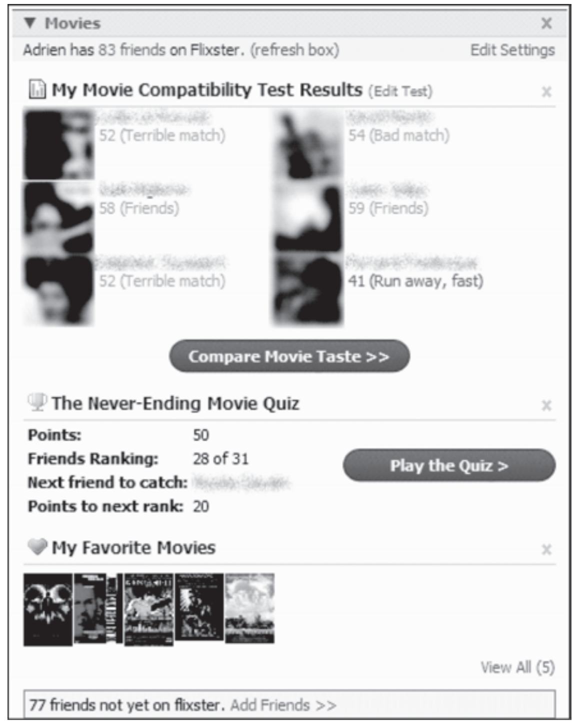
With its open application platform, the social networking site **Facebook** became a huge Internet player in a few months, attracting many service providers and increasing their population of users significantly. Indeed, Facebook made it easy for application developers to leverage the user's profile and social graph of the underlying platform, and thus bring user-friendly services with a social dimension. For example, as shown on Figure 11, the "Movies" application allows the user to rate movies so that his/her favorite movies are shown on his profile page. But the most interesting aspect of this application is the possibility for friends to compare their movie tastes to evaluate their compatibility.

Because there are many existing social networking sites on the Internet that are adopting the application platform approach à la Facebook, Google initiated the **OpenSocial** project, an interoperable framework to build applications on any compliant social networking site. However this framework implements basic contact management actions only and don't have access to all the information and capabilities of all social networking sites. For example, some of them are capable of exchanging "pokes", "gifts" and comments, but there is no interoperable way of invoking these capabilities from OpenSocial so far. This could be the opportunity to develop an ontology of social interaction which could be enriched by the platforms and gradually supported by applications without preventing them to work in degraded mode (e.g. by sending a comment instead of a gift, if this capability is not supported by the platform).

Trends and Issues

Despite the exponential popularity and value of Social Networking Websites (SNSs) on the Internet, the possible links between ubiquitous context-aware platforms and existing "Web 2.0" platforms (O'Reilly, 2005) have been neglected by academia,

Figure 11. The "Movies" application on Facebook,© 2008 Flixster, Facebook. Used with permission.



while Internet players are working together to build controlled interoperability. Although extraction of consistent knowledge from the Web 2.0 is not trivial (Gruber, 2006), there is a huge value in social networks sites (and user-generated content) that should be leveraged to extend the awareness of Social Ambient Intelligence systems, as we will explain in the next section. We believe that proposing a common SNS interaction ontology in current collaborative efforts such as the OpenSocial project is a good track for researchers towards our vision of Social Ambient Intelligence.

Conclusions of the State-of-the-Art

In this State-of-the-Art part, we have depicted an overview of several past and current approaches for context-aware systems, adapted human-system interactions, privacy enforcement and social communications and activities. We have identified the assets of semantic technologies in all these domains, and several issues.

Whereas semantic technologies are a powerful tool to enable interoperability among heterogeneous entities, and to unify knowledge in a common model, we realise that existing research on Ambient Intelligence does not leverage the value of collective intelligence which has emerged with the Web 2.0 and its Social Networking Sites. In the next part of this chapter, we will respond to this paradox by defining our vision of “Social Ambient Intelligence” and proposing several research leads towards this vision.

REALIZING SOCIAL AMBIENT INTELLIGENCE

In this part, we define our vision of “Social Ambient Intelligence” and propose several research leads towards this vision, based on our previous study.

What is Social Ambient Intelligence?

As explained in the Background part of this chapter, the vision of “Ambient Intelligence” consists in leveraging new technologies and techniques (including context-awareness) to design applications that are user-centric, and thus more adapted to the user, his knowledge and his current environment/situation. As the Web 2.0 gave birth to the concept of Collective Intelligence, which consists in generating knowledge from user contributions and interactions on the Internet, it sounds like leveraging this knowledge would be extremely valuable to increase the awareness of “Ambient Intelligence” systems. Assuming that, for instance, recommendations coming from friends are necessarily given more confidence than recommendations coming from predictive statistics, adding a social dimension to “Ambient Intelligence” would result in more relevant results for users, and thus a better user-centricity, which was the rationale of “Ambient Intelligence”.

Based on this analysis, we propose “Social Ambient Intelligence” (SocAmI) as an extension of “Ambient Intelligence” (AmI) that adds a social dimension in order to increase awareness, knowledge and intelligence of such systems. This social dimension would benefit from the “collective intelligence” of Web 2.0 platforms (such as Social Networking Sites), and therefore it will bring more relevance and confidence to users. The addition of this dimension also gives the opportunity to augment the user communication experience with new kinds of social interactions inspired by Social Networking Sites, without having to sit behind a computer.

As semantic technologies have been shown as an excellent framework to model, integrate and exchange formalized knowledge in a unified manner among heterogeneous agents/entities that constitute Ambient Intelligence systems, we believe in their capability to integrate the social knowledge gathered from the Collective Intelligence of the Web users.

In the following paragraphs, we will discuss the issues and challenges implied by the realization of Social Ambient Intelligence.

Converging with the Social Web

It is time for the social web, context awareness, and multimodal interfaces to converge into a Social Ambient Intelligence platform that enforces users’ privacy. We believe that semantic technologies are the best enablers for interoperability, extensibility and intelligent exploitation of user, hardware and social web knowledge, in order to improve interactions between users and information. However, leveraging web knowledge in a semantic ubiquitous system may not be a trivial task according to (Strassner et al., 2007) who claimed that: in order for ontologies to be adopted by a system, this system should have a sufficient amount of semantic knowledge and minimal legacy information to carry. Indeed, the Semantic Web still being an unachieved vision (Berners-Lee, Hendler, & O. Lassila, 2001; Cardoso, 2007), most websites don't rely on semantic technologies to maintain their data. We have presented several initiatives that intend to create interoperable standards based on semantic technologies for universal use of user-generated content and communications kept in separate web platforms. Academics should get involved in this process, in order to take into account the requirements of Social Ambient Intelligence platforms that will leverage these standards. In the mean time, web platforms APIs (Application Programming Interface) can be used to build gateways between specific web social platforms and ubiquitous systems. For example, user feeds (e.g. Facebook's mini-feed, twitter, del.icio.us) could be analyzed as an additional source of context knowledge in the aim of identifying user activities and profile. On the other hand, ubiquitous systems could also be used to push content to these platforms, e.g. automatic presence information inferred from the context.

Bringing Ubiquitous Systems to People

Another issue that we want to address here by adding a Social dimension to Ambient Intelligence is the lack of integration and public visibility of research works related to Ambient Intelligence. The growing ubiquity of networks (infrastructures and ad-hoc), screens and mobile devices brings more exciting opportunities for people to communicate and exchange content but we lack interoperability standards, preventing people from experimenting state-of-the-art research results. In the meantime, innovative ubiquitous products appear on the market, such as electronic photo frames, widget displays, toys that can give weather reports and read emails, and powerful domestic management systems but they all work on their own because we lack common standards and platforms. One promising way of making people progressively adopt ubiquitous systems is to advertise them as applications on popular social platforms (e.g. Facebook), inviting users to deploy required software on their terminal to benefit from exciting new services that could possibly leverage users' context and social graph. Some people may be reluctant to use such systems at first, but we believe that there are solutions to make them accept them.

Gain Trust from Potential Users

Potential users of ubiquitous context-aware systems can be reluctant for the following reasons:

1. Privacy

Users will be concerned with the idea of provisioning private contextual knowledge (such as user positioning) to a "black-box" system which they may not trust, because they are afraid of loosing control of this information (Abowd & Mynatt, 2000), of being tracked or even spied (Bohn, Coroama, Langheinrich, Mattern, & Rohs, 2004). Moreover, most Internet users are already concerned with spam, and many already complain about profiling operated by web sites to improve the relevance of advertising; therefore sharing contextual knowledge can be seen as a major threat for privacy and control of personal information. We believe that advertising should be taken into account as the fair counterpart of a service, but it must be moderated by the system. E.g. a music recommendation service that advertises live performances and merchandising of one's favorite artists seems like an fair service that benefits both the user and the service provider, if the user is fond of music. Nevertheless, the user must constantly be in control of his private information, and confidentiality/security of exchanges must be enforced using mechanisms such as pseudonymity or cryptology. The transparency of the ubiquitous system's implementation and knowledge base can be a major source of trust for users, like it has been with open source software.

2. Intrusion

The subscription to many services that have access to extensive knowledge about users (e.g. their interests, their social network) and also privacy policy management can lead to digital pollution. Users could receive hundreds of recommendations, being asked hundreds of questions about their current situations and confirmations for proposed relevant actions to undertake. Research must be carried out to moderate explicit user interaction (i.e. requests and notifications) without compromising intended communications, user awareness and control. A promising approach for semi-autonomous control of user private data is the use of policies. However, as (O. Lassila, 2005) pointed out, we need a rich representation of policies so that users can define and visualize their privacy rules in a clear and easy way, and delegate their enforcement to the system.

In this section, we have sketched our vision of Social Ambient Intelligence. Main issues consist of the convergence of Ambient Intelligence with the Social web, the involvement of end-users with current research works, the definition of common standards, and the trust to be gained from users (regarding privacy and intrusion).

CONCLUSION

In this chapter, we have reviewed several uses of semantic technologies for context management, adaptive human-system interaction, privacy enforcement and social communications in the scope of Ambient Intelligence. Based on identified benefits and lacks, we defined our vision of "Social Ambient Intelligence" and proposed several research leads towards the realization of this vision based on the convergence of Ambient Intelligence, Collective Intelligence of the Social Web and Semantic Technologies. Through our involvement in several ongoing European, national and internal research projects, we will strive to focus our research on these points and to convey our position and trends to our collaborators.

ACKNOWLEDGMENT

The authors would like to thank Laure Pavlovic for her kind support to improve the quality of this chapter. We would also like to thank the authors of the figures included in this chapter for granting us permission to include them.

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This work was previously published in Context-Aware Mobile and Ubiquitous Computing for Enhanced Usability: Adaptive Technologies and Applications, edited by D. Stojanovic, pp. 311-337, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.11
Virtual Social Networks:
Toward A Research Agenda

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ABSTRACT

Multi-user virtual communities have become an accepted fundamental component of communication whereby community members share information and knowledge for mutual learning or problem solving. Virtual communities in a multi-user virtual environment (MUVE) have evolved into active social networks, formulating an alternative social existence and this phenomenon warrants further investigations. In these virtual social networks (VSNs), member participation is essential for their success. Therefore, developing knowledge on how to manage and sustain participation of members in VSNs fills a gap in our academic understanding of the dynamics underpinning the processes of virtual community development. This article aims to address these issues by extending the theory of sense of community into a virtual context (SOVC) and by integrating it with other communication theory of U&G.

INTRODUCTION

Internet technologies have changed the methodology and content of communications in online environments (Koh, Kim, Butler & Bock, 2007). New forms of communication, such as collaborative communications, which enable people to communicate and interact with one another in the absence of face-to-face interactions, have emerged (Jepsen 2006). Such interactive collaborative communications have led to the formation of multi-user virtual communities for social networking known as virtual social networks (VSNs), and these have become an accepted fundamental component of communication (Koh et al. 2007). This proliferation of virtual communities worldwide provides an important form of communication whereby community members share information and knowledge for mutual learning or problem solving (Chen &Xie 2008). These communities in the multi-user virtual environment (MUVE) have expanded into a space to live and not just for occasional or casual participation (Kwai & Wagner 2008). These virtual social networks are essentially communities aiming to formulate alternative social existences and this evolving phenomenon warrants further investigation.

In this respect, the issue of what makes sense of a virtual community has captured the attention of both practitioners and researchers but so far research on this subject is limited (see Blanchard & Markus 2004, Fisher, Sonn & Bishop, 2002). According to communication theory, a sense of community (SOC) implies an emotionally positive effect which creates an intrinsically rewarding reason to continue participation in an online community (Blanchard & Markus 2004, Whitworth & DeMoor, 2003). When participants experience positive feelings in a virtual community, they are more likely to increase or maintain their membership, thereby contributing to its sustainability and success (Blanchard & Markus 2004, Sangwan 2005). We postulate that the sense of virtual community must be a principal construct in research designed to understand any form of virtual collaboration such as communication and participation in virtual communities-of-practice, or virtual social networks. Indeed this construct can facilitate our understanding of participation in virtual space where organizations are also increasingly using collaborative communication for various issues (Jepsen 2006, Koh & Kim 2003). Prior research has shown that virtual networks play a critical role in determining the way problems are solved, organizations are run, and the degree to which employees succeed in achieving their goals (see Kuk 2006, Kwai et al. 2008, Wietrz & Ruyter 2007). Similarly, virtual social network research has focused on how the structure of bonds affects members and their relationships in physically less-bounded social systems and global communities in a multi-user virtual environment (Wasserman & Faust, 1994). Most large-scale, virtual social networks that rely on members to contribute content or build services share the problem of how to increase participation across the board. The concentration of a small number of members who contribute both to postings and to other content shows that a larger number of participants do not feel motivated enough for regular participation (Koh et al. 2007). For example, in a study of a USENET forum, Franke and Hippel (2003) found that the most prolific 1% of members contributed 20% of the postings, and the top 20% of members contributed to 61% of the messages. Similarly, in a study of an online project, Koch and Schneider (2002) found that 17% of members made 80% of the contribution. Different levels of participation are related to the success of virtual communities (Kuk 2006). Therefore, developing knowledge of how to manage and sustain participation of members in VSNs fills a gap in our academic understanding of the dynamics underpinning the process of virtual community development.

This article aims to address these issues by extending the theory of SOC into virtual contexts (SOVC). First, we demonstrate the theoretical strength of SOVC from the members' perspective to develop a conceptual understanding of why members participate in virtual social networks. In accordance with previous research, we treat the social network context as a moderator (Venkatesh, Morris, Davis & Davis, 2003). Subsequently, we develop a research agenda with propositions for future research work. Implications relating to the satisfaction of members for sustainability of virtual social networks are also discussed. The article contributes toward an improved understanding of the SOVC construct on aspects contributing to the successful VSN for the interests of various stakeholders. VSN organizers can apply the theoretical understandings to increase participation by and satisfaction of their members (Koh & Kim 2003, Porter & Donthu 2008) for successful business models. An understanding of the dynamics of VSNs can also potentially be applied by enterprises and policy makers to facilitate virtual collaboration among their members, and to better transform activities of offline communities into an online context (Kuk 2006). These are important issues for business activities such as marketing and advertising of products and services where, through SOVC, promotion by word-of- mouth and other advertising influences and persuasions can be better exercised in virtual social networks (Chen & Xie 2008).

A COMMUNICATION THEORY PERSPECTIVE ON VIRTUAL SOCIAL NETWORKS

A community is characterized mainly by the relational interactions or social bonds that draw people together (Gusfield 1975). Relational communities are distinguished from territorial communities through their association with human relationships, irrespective of their location or being physically bounded together. In this sense, most virtual communities, including virtual social networks, are relational communities since these are based on common social interests such as social meetings, hobby clubs, religious groups, or fan clubs (Koh & Kim, 2003). Members of virtual social networks can be geographically dispersed while participating in common social actions.

Sense of community (SOC) is a feeling that members have of belonging; a feeling that members matter to one another and to their community; a shared belief that members' needs will be fulfilled through their commitment to be together; a feeling of being emotionally secure through bonding with other members (McMillan & Chavis 1986). This sense of belonging is about individual member's perception, understanding, attitudes, feelings toward the community and his or her relationship to it. At same time, this feeling extends to other members' participation for a complete and multifaceted community experience (Blanchard 2007, Forster 2004).

Similarly, in a virtual community or in a virtual settlement, a sense of community exists with a set of community-like behaviors and processes (Blanchard & Markus 2004, Forster 2004,). SOC is a vital component of a virtual community and is at the core of all efforts to strengthen and build a virtual social network (Chipuer & Pretty 1999, Obst 2002). More specifically, SOVC is defined as members' feelings of membership, identity, belonging or bonding, and attachment and connection to a group with common interests or goals (Koh & Kim, 2003) that interacts predominantly through electronic communication (Blanchard 2007). Affective or utilitarian bonds and connections manifesting a sense of virtual community are developed through social interactions between members using a technological medium. This bonding and connectivity is an important criterion that can be used to differentiate virtual social networks from other virtual settlements (Koh et al. 2007). With the ease of mobility and increased ability to communicate in MUVE, a sense of connection has evolved that ensures trust and value for members in order to build a virtual community (Forster 2004, Porter & Donthu 2008). Research demonstrates that SOVC relates to higher member participation and influence on other members in a virtual community for its success and sustainability (Andrews 2002, Blanchard & Markus, 2004).

Although there are differences between SOVC and SOC, researchers in various virtual settings have adapted the measure of SOC, as developed in the sense of community index (SCI) by Chavis et al. (1986), to study virtual groups (Blanchard 2007, Forster 2004, Koh & Kim 2003,). The SOC construct consists of four antecedents of feelings of membership, feelings of influence, integration and fulfillment of needs, and shared emotional connection (McMillan and Chavis 1986). Koh and Kim (2003) adapted two main dimensions of membership and influence and adjusted the construct for the virtual context. They also suggested immersion as a third dimension of SOVC to explain virtual communities' characteristics of anonymity, addictive behavior, and voluntary and total involvement.

A social network is a social structure made of individuals or organizations that are tied by one or more specific types of interdependency (Friedkin 1982). It reflects the ability to access information and exchange feelings through the links between network members (Friedkin 1982). Social network analysis views social relationships in terms of nodes (individual actors within the networks) and ties (relationships between the actors) (Wasserman & Faust 1994). Social communities can exist as personal and direct social ties that either link individuals who share values and beliefs or impersonal, formal, and instrumental social links (Mathwick, Wiertz & Ruyter, 2008). The likelihood and process of interaction within electronic social networks can be modeled by the nature of network size or degree of openess which is defined as the degree to which a member is near all other members in a network (directly or indirectly) (Constant, Sproull & Kiesler 1996, Mathwick et al. 2008). Prior research explores the capacity of the social networks as a communication channel and their role in influencing the spread of new ideas and practices (Davis 1989) in creating social capital (Mathwick et al. 2008) and other organizational usage (Constant et al. 1996). This approach can be useful for examining and explaining many online business and marketing phenomena and little research has focused on exploiting virtual communities from this perspective.

Building bonds in virtual communities relates to the various levels of participation contributing to the membership life cycle. Research in psychological SOC has revealed some effects on the individual level of participation in offline communities (Burroughs & Eby 1998) where members have a tendency to remain affiliated with others in their community (Fisher et al.2002). This trait of SOC can be extended to MUVE to examine the impact of SOVC on participation in social networks in order to explain members' exit or sustained membership, similar to participation in traditional or face-to-face communities.

Wenger (1999), using the principles of legitimate peripheral participation, illustrate a cycle of how users become incorporated into virtual communities. They suggest five types of trajectories within a learning community: peripheral (i.e. lurker), one who uses an outside, unstructured participation; inbound (i.e. novice), a newcomer who invests in the community and is heading towards full participation; insider (i.e. regular), one who is fully committed community participant; boundary (i.e. leader), one who sustains membership participation and brokers interactions; and outbound (i.e. elder) as one in the process of leaving the community due to new relationships, new positions, new outlooks (Wenger 1999). Kim (2000) reinforces this typology and explains that members of virtual communities begin their life as visitors, or lurkers. After breaking through the initial barriers of communication, members become novices and begin to participate in community life. After contributing for a sustained period, members become regular contributors. If they break through further barriers, members become leaders; and once they have contributed to the community for some time members become elders. This variance in participation can reflect on the building of SOVC and create value for members to join and stay in their virtual community for social networking. Other studies on communities in different research settings also demonstrate that participation is related to SOVC (Cho & McLeod 2007).

RESEARCH AGENDA

By the concept of virtual social networks we understand virtual communities which have a common social interaction interest, and these interactions generate and provide social capital for stakeholders. This social capital is an intangible resource embedded in and accumulated through a specific social structure (Mathwick et al. 2008). These specific social structures allow a higher level of member participation valuable to businesses such as electronic commerce, and organizational activities involving employees' collaboration.

In this article, we investigate SOC as a starting point and adapt it to the virtual community context. Thus, similar to SOC, the principles of SOVC have four antecedents: membership, influence, integration and fulfillment of needs, and shared emotional connection (McMillan 1996). Although the SOC construct has been reviewed, extended and refined in later research in both offline and online contexts (see Table 1 for an overview of selected studies), we used the original dimensions to develop our research propositions. The rationalization for this derives from the fact that none of the studies in online communities (see Blanchard 2007, Koh & Kim 2003, Long & Perkins 2003) has conducted any methodologically rigorous systematic analysis in MUVE. We envisage that, based on our propositions, future studies can provide both internal and external validation of the construct for sustained employment in further research. Moreover, in an offline environment, these dimensions have been established as the key to fostering a sense of connection among members in order to build a sense of community;

Table 1. An Overview of Selected Studies on SOC and its extension to SOVC

Authors	Context	Findings
McMillan and Chavis (1986).	Offline Communities	This study proposes four antecedent of psychological SOC: membership, influence, integration and fulfillment of needs and shared emotional connection.
Chavis, Hogge McMillan & Wandersman(1986)	Offline Communities	This study designs the widely used and broadly validated measure of Psychological Sense of Community from the Sense of Community Index (SCI) instrument (see Chipuer & Pretty 1999, Long & Perkins 2003).
Chipuer and Pretty (1999)	Offline Communities	The study measures SOC using SCI and shows some support for the existence of the four antecedents of the McMillan and Chavis (1986) SOC model in the SCI.
Long and Perkins, (2003)	Offline Communities	This study reassesses SCI using confirmatory factor analysis (CFA) and results yield a poor model fit for McMillan and Chavis's (1986) original theoretical formulation, and develops an eight-item, three-factor Brief SCI (BSCI).
Koh and Kim (2003)	Virtual Community	This study conceptualizes and operationalizes SOVC in three antecedents: membership, influence and immersion, and validates several other antecedents of SOVC: the enthusiasm of the community's leaders, offline activities available to members, and enjoyability.
Blanchard and Markus (2004)	Virtual Community	The paper explores whether online communities do have an SOVC. The antecedents of SOVC differ from physical SOC. The behavioral processes that contribute to SOVC- exchanging support, creating identities and making identifications, and the production of trust- are similar to those found in offline communities, but they are related to the challenges of electronic communication.
Blanchard (2007)	Virtual Community	This study develops an SOVC measure, building on the measure of SOC. Potential antecedents of SOVC, exchanging support, and identification determine that the newer SOVC measure is an improvement over the SCI.
Oh and Jeon (2007)	Virtual Community	This study investigates membership dynamics, patterns of interaction in the virtual community and how different network characteristics (i.e. network size and connectivity) influence the stability of the virtual community, providing insight into dynamic and reciprocal relations among community members.
Porter and Donthu (2008)	Virtual Community	By using membership dimension, this study shows that efforts to provide quality content and foster member embeddedness have positive effects on user attitude about the virtual community sponsor.
Mathwick et al. (2008)	Virtual Community	This study examines and supports the conceptualization of social capital as an index composed of the normative influences of voluntarism, reciprocity, and social trust in a virtual community.

thisrequires further research in different research settings (Fisher et al.2002).

MEMBERSHIP

Membership, defined as the experience of feelings of belonging to a community, includes five attributes: a sense of belonging and identification, emotional safety, boundaries, a common symbol system and personal investment (McMillan & Chavis 1986). It is an important component for a successful virtual community (Oh & Jeon 2007).

The first attribute, having a sense of belonging in a virtual community, is essentially about a member's expectation or faith that he or she will be able to fit into and gain acceptance by other participants of the social network (Chipuer & Pretty 1999) and be identified and recognized by the community (McMillan & Chavis 1986). This identification can be manifested in many ways in an online environment (Koh & Kim 2003), for example, by referring to each other by name in an online community of social networks (Blanchard & Markus 2004). This expression can create intimacy between members and a sense of belonging to the community.

The second attribute, emotional safety, is a feeling of security and willingness to reveal how one really feels in one's community (McMillan & Chavis 1986). Virtual community participants can feel a degree of emotional safety in their community whenever support is available, in terms of simple interaction or giving basic verbal support (Bagozzi and Dholakia 2002). Members herd together because the need for emotional safety reinforces them to do so and such reinforcement binds them into a cohesive virtual network (Oh & Jeon 2007).

The third attribute, boundaries, consists of elements such as language, dress, ritual and logistical time or place settings indicating who belongs or does not belong to the community (McMillan & Chavis 1986). Obst et al. (2002) argue that members are more aware of their membership within a common interest boundary, such as in a virtual community, than in a geographic community of common interest. Boundaries can also be criteria for membership (McMillan 1996). In virtual communities for social networks a list of frequently asked questions provides information about the community's character, core purpose, expectations of members, taboo topics and norms so that members with similar inclinations can identify with the community (Leimeister, Cesareni & Schwartz, 2005). Furthermore, some virtual communities are regulated by moderators and by criteria for membership that must be met prior to participation (McMillan 1996). Rituals such as "waving hello" when entering a particular chat room, or controlling access through an initiation ritual are also part of the boundaries separating members from non-members (see Wenger 1999).

The fourth attribute of membership, a common symbol system consists of elements such as special languages (from simple words to phrases that represent messages known only by the members of the community), or objects that have a special meaning for the members (for example, structures, paintings, sports equipment) (García, Giuliani & Wiesenfeld 1999). Understanding common symbol systems is a prerequisite to understanding the community and its members (McMillan & Chavis 1986). In the context of virtual communities, groups establish linguistic conventions such as signature styles, unique abbreviations, emoticons and specialized vocabularies or spellings which become a common symbol system of the communities that not only reflects their culture but also readily identifies regular participants (Blanchard & Markus 2004). Members sharing a common symbol system will be able to identify themselves with the community and develop a feeling of membership (Blanchard and Markus 2004,Chipuer & Pretty 1999).

The fifth attribute, personal investment, denotes the contribution that members make to the community. Personal investment, "material" or "non-material" (Blanchard 2007, García et al. 1999) can provide the feeling that one has earned a place in the community and its membership, which then becomes more meaningful and valuable (McMillan 1996). For the virtual context, members can show a willingness to invest in the community by offering unsolicited help without an obvious request or immediate benefit to themselves (Chipuer & Pretty 1999, Porter & Donthu 2008).

With regard to membership, McMillan and Chavis (1986) argue that the five attributes of membership: boundaries, emotional safety, a sense of belonging, personal investment and a common symbol system, fit together in a circular, self-reinforcing way (Oh & Jeon 2007). Thus, the greater the feeling of membership experienced by members of the community, the more it is likely to create an SOVC. Further, the greater the feeling of membership, the more likely that membership will be continued over a period of time.

Proposition 1a: *There is a positive relationship between membership and SOVC.*

Proposition 1b: *There is a positive relationship between a sense of membership and sustainability of membership over time.*

INFLUENCE

A bi-directional influence between a community and its members is needed to create an SOC (McMillan & Chavis 1986, Porter & Donthu 2008) and to cultivate trust and harvest value (Porter & Donthu 2008), and to create community cohesiveness (Massey, Montoya-Weiss & Hung, 2003). SOVC is contingent on a social network virtual community influencing its members and likewise a member must have the potential to influence the community. The ability of a virtual community to attract and simultaneously influence its members is crucial to maintaining cohesiveness (Chipuer & Pretty 1999, Massey et al. 2003). The salient element of influence is the development of trust (McMillan 1996). Being conceptualized as a form of belief, intention and behavior, trust refers to confident, positive expectations, the belief and willingness to act based on the community's conduct (Leimeister et al. 2005). Influence also reflects the cognitive aspects of a virtual community (Obst et al. 2002). Influence can be measured by three indicators: expressing a minority opinion, asking for or giving neutral, opposite or popular opinions, and asking for clarification (Ligorio et al. 2008, Massey et al. 2003). The influence expressed either by taking a stand on the divergent opinion or by asking for clarification shows a willingness to be influenced by another member, expressing both interest in another viewpoint and a willingness to expend extra effort to understand it (Massey et al. 2003).

Two elements exist regarding the level of dyadic influence the virtual community has on its members: first, the members' need for consensual validation; and second, the community's need for conformity (Bieber, Engelbart, Furuta, Hiltz, Noll, Preece, Stohr, Turoff, & VandeWalle 2002). One reason for conformity relates to the pressure on the members to validate the virtual community's views or values (Hung & Li 2007, Porter & Donthu 2008). This pressure can shift from the individual member to the community to consensually validate its members for creating common norms (McMillan & Chavis, 1986). Members with a stronger need for consensual validation tend to be more influenced by the virtual community because of the need for reassurances provided by other members who share a similar experience. Likewise, an individual will feel a stronger pressure to validate the community's view when the virtual community has a strong need for conformity (Hung & Li 2007).

Proposition 2: *There is a positive relationship between influence and SOVC.*

INTEGRATION AND FULFILLMENT OF NEEDS

Needs-fulfillment suggests that members of a community believe that the resources available in their community will meet their needs (McMillan & Chavis 1986). Prospective member attraction to a social networking virtual community depends on the perceived satisfaction the member may receive from fulfillment of his/her needs (Massey et al. 2003). For a stronger sense of community, the social networks virtual community can find ways to juxtapose and integrate members' needs and resources (see Oh & Jeon 2007). The extent to which integration and fulfillment of needs is achieved in a virtual community depends on the degree of ease with which an individual member's need fits among the community needs. In this sense, needs-fulfillment is similar to the "perceived usefulness" construct in the Technology Acceptance Model (TAM) (for example, Davis 1989), and "uses" dimensions of Uses and Gratification Theory (U&G) (Katz, Gurevitch & Hass 1973, Sangwan 2005).

The principle of integration and fulfillment of needs includes both the individual member's feeling of being supported by other members in the community while also supporting them (Blanchard & Markus 2002). The main types of satisfaction in being a member of a virtual community are status in the online social network, shared values, and meeting other's needs while having one's own needs fulfilled (Chipuer & Pretty 1999). Virtual social network resources such as content, in archives or other formats, represent aggregate collective expert resources and social capital of knowledge that can meet member needs (Mathwick et al. 2008). Member-generated content that derives from members' competencies and, through active participation, contributes to this social capital of knowledge, increases value for all members (Porter & Donthu 2008; Stohr, Turoff & VandeWalle, 2002).

Members look for support and reinforcement by either expressing a need, or offering to fulfill another member's needs (Ligorio 2008). The fulfillment of one's need helps members develop a sense of community (Bagozzi & Dholakia2002). We utilize the U&G theoretical framework which is grounded in the functionalist and communication research paradigm to extend the antecedent of integration and fulfillment of needs in the SOVC model in the virtual social network environment (Blumler 1979). This needs-gratification is concerned with what members do with the VSN, and suggests that members will be motivated to select a virtual community that best gratifies their needs. U&G theory proposes five categories of use-gratification, namely: cognitive, affective, personal integrative, social integrative and tension release needs (Katz et al.1973). Cognitive needs represent the intrinsic desire for information acquisition for knowledge and understanding in an increasingly information-rich society and in the context of VSN can be interpreted as functional or resource-based needs that are gratified by member-generated content (Stohr et al. 2002). Affective needs are related to emotional experiences and an intrinsic desire for pleasure, entertainment and aesthetics (Katz et al.1973). These emotive needs (Sangwan 2005) are served when a virtual community or VSN evolves beyond its functional or resource-based needs-fulfillment orientation. It then serves these emotive needs through their expression and exchange of social-emotional support (Ligorio 2008) or offers to help. These aspects also indicate that the members asking or offering emotional support believe in the mutual success of their VSN (see Blanchard and Markus 2004). Personal integrative needs are contextual needs (Sangwan 2005) and derive from an individual's desire to appear credible, be perceived as confident, and to have high self-esteem in a specific context. These needs are closely related to an individual's value system (Katz et al.1973). Social integrative needs are affiliation needs where members want to be part of a community and want to be recognized as part of it and develop a sense of belonging. These can be served in many ways; for instance, in the process of supporting other members' resource-based needs, one can also fulfill one's own need for recognition (Forster 2004). Tension-release needs relate to the need for escape and diversion from problems and routines (Blumler 1979, Ligorio 2008).

Prior research shows needs-gratification as one of the principal motivators for virtual community usage (Sangwan 2005, Stafford, Stafford & Schkade, 2004). We propose that functional, emotive and contextual needs-fulfillment affects the user's feeling of needs-fulfillment in a virtual social network.

Proposition 3: *There is a positive relationship between integration of needs and SOVC.*

Proposition 4a: *There is a positive relationship between cognitive needs-gratification and SOVC.*

Proposition 4b: *There is a positive relationship between affective needs-gratification and SOVC.*

Proposition 43c: *There is a positive relationship between personal integrative needs-gratification and SOVC.*

Proposition 4d: *There is a positive relationship between social integrative needs-gratification and SOVC.*

Proposition 4e: *There is a positive relationship between tension release needs gratification and SOVC*

SHARED EMOTIONAL CONNECTIONS

Shared emotional connections (SEC) is a commitment and belief that members have shared and will share history, common places and time together, and similar experiences in their community (McMillan & Chavis, 1986). SEC consists of the following mechanisms: frequency and quality of the interaction, a shared history, and the investment that people make in their community (Chipuer & Pretty 1999).

The frequency and quality of the interaction (for example, sending and reading messages) are important in creating positive experiences and bonds in virtual environments (Bieber et al. 2002). The frequency of reading messages has a greater influence than that of sending messages in forming close relationships amongst members (Hung & Li 2007). The quality of SEC is influenced by mechanisms such as common experiences of risk and values and traditions (McMillan 1996). In a virtual community or VSN, shared experience of crisis and threats from an external source can serve to increase connections through triggering of intense discussions and generating trust (Porter and Donthu 2008).

Shared history is another aspect that makes members more similar to each other, facilitating the feeling of belonging together (McMillan 1996). The longer members stay in a community, the more knowledge representing the community's values and traditions they will gather. In this sense, a common history creates a sense of continuity and stability (McMillan & Chavis, 1986). Participants who have a shared history or have a background in common, are more likely that a sense of community may develop and be shared *in* these interactive VCs than those sharing haphazard geographical communities with nothing in common (Hemetsberger 2002). Similarly, investment, such as contributing time and effort to organizing community-related activities, influences SEC by determining the importance of the community's success and status to individuals (Hemetsberger 2002).

Proposition 5: *There is a positive relationship between shared emotional connection and SOVC.*

STRUCTURE OF VIRTUAL SOCIAL NETWORKS

Virtual Social Networks or virtual communities exist for common use for social interaction, for sharing common places or space, and common bonds (Burroughs & Eby, 1998). These networks have varying levels of ties or bonds that form strong to weak interactions (Constant et al. 1996). Smaller, closed and tighter networks have stronger bonds. Nevertheless, these may provide a less positive experience for their members than open networks with lots of loose connections and weak ties (Constant et al. 1996). More open communication networks are more likely to introduce a wider range of innovative ideas and excitement to their members than closed networks (Friedkin 1982). In closed networks, only an exchange of information and feelings with each other exists while in open networks members can exercise an influence outside as well as within their subnetworks (Friedkin 1982). In larger groups it may be easier to take advantage of the benefits of living in a community without contributing to those benefits (Wasserman & Faust 1994). However, loosely-knit, open networks may limit the ability to recognize members or track emotional facts about all members of a group. The structure of a social network, virtual or not, affects the process of interaction between members within it. In this research, we expected the structure of social network would affect the development process of SOVC.

Proposition 6: *Virtual Social Network structures moderate the relationships between (a) membership, (b) feelings of influence, (c) integration, (d) fulfillment of needs, and(e) shared emotional connection and SOVC*

SENSE OF VIRTUAL COMMUNITY (SOVC) AND PARTICIPATION

Participation, treated as a dependent variable, reflects SOVC by implying motivation for member participation or a lack of it that influences sustainability of a virtual social network (Kuk 2006). A member who starts as a "lurker" by reading discussions but rarely actively participating may build up an SOVC by experiencing the specific culture and etiquette of the community gradually. There may always be some users with a lower SOVC, who will continue to habitually lurk on a forum, virtual community or VSN, and rarely contribute (Wenger 1999). But building SOVC can enforce higher participation from members. In this research, we expect SOVC to add to continuance and preference for a virtual social network.

Proposition 7: *There is a positive relationship between SOVC and the level of participation.*

CONCLUSION AND FUTURE RESEARCH

The framework offered in this article is designed to investigate SOVC by revisiting the theory of SOC and extending its antecedents into a virtual context of social networks. The structure of social networks is proposed as a moderator in the process. We demonstrate how SOVC may exert influences on participation in virtual social networks from the members' perspective. Subsequently, a research agenda with propositions for future research work is developed. Our major contribution is to develop a better theoretical understanding of SOVC within the context of virtual social networks and its impact on VSN participation. Our contributions to future research include presenting an integrated and improved research framework from communication theories perspectives and indicating avenues for further research by developing a set of propositions. We provide insights into the interaction between participation and social network structure. From a managerial practice perspective, our study also provides a rationale to explain various needs and levels of participation of members in virtual social networks and virtual communities which may have implications for businesses seeking to establish an online presence and trying to understand user behavior. Understanding virtual social networks is of interest to organizations that want to increase their content and other resources for a successful business model.

We recognize that our research framework suffers from some limitations. We focus on membership and participation in a VSN. However, there may be a difference between a member who logs on anonymously (such as a guest visitor) and a registered member logging on with a recognized name or pseudonym. This makes it difficult to establish the intensity of participation in terms of SOVC development. In addition, prior research finds that remaining anonymous encourages participation in a virtual community by ensuring personal privacy (Andrews 2002). This is an important distinction because of the possible effects of anonymity or identity may have on participation levels and on building SOVC.

Finally, in terms of suggestions for future research, a cross-cultural approach to the study of VSN and SOVC will be valuable. The knowledge of how cultural factors account for variance in members' behavior and participation will intensify the generalizability and validation of such research.

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This work was previously published in International Journal of Virtual Communities and Social Networking, Vol. 1, Issue 1, edited by S. Dasgupta, pp. 1-13, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 8.12
Situated Evaluation of Socio-Technical Systems[1]

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ABSTRACT

This chapter introduces situated evaluation as an approach for evaluating socio-technical innovation and change. Many current evaluations simply identify the impacts of technology and deprecate alternate uses in their analysis. Situated evaluation instead calls for understanding how innovations emerge through use; this entails consideration of diverse uses, the contexts of use, and the reasons for the development of multiple realizations. The chapter presents a comparative study of different classroom uses of electronic Quill in order to demonstrate how this alternative evaluation can be conducted and to address the value of understanding and fostering diverse cultural appropriations of a socio-technical innovation.

What about the lay public as producers of technology and science? From the vernacular engineering of Latino car design to environmental analysis among rural women, groups outside the centers of scientific power persistently defy the notion that they are merely passive recipients of technological products and scientific knowledge. Rather, there are many instances in which they reinvent these products and rethink these knowledge systems, often in ways that embody critique, resistance, or outright revolt.

—Eglash, 2004, p.vii

INTRODUCTION

Implementing an innovation entails making changes to an existing system of social practices. People involved with that system naturally want to know what those changes mean and are, therefore, drawn to calling for some sort of an evaluation. Based on the results of the evaluation, practitioners, policy makers, and administrators make their practical decisions about the fate of the innovation. They often focus on evaluation outcomes alone, but the setting of evaluation questions and methods is as important

DOI: 10.4018/978-1-60566-264-0.ch045

as the outcomes. Evaluation processes embed evaluators' assumptions about the innovation and its relation to the relevant social contexts.

In this chapter, we raise questions about the basic assumptions and limitations that standard approaches to evaluations have, and introduce *situated evaluation* as an alternative approach that aims to uncover, not the way that an innovation interacts with practice, but rather the very emergence of innovations through practice. Through a study of Quill, an electronic composition system that was developed for teaching writing in the early 1980's, we demonstrate how this alternative evaluation can be conducted. We also discuss the values, challenges, and methodological issues related to using situated evaluation in supporting further understanding of socio-technical innovations. As new digital technologies increasingly pervade aspects of our daily lives, the innovations-in-use issues that arose in Quill implementations are even more relevant today.

QUESTIONING THE NATURE OF STANDARD EVALUATION

Standard evaluation practice tends to emphasize either formative or summative approaches. Formative evaluation is typically done during the development or improvement of a program and is conducted iteratively. Results are often informal and lead to recommendations for change. Summative evaluation provides information on the program's efficacy, such as improvement of student learning. In this chapter, we propose an alternative, which questions the basic assumption of "what" it is that is being evaluated.

In evaluating a new technology, researchers typically consider the innovation as a fixed object created by professional developers. They further assume that its benefits are somewhat fixed and known in advance with respect to social practice. For example, a program might be developed to help students learn a concept in science or to help a community engage in community building through better communication. Evaluation then becomes a way to improve that program or to assess its effectiveness. This is a reasonable approach, one that is fully in line with calls for reflective practice. But in its extreme form, the assumption that what the program actually is known prior to its integration into social practice becomes what Papert (1987) defines as *technocentrism*:

Egocentrism for Piaget does not, of course, mean "selfishness"—it means that the child has difficulty understanding anything independently of the self. Technocentrism refers to the tendency to give a similar centrality to a technical object—for example computers or Logo. This tendency shows up in questions like "What is THE effect of THE computer on cognitive development?" or "Does Logo work?" (p. 23)

The problem here is that a technocentric perspective limits the scope of the evaluation, often making it difficult to see unexpected uses of an innovation. But, as any developer knows, technical innovations often result in unplanned uses and diverse readings of the innovation. Often, the variation in use is greater than the variation in programs, so that the claim to be evaluating a particular program becomes convoluted with discussions about faithfulness of implementation or effectiveness of the program per se versus effectiveness of its introduction.

One good example occurs in the discourse on online collaboration and learning systems. The early visions of new communication and information technologies asserted that their fundamental attributes could support innovative learning environments that promoted students' active participation, reflective thinking, attainment of self-discipline, and connections with the real world. However, this visionary perspective of educational computer-mediated communication has altered due to the unexpected effects of diverse teaching and learning practices.

For instance, Burniske (2001) designed and implemented several "telecollaborative" projects using e-mail, but eventually reported on the limitations of telecommunication for learning. Burniske's first project, "Project Utopia," used electronic mailing for having his students discuss utopia and dystopia with another colleague's students in a different location. Burniske judged that this project "had inspired a few constructive discussions, but many of them dissipated as students' imaginations, liberated from real-world concerns, took flight" (p. 36). Then he developed another project, "South African Elections' 94 Internet Project," which allowed e-mail exchanges among 11th and 12th grade students in South Africa and the U.S. However, he realized that students' discussions remained shallow and felt it difficult to improve the quality of the discourse. From these experiences, he started questioning the linear impact of new communication technology integration on student learning. Other scholars from critical perspectives have similarly questioned positivist views of technology's effects on practice (Bryson & De Castell, 1998; Bruce, Peyton, & Batson, 1993). These critical views have argued that new technologies do not generate social change, but are instead mutually constituted with social practice.

Standard (summative and formative) approaches have wide-ranging and important uses for evaluating socio-technical systems. But as they are usually carried out, they also have a crucial limitation related to examining the interaction of the technical innovation with the context in which the innovation is used. This makes it difficult to attend to the process of change, and consequently, to many of the concerns people have about innovations.

R. M. Wolf (1990) describes three key problems with standard evaluation. First, most evaluations do not identify the reasons for the observed phenomena. Thus, they do not say how the innovation can be improved, nor what aspect of it produced the measured effects. Second, not being able to account for why changes occur means that it is questionable to generalize to other settings in which the innovation might be used. Third, the development process often continues after the evaluation, so that most evaluations are effectively of innovations that no longer exist. Again, without knowing more about the situation and process or use, one cannot say whether initial results are still valid for the changed innovation.

Many researchers have proposed ways to attend more to the process of change. Some call for an emphasis on formative evaluation. Others call for broadening the range of measurement tools used for summative evaluation (Miles & Huberman, 1984). In *responsive evaluation*, evaluators become sensitive to the interests and values of the variety of participants involved with the innovation (Stake, 1990). Others call for multiple case studies across different settings to identify the variations and differences (Stenhouse, 1990). Each of these approaches makes a contribution to the study of socio-technical innovation and change. But often these methods fail to answer a basic question for a potential user: How can the innovation be re-created in one's own setting? Rather, they still designate which type of use is "acceptable" and which is "unacceptable." This leads us to raise a fundamental issue about the nature of evaluation: What is the "it" being evaluated?

SITUATED EVALUATION

Situated evaluation is an approach to articulating the emergence of innovations through practice, assuming that innovations are mutually constituted by social practice and some external input. It starts with the common finding that a program operates differently in different settings. But rather than postulating that there is one program used in different ways, it asserts that multiple programs come into being through use. This ontological shift leads to different ways of analyzing, describing, and conceptualizing alternate, or even non-uses. A

Table 1. Questions about innovations and change

Old Questions	New Questions
What can the innovation do?	What do people do as they use the innovation?
To what extent are the innovation's goals achieved?	How do social practices change, in whatever direction?
What constitutes proper, or successful, innovation?	What are the various forms of use of the innovation-in-use?
How should people or the context of use change in order to use the innovation most effectively?	How should the innovation be changed and how can people interact differently with it in order to achieve educational goals?
How does the innovation change the people using it?	How does the community fit the innovation into its ongoing history?

bibliography of situated evaluation studies can be found online at http://illinois.edu/goto/siteval.

A situated evaluation approach conceives technology users as active creators, rather than as "passive recipients of technological products and scientific knowledge" (Eglash, 2004). Users actively rethink the meaning and use of a technology and reinvent its practices by appropriating them within their situated, cultural contexts. Eglash (2004) calls this process *appropriating technologies*. We would go one step further to say *creating technologies*.

In these situations, we need a new type of evaluation that is open to new variables and sensitive to alternate uses and interpretations. This new concept of evaluation needs to focus on the *innovation-in-use*, and its primary purpose is to understand the different ways in which the innovation is realized and thus created. *Situated evaluation* then emphasizes the unique characteristics of each situation in which the innovation is used. With this approach, the object of interest is not the idealized form in the developer's specs, but rather, the realization through use. The "it" being evaluated is no longer the innovation (or even what we call the *idealization*), but the innovation-in-use, a situation-specific set of social practices. Recognizing the richness and the importance of the realization process also leads us to ask new sorts of questions for evaluation (see Table 1):

- What practices emerge as the innovation is incorporated into different settings?
- How well do the different uses of the innovation work?
- How can different realizations be improved?

KEY ELEMENTS OF SITUATED EVALUATION

Situated evaluation is a process of discovering relationships. Although it does not resolve into a simple, linear procedure, there are three major aspects of this process. First, it looks at the idealization of a technical system or program, in order to delineate as fully as possible what was intended by the developers. Second, it examines the settings in which a technology is used. Third, it analyzes the realization processes in different settings and generated hypotheses about how and why these realizations developed as they did.

The Idealization of the Innovation

We define the elements of the innovation as intended by developers as its *idealization.* An analysis of the idealization is part of a situated evaluation because it serves to characterize how participants in the setting of use might have perceived the innovation. It is also an index of the intentions of the developers, people who are often important participants not only in the initial creation of the innovation, but in its re-creation in context.

In contrast to the priorities for summative evaluation, the innovation is not privileged over any of its realizations; similarity to the idealization does not count as more successful, and non-use can be as important to consider as "faithful" use. Moreover, the innovation is not seen as an agent that acts upon the users or the setting, but rather as one more element added to a complex and dynamic system. It would be more correct to say that the users act upon the innovation, shaping it to fit their beliefs, values, goals, and current practices. Of course, in that process, they may themselves change, and their changes as well as those to the innovation need to be understood as part of the system.

The Setting in Which the Innovation Appears

The shift in perspective from the view that realizations are distortions of the ideal to one in which realizations are creations that result from active problem-solving has implications for the sorts of questions researchers need to ask in evaluating innovations. With this perspective, the social context in which the innovation is used becomes central. Questions relating to cultural, institutional, and pedagogical contexts need to be addressed. To answer these questions in full is a formidable task, but focusing on a few specific aspects may go far in providing what is needed for a situated evaluation.

The Realizations of the Innovation

The third aspect of a situated evaluation is to study the realizations of the innovation in different settings. This means, first, to examine the ways the innovation was used and search for the reasons that changes occur. This includes analyzing how the idealization was consonant or dissonant with existing social practices. It also includes studying how the innovation's use led to new social organizations. Second, is to look at the variety of uses across settings, treating each of these as an independent re-creation of the innovation, rather than as a data point for an aggregate statement about the innovation. Third, is to examine changes in the design of the innovation brought about by its use and the ways these changes relate to new practices.

Comparisons of Situated Evaluation with Standard Evaluations

A key difference between situated evaluation and the standard frameworks is that its purpose is to learn first how the innovation is used, not how it ought to be changed or whether it has claimed effects. Because it is concerned with actual use, it does not focus on the innovation or its effects, but rather on the social practices within the settings in which the innovation is re-created. This shift in focus has implications for the audience of the evaluation, the role of setting variability, the tools for evaluation, the time of assessment, and the presentation of results.

Focus

Standard evaluation is concerned either with properties of the innovation alone or with its "effects." In contrast, situated evaluation focuses on the way the innovation becomes social practices.

Audience

Situated evaluation results can be used by both users and developers. Users can make decisions not only about whether to use the innovation, but how to use it in their particular context. Developers can learn how to revise the innovation taking into account the variations in use.

Purpose

For situated evaluation, the audience is broad, as are the actions that follow from the findings. The results could lead to developers changing the innovation, to users changing their practices, to adoption of only parts of the innovation, or to deeper understanding of the process of use.

Variability of Settings

The central concern for situated evaluation is with characterizing the way an innovation comes into being in different contexts. Because the audience for the evaluation wants to know how to improve the use of innovation, it is useful to have a variety of contexts that they can compare to their own setting or to ones they might create. Thus, it is most appropriate when there are a variety of contexts of use, and differences across those settings.

Measurement Tools

With situated evaluation, the emphasis is on differences across contexts. This emphasis implies the use of qualitative tools, including observations and interviews that are structured to elicit information about recurring social practices in the setting and to draw out differences among realizations.

Time of Assessment

Situated evaluation can start once the innovation is developed enough to be placed in a classroom. This is in contrast to formative evaluation, which might start even earlier, in a laboratory setting. Situated evaluation can continue well after the developers have finished. It could be done before summative evaluation as a way to identify sites or issues to study, or afterwards as a way to study the process of change.

Results

Because a situated evaluation seeks to characterize alternate realizations, it requires multiple, detailed descriptions of specific uses. Changes need to be described using appropriate quantitative or qualitative representations, but more importantly, the reasons for changes need to be discussed and linked to characteristics of the settings of use. The process of change, including changes in the innovation, in the users, and in the setting, becomes paramount.

Situated Evaluation and Ethnographic Inquiry

Situated evaluation significantly differs from standard (summative and formative) evaluations that start with the given and ask how to improve it. Hence, evaluators who approach from a situated evaluation perspective would not simply identify the strengths and weaknesses of a technology and generalize the conditions for successful implementations. Situated evaluation also does not pursue wide and decontextualized dissemination of an innovation across different settings. Instead, through contrastive analyses and narrative accounts, evaluators seek to create a shared space for multiple technology users to reflect their values and practices so that they can continue re-creating their technology uses through practice. The audience for the evaluation would also want to compare to their own setting or to ones they might create.

Situated evaluation resembles the “sustained and engaged nature” of ethnography and extensively uses ethnographic methods, “long-term participant observation with in-depth interviewing” (Miller, Hengst, & Wang, 2003). To understand the process of change and to excavate different views or interpretations of socio-technical changes within contexts, situated evaluation demands evaluators’ relatively long-term and ongoing engagement. An’s study (2008) shows how ethnographic inquiry and methods have guided her situated evaluation of an alternative computer training practice implementing community service. According to her study, the methodological emphasis of situated evaluation needs to continuously create a dialectic between the “contextual” and “narrated” worlds in order to generate credible results throughout data collection, analysis and

Table 2. Comparisons among the three types of evaluation

	Formative	Summative	Situated
Focus	Innovation	Effects of the innovation	Social practices
Audience	Developer	User	User (but also developer)
Purpose	Improve the innovation	Decide whether to adopt innovation	Learn how the innovation is used
Variability of Settings	Minimized to high-light technology	Controlled by balanced design or random sampling	Needed for contrastive analysis
Measurement Tools	Observation/Interview/Survey	Experiment	Observation/ Interview
Time of assessment	During development	After initial development	During and after development
Results	List of changes to the technology	Table of measures contrasting groups	Ethnography

reporting. Different natural settings and uses of an innovation cannot be arbitrarily analyzed and compared in parallel. Rather, situated evaluation develops the researcher's continuous and meaningful construction of knowledge through sensitive use of multiple research methods.

Situated evaluation is also based on the idea that the researcher-participant relationship can significantly shape the researcher's understanding of the insiders' perspectives. What enables scientific inquiry is not the elimination of subject errors or biases, but the researcher's on-going, self-reflective learning to understand the multiplicity and complexity of modern social reality by carefully observing practice. Hence, evaluators weave possible interpretations about the phenomena on the basis of what they hear and observe. In this sense, conducting situated evaluation is a constructivist and historical process of learning for evaluators to make meaningful knowledge.

Briefly, situated evaluation requires an evaluator's sustained, extensive, and self-reflexive engagement. That effort is worthwhile if one wants to understand diverse cultural adaptations of technology and the process of technology design and use *in situ*.

A STUDY OF ELECTRONIC QUILL IN USE

Quill (Bruce, Michaels, & Watson-Gegeo, 1985; Bruce & Rubin, 1984; Liebling, 1984; Rubin & Bruce, 1985, 1986) was an approach to the teaching and learning of writing built around a software system that included both tools and environments for writing. From 1983 to 1987, it was used throughout the U.S. and Canada, primarily in upper-elementary and middle-school grades. Quill is no longer commercially available, but the Quill studies show extensive classroom data on its use. The studies examined how Quill was realized in different ways in diverse settings. They also looked at the details of the implementation processes to understand how the realization reflected the unique characteristics of Quill, as well as the particular classrooms in which Quill was used.

One of the Quill studies is described here in order to demonstrate how a situated evaluation can be conducted in a specific case. This study focused on the various ways that Quill's goal of purposeful writing was realized through the use of Mailbag, one component of the Quill software. Mailbag was a version of email used by the Quill students, years before many people became aware of it. The goal of the study was to understand

Table 3. Contrasts between QUILL and traditional classrooms

QUILL Classroom	Traditional Classroom
Prewriting	Sit and write
Topic choice	Designed topic
Multiple genres	Mostly narrative
Multiple real audiences	Teacher as audience
Real purposes	Writing for a grade
Conferencing	Red marks as response
Revision	Editing
Collaboration	Hidden papers
Sharing writing	Isolated writers
Writing across the curriculum	Writing in English class

how realizations of an innovation were created, and to use real classroom examples for insight into the process of integrating new technologies into teaching.

The following presents the findings in two major sections: the idealization of Quill and realizations of Quill. The latter describes alternate implementations of Mailbag and how the integration of students' and teachers' purposes and habits with the innovation produced different realizations. The data gathered include writing by the teachers about their own classrooms, student writing, electronic mail (both from Mailbag and from a network for teachers), and field notes from classroom observations.

The Idealization of Quill

Quill's design was based on research on composition, and encompassed prewriting, composing, revising, and publishing aspects of the writing process (Bruce, Collins, Rubin, & Gentner, 1982; Flower, 1981; Flower & Hayes, 1981; Graves, 1978, 1982; Newkirk & Atwell, 1982). It included a text storage and retrieval program (Library), a note-taking and planning program (Planner), and an electronic mail program (Mailbag), all supported by a text editor (*Writer's Assistant*; Levin, Boruta, & Vasconcellos, 1983).

In its software, accompanying curriculum (Quill *Teacher's Guide*; Bruce, Rubin, & Loucks-Horseley, 1984) and teacher workshops, Quill embodied a philosophy for teaching writing. Quill emphasized the process of writing, including the importance of both planning and revision. The contrast between Quill classrooms and traditional classrooms is highlighted in Table 3. On the left is a gloss of what we call the idealization of Quill, that is, the view of what Quill was supposed to become in classroom use. On the right are parallel descriptions of a more traditional writing class. Many teachers tried to integrate Quill with some of these discrepant practices. Although major changes in the teaching of writing have occurred since then, many classrooms still approach writing in the "traditional" way. Moreover, the issue of how classroom technology adoption is inseparable from pedagogy is still relevant (Mishra & Koehler, 2006)

A central element within the idealization of Quill was an emphasis on real audiences and purposes, which was expressed in the software, teacher's guide, and training. In the software, Mailbag, in particular, reified this emphasis on audience and purpose. Combining features of the post office, the telephone, and a bulletin board, it facilitated direct communication among students, groups of students, and teachers. With activities suggested in the Quill *Teacher's Guide*, it encouraged a variety of purposes for writing that students seldom experienced in school: "chatting," persuading, informing, instructing, and entertaining. It also motivated students to write more by introducing a personal element into the experience.

Many teachers introduced "writing as communication" to their students through Mailbag. Since they had used Mailbag extensively during training, teachers appreciated the differences between sending Mailbag messages and standard classroom writing assignments. They saw Mailbag as a way to help students understand writing as a communicative act through participation in writing activities that demanded a real audience and purpose.

Realizations of Quill

The realization of Quill in any real classroom was a re-creation that drew upon the idealization, but was usually more dependent upon characteristics of the situation of use, institutional forces, the teacher's goals and teaching style, the students, and idiosyncratic technical details, such as the number of computers or room layout. Thus, the many forms of Quill-In-Use differed markedly from the original conception.

Of course, each teacher understood the idealization of purposeful writing in Quill in his or her own way, and the variety of realizations were due in part to different teachers' interpretations of our message. What mattered was not just Quill's conception of purpose, but that of the people who used it: What did teachers and students think writing was useful for? How did they use writing to accomplish personal goals? What did teachers think students should learn about writing in school? What natural goals for writing existed in classrooms or community contexts?

In most classrooms, Mailbag use *did* lead to more purposeful writing. Students saw Mailbag as an unconstrained writing environment and were thus able to use it for their own purposes. But the specifics of this use took many different forms, often surprising both us and the teachers involved. A few teachers regarded the openness of the Mailbag environment as a pedagogical problem, and in these cases, little purposeful writing with Mailbag occurred.

For several teachers, Mailbag and its built-in assumptions were completely consistent with their current classroom practices and their attitudes toward teaching writing. These teachers firmly believed in "student-centered education" and in students' feeling ownership of the process and product of their work in school. They saw Mailbag as a welcome extension of the way they already taught writing. They were comfortable with students' deciding when, where, why, and on what topics to write. For instance, Bonnie's multigrade, village-school classroom reflects this symbiotic use of Mailbag. Students used the program frequently and enthusiastically from the beginning of the year. Bonnie offered the following comments about her class' early use of Mailbag:

Probably the best thing about Mailbag is communicating. The person at the keyboard is in complete control. I never made any Mailbag assignments. Students could use it or not, decide what they would say, to whom, when, how often, and why.

The Mailbag messages written in this class show their oral-language character. Students seemed to regard Mailbag as an environment in which they could carry out the same communicative functions for which they used oral language. Although many messages contained nonstandard grammar or spelling, Bonnie never corrected any student message. She considered Mailbag to be in the students' domain, where spelling and punctuation were secondary to just plain communicating.

In Bonnie's classroom, students expressed their control over Mailbag by deciding both when to use Mailbag and when to stop using it. Several other teachers also found that students' enthusiasm for Mailbag diminished as the year went on, but Bonnie's comment about this shift reflects again how her educational views easily encompassed such as change:

By springtime the Mailbag was hardly used at all. At first I was disappointed, then pleased. The students had learned that there were appropriate forms of communication for specific needs.

Especially in small classes where students knew each other well and saw one another frequently outside of school, the kind of communication Mailbag facilitated was mostly redundant. As Bonnie implies, students had become more sophisticated about audience and purpose and were not satisfied with a communicative situation that did not increase their access to real audiences.

In one class, however, interest in Mailbag remained strong during the entire year. Hans taught high school in Bonnie's village and used Mailbag with his class after learning about it from Bonnie. He designated one disk as the students' private Mailbag disk and promised the class that he would never read it. The students continued to send messages on the disk all year, and Mailbag remained the most popular Quill activity. As the year went on, Hans actually had to ration Mailbag's use because he wanted students to use the computer for other kinds of writing as well. Why did Mailbag remain so popular in this class? Certainly at least one influence was the unique audience Hans defined for Mailbag messages. It appears that the secrecy of the disk made the communication environment unusual enough that students did not consider it redundant with face-to-face communication.

Since many Quill classrooms had only a single computer, using Quill required some teachers to rethink their classroom management practices. How were they to integrate a free-form activity like Mailbag into a more structured day? Wilma, a fifth-grade teacher, invented a procedure to deal with the changes in her classroom structure. Wilma's students' excitement over Mailbag was particularly significant to her, since one of her goals for the year was to help her students learn to enjoy writing. While she was enthusiastic about Mailbag's effect on her students, she was troubled by its classroom management consequences:

When we started using Mailbag, I had a problem with my students wanting to be back at the computer constantly checking to see if they had any mail or not. We decided we needed to devise a system that would solve the problem. We talked about what we could do, and soon came up with a mailbox poster, which worked quite well. We each wrote our computer code name on a Library book card pocket, and glued the pockets to a piece of poster board. The poster board was then hung on the wall behind the computers. Another pocket was added to hold slips of red paper. When a student left a message on Mailbag for White Knight, he or she would put a red slip into White Knight's pocket. After While Knight read his messages, he returned the red slips to the extra pocket.

The classroom management issues were so central to teaching with Quill that Wilma's idea spread around the community via our technical assistance visits and the teachers' electronic mail network. The classroom management problem turned out to be a common one, and many teachers adopted Wilma's solution.

Not all integrations of purposeful writing with Mailbag into the classroom grew out of a symbiosis between Quill and a teacher's purposes. In one case, a teacher completely rejected Mailbag because it conflicted with her views of the appropriate way to teach writing. This teacher started out using Mailbag in the usual way, and students began sending messages according to their own purposes, such as love letters to one another. When the teacher discovered this, she immediately made Mailbag unavailable since she felt that the messages students had been exchanging were not appropriate classroom writing. The gap between her pedagogical assumptions and those underlying Quill was too great.

In a slightly different attempt at integration, a fourth-grade teacher tried to combine a fairly traditional writing assignment with Mailbag. The idea for her assignment came from the Quill *Teacher's Guide*, where we had described a "Classroom Chat" activity, based on a popular newspaper column called "Confidential Chat." In the newspaper prototype, writers send anonymous letters describing their personal problems; they usually adopt a pseudonym that refers to their situation (e.g., Hassled Mom or Concerned Commuter). Quill's variation had students sending anonymous messages to the Mailbag's Bulletin Board in order to discuss personal problems anonymously with others students in the class. Mixing the pseudonymous personal consultation idea of Classroom Chat with a more traditional teacher-directed writing assignment, the teacher sent the following message, complete with pseudonym:

Dear Classy Computer Kids,

There are five members in my family and only one shower. Because I'm the youngest member of our family, I'm the last one in line to take a shower. By then, there's usually no more hot water and not too much time for me to wash behind my ears! It's a horrible way to start a day. What can I do to solve this problem?

Cold, late, and dirty,

I. Needabath

The following tongue-in-cheek student response hovers between reality and fantasy, much as the original letter did:

Dear I. Needabath,

I think you should tell the first person that takes a shower you have to go to the bathroom. Then they should let you go before they take a shower. Quickly lock the door and take your shower. You will have enough of time to wash behind your ears.

Sneaky and Desperate,

Kerry N. and Jenny B.

An interesting problem emerged in this activity because of the conflict between the teacher's goals and the presuppositions of Mailbag. The form of the teacher's message mimicked that of the standard confidential chat letter, but the students in the class all knew who had sent the letter and, even more important, that it posed a fake problem. Thus, their assignment was to pretend they were answering a real letter from a needy person, while knowing it was an imaginary letter from their teacher. While students produced imaginative replies, we observed that students were confused about their audience (their teacher or I. Needabath) and their purpose (real or fantasy) while they were writing. This lack of clarity was most obvious when they were signing their names; many were not sure whether to use their own names or to make up clever pseudonyms. In this situation, the teacher's assignment worked only weakly as an attempt to integrate two inconsistent pedagogical goals.

Teachers were not the only ones for whom Mailbag offered new opportunities for integrating technology with personal goals. In several classrooms, students found in Mailbag, a new and unexpected way to pursue their own purposes in school. Students in Syd's fifth-grade class in Juneau discovered that Mailbag could serve an unexpected purpose in their relationships with others in the classroom. One of Syd's students "saw himself without friends"; Syd worried about both his academic and social development:

He chose late Friday for his time [on the computer] so he could miss it, not realizing that more often than not, late Friday was the easiest time for me to be his partner. The other children, in spite of their ugliness to one another, were able to sense his feelings and began writing [Mailbag] letters telling how much they liked him and that they wanted to be his friends. There is no way to describe the face of this handsome, brown-eyed boy as he read these notes, frequently slipped into his desk anonymously. He sat near me for obvious reasons and I would watch him remove one and literally clutch it to his chest.

Syd's students, having learned the power of writing, chose to use it to be kind to a troubled student with whom face-to-face communication was difficult.

Many students in field-test sites in Alaska used Quill to answer a pressing communicative need; they were unable to be in touch easily with people outside of their own villages and they had no way of meeting new people. Partly in response to their needs, the Quill project in Alaska instituted a long-distance network, implemented through a combination of human travel and U.S. mail (Barnhardt, 1984).

On one of our trips through Alaska to visit classrooms, we carried a disk called "Supermail." This was a very slow, but still effective, way to carry electronic messages from one village to the next, when even dialup connections were rare and unreliable. The Supermail disk facilitated communication for some students in Nikolai, as Don, their teacher, explains:

What made this activity fun for my class was the fact that Chip had just come from Telida and the most recent messages on the disk were from cousins and playmates upriver. This connection made the notion of sending hellos to strangers Outside seem less threatening.

Don reflects his students' view of the world by referring to the rest of the United States outside Alaska as Outside, to them a vast and little-known area. The Supermail disk provided an opportunity for the students to be in touch with the outside world; it made the transition gradual by allowing them to expand their understanding of communication from a familiar audience to a larger and unfamiliar audience Outside.

The crucial point for us here is that Supermail was nowhere envisioned in the original Quill design, or idealization. It didn't exist at all for most Quill classrooms and users. Instead, it emerged from the unique social and geographical situation of Alaskan village schools, and was thus as much a new technology as any other Quill component, although one created through use. For some in Alaska, Supermail became a salient part of the Quill experience. In a standard evaluation approach, we might footnote it as a user adaptation of the pre-existing program; with situated evaluation we describe it as an innovation created through practice.

It may be helpful to refer to Dewey's (1922) critique of the dualism of means and ends. He discusses how "means and ends are two names for the same reality"; that they are convertible, one into the other:

Only as the end is converted into means is it definitely conceived, or intellectually defined, to say nothing of being executable. Just as end, it is vague, cloudy, impressionistic. We do not know what we are really after until a course of action is mentally worked out. (p. 29)

Standard evaluations tend to assume a separation of means and ends: The program is a known, fairly well-defined means and the desired outcome is a known and somewhat fixed end. Situated evaluation, in contrast, assumes that means are created as much through use in a community or classroom as they are through development in the lab. Ends emerge as well, reflecting those new means. Supermail was an innovation created through use, because of ends that were unknown during development, or at best "vague, cloudy, impressionistic." Its creation defined new ends for the participants.

CONCLUSION

In the Quill study, the use of Mailbag for purposeful writing is only one area in which alternate realizations of Quill arose. In every case in which Quill raised significant pedagogical issues, teachers had to confront the relationship of their past practices to those implied by Quill. This resulted in a variety of solutions to the need to integrate Quill with sometimes disparate goals, values, and practices.

Our analysis views these as creative solutions to the complex and ill-defined problems teachers or, for that matter, anyone, must solve when presented with an opportunity to change. As we see through this study of Quill in use, an innovation is not an object that can be packed inside a box, but rather a set of practices that emerges from the social setting of its use. Thus, in a sense, the user does not accept or reject an innovation but instead creates it through action in the world.

The key notion about situated evaluation, as also shown in the Quill study, is that it does not postulate an *a priori* innovation to be used in various settings. Rather than investigating the practices or impact based on such an innovation (as formative or summative evaluation would do), it seeks to discover what innovation comes into being through practice.

Accordingly, situated evaluation highlights the power of the social context to affect the use of a new technology. How the features of the technology interact with human needs, expectations, beliefs, prior practices, and alternative tools far outweighs the properties of the technology itself. This does not mean that we ignore the influences of developers' visions and technical designs. Instead, we seek to develop a holistic understanding of an innovation as a mutual adaptation between technology and its situated social settings. This understanding of the idealization and various realizations of an innovation can help improve further re-creations of a socio-technical system.

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KEY TERMS

Situated Evaluation: An approach to uncovering or articulating the emergence of innovations through practice, assuming that innovations are mutually constituted by social practice and some external input.

The Innovation-in-Use: Different ways in which the innovation is realized and thus created by diverse users. Situated evaluation, which is open to new variables and sensitive to alternate uses and interpretations, focuses on understanding *innovation-in-use*.

Idealization: The elements of the innovation as intended by developers.

Realization: The ways the innovation was used, modified, and re-created by users *in situ*.

Appropriating Technologies: Users actively rethinking the meaning and use of a technology and reinventing its practices within their situated, cultural contexts.

Technocentrism: The tendency to focus on technological artifacts or mechanisms to the exclusion of social, cultural or historical perspectives.

ENDNOTE

1. This chapter adapts portions of *Electronic* Quill*s: A Situated Evaluation of Using Computers for Writing in Classrooms* (1993) by Bertram C. Bruce and Andee Rubin.

This work was previously published in Handbook of Research on Socio-Technical Design and Social Networking Systems, edited by B. Whitworth & A. de Moor, pp. 685-698, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.13
Online Virtual Communities as a New Form of Social Relations:
Elements for the Analysis

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ABSTRACT

The generalization of the new information technologies has favored the transformation of social structures and the way of relating to others. In this changing process, the logic of the social relationships is characterized by the fragility and the temporality of the communicative systems reciprocity which are established "online" in a new cybernetic culture. "Virtual communities" are created in which the interaction systems established by individuals exceed the traditional categories of time and space. In this manner the individuals create online social webs where they connect and disconnect themselves based on their needs or wishes. The new online communication technologies favor the rigid norms of the "solid society" that dilute in flexible referential contexts and reversible in the context of the "global and liquid society" to which the sociologists Bauman or Beck have referred to. Therefore the objective that the authors propose in this chapter is to try new theoretic tools, from the paradigms of the new sociology of technology, which let them analyze the new relational and cultural processes which are being generated in the cultural context of the information global society, as a consequence of the new communication technologies scope. Definitely the authors propose to analyze the meaning of concepts such as "virtual community", "cyber culture", or "contacted individualism", as well as the meaning and extent of some of the new social and individual behaviors which are maintained in the Net society.

DOI: 10.4018/978-1-60566-650-1.ch022

TOWARDS A MEANING OF "VIRTUAL COMMUNITY": A NEW STUDY OBJECT IN THE INFORMATION SOCIETY

The social dimension is one of the natural attributes of the human being, which must be understood as an individual person in interaction with a relational environment. Group, communities and culture are concepts which approach us to the man study in its complex network of social interaction as a social system. In this sense the plural evolution and interaction of the communities and the institutions as well as the forms of social relations and communication have shaped the history of humanity.

The community has been defined as a study object and subject from varied approaches, which comprise from the primitive forms of social association to the complex relationships of the post-industrial society in which the concept "virtual community" has emerged.

From the sociological point of view, community is a concept with a polysemous value, but as a global idea it responds to the anthropologic imperative of the social encounter and the need to create a sense and give shape to the human society. A possession feeling consolidates in it, understood as a psychological community feeling, in which one feels oneself as an active group member, which is decisive for the individuals own identity. Likewise, the feeling of a participation conscience and the link to a common territory are fundamental aspects (Gurrutxaga, 1991) (Pons Díez, J.; Gil Lacruz, M; Grande Gascón, J.M., 1996). The community is a network of social links, that can be based on a territory (a city), on common interests (associations, clubs) on similar characteristics of the individuals (Bar Association) or on an online platform (blogs, etc). Definitely, the community is an analytical category which defines human interaction as a constituent of the social reality, redimensioning the individual as a socialized person in a specific group, with social and symbolic representations and cultural values. Besides a social and anthropological approximation, we can consider the community as a context of action which contributes to the generation of realities based on symbolic truss.

The globalization and informationalization process has generated the transformation of our societies, including the space dimension. In such transformation the new space logic is characterized by the domination of a flow space, structured in electronic circuits that link themselves in the strategic nodes of production and management, which exceeds a space of places locally fragmented and the territorial structure as a way of daily organization. This new dimension takes us towards a Global City, understood as a "net of urban nodes of different levels and different functions, spreading all over the planet and that functions as the nervous center of Informational Economy. It is an interactive system to which companies, citizens and cities have to adapt themselves constantly. "(Castells, 1997: 2).

The Information Technologies are the fundamental instrument that allows the new logic of the social relationships to demonstrate themselves in reality. In them, Internet constitutes one of the most outstanding cases of the growing technological environment whose result has been the step from the Industrial Society to the Information Society (Cornella, 1997).

In the full expansion of Internet, the virtual communities are becoming a new social relationship format where the different communities turn to it to satisfy expectations and needs, to contribute its collaboration and to feel themselves as part of a great community. Unlike the Traditional Community, these impersonal spaces are characterized by the anonymity and the lack of human contact. These new relationship forms are giving way to a media society produced by a change of the social rules, by the capacity of transmitting ideology or by inducing behavior; definitely, by the generalization of a mass culture extensible to all social classes and communities. This turned Internet into a virtual community as means to unify the communications (Sánchez Noriega, 1997).

The first Virtual Communities were based mainly on the simple commerce or the sale of products through the Network, or on a web site where the users could place their personal webs freely. The current Virtual Community was born in this way, whose philosophy is based mainly on the leisure and recreation field, though it houses cultural societies or with certain scientific level: *Geocities*[1]. But the origin of these cyberspace centers is determined by the scientific communities that before the beginning of Internet formed a group and interchanged information (Cantolla, 2000). In 1985, the first Virtual Community of the history arose, *The Well*[2], created by a group of ecologists that "met" to debate about their issues.

Within the Network, new communication forms appear promoted by the use of the electronic mail, but the information exchange among the members was not immediate (deferred communication). Later, with the arrival of the World Wide Web as a hypermedia system that works on Internet, the communication is produced in real time, coming up the interactivity.

This new communication form obliges to distinguish between the Traditional Real Community and the Virtual Community (Iparraguirre, 1998).

Traditional Real Community

- Physical and temporal space for everyone.
- It is developed in the Real Society where the space-time nations and physical encounter determine its behavior and is limited by the territory.
- It is the material support of the Virtual Community.

Online Virtual Community

- The physical and temporal space is not a limitation any more.
- It is developed in the Virtual Society, the cyberspace territory, where there are no frontiers and is planetary.
- It appears when a Real Community uses the telematics to keep and widen the communication.

The breakage of the space-time barriers through the use of the new technologies allowed the development of numerous Virtual Communities. The permanence on the Network depends on basic elements such as the interactivity time and the emotional component among the members that form part of it, what refers us to the traditional sociability forms.

In order to understand the concept of "virtual community" properly one has to get back to the original concept of "community". For the sociologist Tönnies (1986:97-98), the concept of community (Gemeinschaft) (Community) is the stage on which the modern industrial society settles down (Gesellschaft) (Society). The community is characterized by the sort of relationships that prevail in it (based on the family, the homeland and the blood). He defines the community as a sort of social interaction in the emotional identification: he refers to the reciprocity that arises from sharing bonds based on the family, race or blood. The communication will is in the basis of this relationship which gives place to the social action. Therefore, for Tönnies, the community has its original root in the feelings. This definition is useful to refer to the community as a space of feelings and communication. Likewise, the members of a group share specific meanings and a collective vision that come forth from the shared experiences and that generates an own jargon at the end. (Prat, 2006: 29).

The sociological tradition considered the community as a group of persons who, besides exhibiting the social groups characteristics, has a territorial basis or a geographic territory that serves as seat. The first conceptualizations about the communities were carried out on the basis of territorial communities where a person could spend the whole life, as they were relatively self-sufficient. A city, a town, a village, a neighborhood constitute examples regarding this community concept. Under this concept it is present the idea that considers that the community implies more close bonds among the members that the ones existing among the members of a larger society

(Gesellschaft) (Society). A so called "communitarian feeling" exists among the members of a community.

However, nowadays, the use of the community concept is quite different according to the contexts and is used at present in a more varied and wide form. It is even tended to name community to groups that are not but conglomerates or social categories. Due to the urban sprawl, the social groups, the communities among them, went beyond the territorial frontiers. Those who emphasized the non territorial nature of the modern communities were the sociologists specialized in the analysis of the socials networks. (Scott, 1994; Wasserman and Faust, 1995). Besides studying the attributes of the group members, the sociologists of social networks analyze the relationships that are produced among them, their objective, intensity, quality as well as the structure and dynamic that arise from them. Wellman and Gulia, for example, have studied communities whose relations network goes beyond their geographic frontiers. Besides, these relationships tend to specialize being contextualized and not globalized at the same time; i.e. a person is related to other persons not in a total and integral manner but in certain specific contexts and will establish relationships with other persons if the context and objective of said relationship are different. According to Wellman and Gulia, the relationship network in which a person takes part might comprise a group of persons that are very far away in the geographic space and besides show time variations. This tendency is confirmed even more now in the cyberspace, where the sociability capacity of the persons is strengthened and creates the possibility of a new sociability manner among them. Wellman and Gulia have demonstrated that the virtual communities are also communities, although their members might not have physical nearness, similar bonds to the ones of the territorial communities are developed among them (Wellman, 1999). Definitely, the concept of virtual community seems to have its origin in the traditional concept of community and is clearly linked with the concepts of communication and socialization.

In fact, the Web allows now to integrate also communication functions and so the virtual communities arose which have a web site as coordination centre both of information and communication reservoirs. The web site became the "territory" of a virtual community. A non geographic territory as the communities studied by the sociologists during a social development stage, but an electronic territory, distributed in the new space that we call "cyberspace". Likewise, there are computer programs specialized in the construction and management of virtual communities, but, what is really a virtual community?

Howard Rheingold, to whom the term "virtual community" has been attributed, in his book, *The Virtual Community*, which became a classic work of literature about the cyberspace, defines the virtual communities as "… social aggregations that arise from the network when a sufficient quantity of persons enter into public discussions during a long enough period of time, with sufficient human feeling, to form networks of personal relationships in the cyberspace" (Rheingold, 1993: 5). We find three basic elements under this definition: the interactivity, the emotional component and the interactivity time, as conditions for a virtual community to exist and they are related to some of the characteristics of the communities in general.

According to Michael Powers, a virtual community is "an electronic place where a group of persons meet to interchange ideas in a regular manner … It is an extension of our daily life where we meet our friends, work mates and neighbors, at the park, at work or at the communitarian center". A more technical definition would be: "... a group of persons that communicate through a network of distributed computers, … (the group) meets at an electronic locality, usually defined by a server software, while the customer software manages the information interchanges among the group members. All the members know the addresses of said localities and invest sufficient time in them in order to be considered a virtual community" (Powers, 1998: 3). The sociological concept of community as inclusive social group, with a territorial basis, is recreated in the virtual community, but the territory of the later is virtual and not geographic. The community does not occupy a space in the physical world but in cyberspace.

However, the essence of all these communities does not lie in the nature of the CMC (computer-mediated communication) that structures them, but in the fact that they are integrated by real individuals, flesh and blood and who for the sake to be included in the community, adopt a form of "online person"; a virtual identity that represents the self of the individual before the other, the totality of the social environment in which the individual is immersed (Turkle, 1995). Therefore, in order to understand the phenomenon reality it will always be necessary to take into account the dialectic of the self/other (identity/otherness), as the description of the virtual communities will always be connected to the recognition that they only exist when several individuals experience it as such, which refers us to the traditional concept of socialization once more.

Definitely, the social investigation about the virtual communities poses several serious queries on its relationship with the "real life" communities. Among them: what is lacking from the real communities for the human being to satisfy the social needs "virtually" through Internet? Do the virtual communities represent the beginning of the real communities' deterioration? Or simply, do they represent a new way of understanding and living the social relationships?

The theoretical and empirical works performed by the science and technology sociology have not been able so far to give an answer to said queries. During the last years, these studies became an alternative and useful theoretical, conceptual and methodological framework, in order to think about the analysis of the technical innovations and the incidence in the relationships and social behaviors, though the CMC technologies, or Internet itself, have not become yet a widely extended focus of attention among these investigators. In fact, it deals with the everlasting forgotten of the social sciences.

In order to reply to these queries in a general manner, we will adopt the theoretical paradigms of authors like Bauman, Beck or Castells to seize how the human needs of belonging to a community enlarge and adapt themselves in a relational and cultural environment, much more flexible with the advent of the new communication technologies. However, this interactive process that suggests new socialization and endoculturation forms is not exempt of contradictions, as the freedom and autonomy that allow the online communications generate certain frustrations regarding that innate human wish of belonging to an everlasting relational community. This has been named as the ambivalence of the new "connected individualism".

THE NEW SOCIAL/RELATIONAL AND CULTURAL DIMENSION OF THE "VIRTUAL COMMUNITIES"

The itinerary of the new communication technologies is closely entwined with the social and cultural changes as well as with the languages and narrative transformation. New concepts arise in order to seize new relational models as result of the convergence of these changes. One of these concepts that define the "information society", "network society" or the "connected society" is the "cyber-culture".

The investigation about the cyber-cultures started recently due to the accelerated advent process of the technological society. Bauman had already warned in the 90´ that it was necessary to break the individual-technology dichotomy and work on the reality/virtuality ambivalence as human product (Bauman, 1990). Therefore, it is essential to integrate the technology to the social and cultural environment (Feenberg, 1999), with the aim of knowing the dimensions plurality that characterize our existence in the information society.

In fact, the cyber-culture, understood as a set of social-technical-cultural systems that take place at the cyberspace (Lévy, 2007: XV), starts transforming the beliefs and speeches of the cybernauts through constant leaps and interactions between the "interface" and the "real world". The online practices start in this way to overwhelm the virtuality and to burst in the reality of the individuals beyond what has been imagined.

The transformations that we are witnessing in these stages of *attitudinal zapping* between the virtual and the real are configuring new ideas of the "being" and new expressions and representation manners of the individual and the community online.

Internet, more than a communication technology, constitutes itself in a par excellence representation technology of the new century. The initial fictional construction of the self is being replaced there by the reconstruction and recognition of the individual in the virtual practices.

The new forms of symbolical representation that are emerging from the Internet virtual space are giving place to new ways of privacy, personal and collective identity and, in brief, to new social relationships as manifests the use of spaces or virtual communities such as Youtube, Myspace, Hi5 or Facebook. Therefore the virtual and the real should not be understood as two opposed categories as the digital culture is, to a great extent, an extension of the culture concept, where the virtual really suggests "another" experience and another analysis of the real that compels us to a better understanding of the bonds and cores that link the realities and the appearances, the illusions and the symptoms, the images and the models. The virtual does not replace the real but it represents it; it is a laboratory of ontological experimentation that compels us to give up the support of the appearances and turns us hunters of the real in forests of symbols (Quéau, 1995: 79).

Therefore, we consider that it is not possible to separate technology, culture and society as autonomous and independent actors, as this would mean to understand the human independently from the material environment and the signs and images that give sense to life and world. "Therefore, the material world and less its artificial part of the ideas cannot be separated through the ideas with which the technical objects are harbored and used, nor from the human beings that invent them, produce them and use them" (Lévy, 2007: 6). The line that divides the real worlds from the virtual realities tends to blur with the progress of the simulation capacities that offer us the technology and its corresponding appropriation by the individuals, provoking new ideas and offering spaces to new experiences that would not be possible without the technological progress. In this sense to define the so called "cyber-culture" implies to understand how certain practices have been naturalized in the popular culture through the symbolic representation and the new communication forms that the individuals experience through the "virtual communities". Indeed and as Turkle points out, the computers by themselves would not have any value without the cultural representations and relationships which take place with the use the individuals make of them: "The computers would not be turning into powerful cultural objects if the people would not fall in love with his machines and with the ideas that the machines entail" (Turkle, 1997: 63).

One of the features that define the new social and communicative relationships that take place in the cyberspace cyber-culture is the simulation and the anonymity. Not everything in the cyberspace is simulation; however, the interfaces have caused the anonymity adoption from the beginning and the possibilities of constructing fictional personalities. The level of anonymity has a very important influence on our behavior as it leads to the lack of inhibitions or relaxation of the normal limits that the society imposes on us. Likewise, the anonymity becomes vital at the moment of experiencing on Internet with our personality; the falseness sensation gets lost and the adventure and exploration sensation is acquired. Therefore, it is interested to know what one feels while playing with the identity, experience different roles and see how the others react. This process changes the traditional sense of "role", "community" or "group" concepts defined by Durkheim, Weber or Mead in the classical sociology. In fact, the physical distance and the few social presence existing in the "virtual communities" make us feel less inhibited, safe from being discovered and less subdued to the command of our superego and the social structures.

Goffman referred to this process with the denomination "game information". From this definition we could say that the relationships in the network constitute a potentially infinite cycle of occultations, discoveries, false disclosures and rediscoveries through which we devote great efforts to produce and sophisticate the image we want to give to others without them knowing how much effort it requires (Goffman, 1959). On the Internet, the game information is much more flexible due to the opacity of the environment and due to the possibility of changing the interface if the game does not run well. The chats and forums offered the first experimentation windows at the beginning of the Network. Nowadays, with the development of the web 2.0, the new MUD as Second Life became the benchmarks in the role games and, therefore, the anonymity in the cyberspace.

This game information that enables Internet generated a new communitarian social idea through the socialization processes that are produced in the "cyber-culture". In fact, nowadays, the communitarian social idea is placed in the center of the theoretical debate: "The technological determinism is not any more a simple concept of intermittent appearance throughout the political thought of the XX century, to become, in fact, part of the communitarian idea about the technology. And it remains continuously corroborated when, curiously, both from technophobes and technophile positions; it is insisted on the inexorability of the technological development" (Aibar, 2002: 38).

The communitarian social idea of Internet, as a set of meanings and symbols, acts in the practice and in the everyday life contributing sense to the human behavior, to the social relationships and the human relationships with the objects, independently of its existence for the "conscious" of this society. According to Vayreda (2004), the technologies of the Computer-mediated Communication (CMC) are a component of the idea instituted of Internet that acquires sense in the daily practices of the individuals. The idea of the CMC is not a scheme of senses, even, without ruptures and fissures. On the contrary, its strength lies precisely in its capacity to adapt the diversity, and, even, the contradiction of the individual behavior of the persons who interact through these platforms (Vayreda, 2004). This is another example of the contradictions that characterize the liquid, individualized and globalized society referred to by Bauman, Beck and Giddens.

The new communication technologies offer us the possibility of connecting and disconnecting ourselves to the social relationships according to our will in the ontological need that the human being has to find protection in the community, either a real or virtual community. But for the communitarian idea that Internet recreates, new contradictions and relational uncertainties are generated that the citizens are not always able to distinguish. It has to do with the dichotomy between the community and the freedom, two opposed forces and equally powerful, two essential values, apparently incompatible and subject to a strain difficult to be placated, according to Bauman (2003).

The key to solve this contradiction is in what Castells calls "directed interconnection"; i.e., "the capacity of anyone to find the own destiny in the network, and in case of not finding it, create the own information arising the appearance of a new network" (Castells: 2001: 67). The electronic inter-connectivity, feature of the CMC technologies, becomes a customized connectivity, turns to be a self-management promise, of individual freedom. The only condition is not to switch off the computer, not to leave the network. According to Vayreda´s words (2004) the idea is to "change from forum, construct a new one, and invent an issue .... but never to switch off". This process responds to a new form of socialization in which the individual decides freely when to connect himself and how to manage the interaction with another individual, without anything being predetermined and defined beforehand as in the traditional socialization forms.

VIRTUAL COMMUNITY, "LIQUID SOCIETY" AND CONNECTED INDIVIDUALISM

The new context of a global society based on interactive communication favored by the information technologies boom is generating what we could call a "cyber cultural revolution". In the XVIII century series of phenomena converged which came to be called "industrial revolution" which meant a transformation of the social and production relationships with the market boom as a way of global interchange of material and cultural goods. Today we can talk about the "cyber cultural revolution" as a transformation process in which the new information technologies are transforming the social structures, the relational forms as well as the own cultural context in which those new forms which individuals adopt to relate to one another and with the environment acquire sense. It has to do with the new "online" environment in which social relationships are separated from the traditional time and space categories. The question one must pose is in what way are the social structures changing? The contemporary sociology does not have any answers to these new phenomena. The time of solid modernity certainties is giving place to another liquid modernity of uncertainties. Solid becomes liquid and with regard to the enigma of "social reality effect" as the one of "network effect" or the "Crowds" (Negri) and "Smart Mobs" (Rheingold, 2004), we only know that they exist but at the moment there is no paradigm that has the key to seize them in its totality. The only thing we can do so far is to learn to coexist and to know how to be in this new "liquid" context full of uncertainties, until we rebuild the concepts of these two basic categories (time and space) for any type of society.

In this interpretation line, one of the greatest descriptions about this new technologized age is given by the Polish sociologist Zygmunt Bauman, who in Liquid Love (2005) talks about a society that moves at a great speed through "liquid" individuals; in other words, people without lasting bonds who have the need to develop and establish ephemeral contact types based on the Internet connection, from Bauman´s point of view, implies an exercise of continuous connection and disconnection; in a virtual relationships network which have an easy access and output. Any resemblance with cinematographic Matrix is not pure coincidence.

In the passage from the solid world to the liquid phase of modernity captured by Bauman there is a fight between the globalizing power of Internet, based on the connection, and the local problematic of each individual or community. It is obvious that Internet is a global environment, but most of the investigators emphasize that the practices acquire a meaning in the local framework. The sites with most traffic in Europe and the United States are the search engines like Google, Yahoo or Windows Live), which are to access door to the navigation of individual and collective interests, big compartments of multiformat content (Fotolog and YouTube). Those are spaces of local information's (digital newspapers) and spaces to buy and sell products (e-Bay) whose usefulness only acquires meaning in the products and services exchange of local scope. Many talk about the kingdom of the "glob quality" in other words global sites due to its scope but with local focus to capture the attention of a specific audience.

The Internet revolution does not limit itself exclusively to the cyber space. In the "network society" (a definition of the Spanish sociologist Manuel Castells) converge the Web (the great generator of a paradigm change that allows, at least in papers, to overcome the temporal-space barriers of people who live in the planet), the globalization, and the institutions crisis in a new relational context that could be denominated as "connected individualism". In this context of the contemporary society, people live in networks not in groups. The groups assume that all the participants know and trust each other, while the essence of the networks is a set of interactions and exchange of information. Of course, this does not mean that groups do not exist, but rather that the life of an individual cannot be reduced nor to a concrete group, nor a fixed place, many times it is the blending of both interaction ways.

The new possibilities that the online interaction technological systems offer are not the reason of the transformation on the ways we connect ourselves. The technologies mainly are developed as an answer to the needs that we have to interact with others. Therefore, the social organization type and the technology that we use influence each other and start giving form to a social contemporary life.

The relationships which we create do not belong to a specific place but are at the same time local and global, product of the communication technologies development. In general, the traditional communities based on a concrete unit lose importance due to the relationships that we maintain with people who are physically in different places and in that way we participate of multiple social networks. The characteristics of modern life, more and more privatized and customized, are reflected in our ways of generating relationships which are more selective and voluntary than in the past. Although our contacts are global; that is to say, scattered in different areas, we continue connecting ourselves from some place, could be our house or our work, which means that we have globalized our relational network always having as reference a local context. (Ninova, 2008).

The new information technologies are changing the way in which we connect ourselves, as we do not necessarily have to be in a place to communicate with others. In fact the physical context becomes less important. The connections are among individuals and not among places, in that way technology offers a change: connects individuals wherever they are. The people become portable; they can be located for interaction through technology in wherever. In this way, the communication person to person becomes central and it supports the defragmentation of the groups and the communities turning them into "liquids". The individuals can "connect" and "disconnect" them to the social structures which even though they continue defining the social behaviors, they do so with more flexibility and liberty than in the past. They are the new "liquid times" the ones Bauman talks about, where the new technologies allow flexibility and fragmentation of the social relationships. Therefore the transition towards a customized world provides the connected individualism[3] where each person changes fast among bonds and networks. It is the person who defines how to operate to obtain information, support or collaborate in some project. We become more flexible when interacting in different spaces.

CONCLUSION

In this chapter it has been pointed out how the new information technologies are changing the traditional ways of communication and of relating with the immediate social environment. In fact in the "network society" or also called "information society" new concepts arise like the f"virtual community" or "cyber culture" associated with new social behaviors which are generated by the online communication programs. As a consequence of this, the traditional analytical categories used by the sociology to study the new social interaction systems generated in the information society are becoming obsolete. So, in this chapter the concepts used in sociology to explain the meaning and the scope of the new "online" communication cultural devices and its incidence in social relationships, in communication and definitely in the social and symbolic structure of the social groups have been checked and widened

Definitely, the virtual mobility that is being practiced in the last decades and which already forms part of our daily life demands a change in our ideas about the influence which the new technologies have, and at the same time, they make us assume that the online/offline dichotomy is a myth. The communication mediated by the computer offers flexibility and autonomy, and in no case, does it substitute the face to face communication but it supplements it and enlarges it. The online relationships fill in the empty spaces in our lives many times.. The proximity does not matter anymore; the communities and the groups are more disperse in time and space.

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KEY TERMS AND DEFINITIONS

Connected Individualism: It is about a term coined by Wellmann (2002) in which the individual operator of his/her network is important, rather than the household or work unit. It is called network individualism—where technology users are less tied to local groups and are increasingly part of more geographical scattered networks. From the sociology point of view it is an expression about the "new liquid and individualized society" referred to by Bauman and Beck, according to which the individuals are more and more determined for the great social structures and therefore they are more owners of their individual destinies thanks to the communication possibility and customized relationship that facilitates the new information technologies.

Cyber Culture: Is a new culture form (symbolic group of values, beliefs and rules that give sense to the social action) that is emerging, due to the use of the new communication technologies. Therefore, the cyber culture is an extension of the traditional concept of culture that brings together the set of human relationships mediated by the information control mechanisms through the different technological communication systems. This turns the communicative process into more fluid and flexible social relationships and in many cases distant from the traditional space-temporal categories.

Cyber Cultural Revolution: It is the social and cultural transformation process generated by the use of new communication technologies. The multimedia revolution has several ramifications in which Internet has a central place, but where other digital networks coexists. Under sociological terms it is about the coexistence and slow displacement of the Homo sapiens, product of the written culture, to the digital homo, who worships the new communication technologies. Definitely, it is about a transformation process of the social and communicative structures through which the daily consumption habits and the human relationships moved about gradually from the daily spaces of the social interaction to the virtual spaces of social relationships created by the new information technologies.

Smart Mobs: It is a collaborative social dynamics made up of persons able to act jointly in order to achieve common objectives when they even know each other. The persons who perform these strategies called Smart Mobs, collaborate in a new context and under circumstances where the collective action was not possible before, thanks to the use of new communication tools and data development.

Society Network: It is a sort of advanced social organization based on technological communication networks. The networks are made up of nodes and links that use a plurality of paths to distribute the information from one link to another. This society auto regulates itself through even governance hierarchies and power distribution. In this sense, Castells states that "we are passing from the information society to the networks society", where each one of the users is a node of different networks that exchange by means of the use of the information technology.

Online Socialization: It is the process through which the individuals internalize and learn the rules and values of a specific social and cultural context through the virtual relational spaces that are created on the online network. This concept is displacing the former socialization concept, as the new technologies create new virtual socialization spaces beyond the family, the educational system and the labor market. These new online socialization contexts do not refer to a specific space and time but in many cases they are created spontaneously and overlapped on the network arising virtual learning and socialization communities.

Virtual Communities: Virtual community is a community whose bonds, interactions and social relationships are not produced in a physical space but in a virtual one as Internet. Investigators like Rheingold define the virtual communities as social groups that emerge from the Network [Internet] when sufficient people establish social communication and interchange networks characterized by the relative space stay and based in a feeling of belonging to a group, to form links of personal relationships in the cyberspace. Three main elements of the social and communication relationships converge under this definition: the reciprocity, the relational affective component and the interactivity time.

ENDNOTES

1 See: www.geocities.com

2 See: www.well.com. The experience of this Virtual Community is gathered in Rheingold´s book. The author describes in a practical way, how this VC was formed, which was its development, etc., becoming one more member of it. We can point out a fragment in which it is described what the persons can do both on this VC and on others: "people who form part the VCs use the words that appear on the screen to interchange courtesies and to discuss, carry out commercial transactions, interchange information, supply emotional support, plan, have great ideas, fall in love, meet friends, etc.

3 "networked individualism" (Wellman, 2002)

This work was previously published in Handbook of Research on Social Dimensions of Semantic Technologies and Web Services, edited by M. M. Cruz-Cunha; E. F. Oliveira; A. J. Tavares & L. G. Ferreira, pp. 435-447, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.14
Learning for the Future: Emerging Technologies and Social Participation

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ABSTRACT

Over the last five years there has been a large scale shift in popular engagement with new media. Virtual worlds and massive multiplayer online games attract increasing numbers, whilst social networking sites have become commonplace. The changing nature of online engagement privileges interaction over information. Web 2.0 applications promote new kinds of interactivity, giving prominence and prestige to new literacies (Lankshear and Knobel, 2006). To date, discussion of the opportunities, and indeed the risks presented by Web 2.0 has been largely confined to social and recreational worlds. The purpose of this chapter is to open up discussion about the relevance of Web 2.0 to educational practice. A central concern in what follows will be to show how the new ways of communicating and collaborating that constitute digital literacy might combine with new insights into learning in ways that transform how we conceive of education (Gee, 2004).

DOI: 10.4018/978-1-60566-120-9.ch001

INTRODUCTION

The term Web 2.0 was originally coined by O'Reilly (2005) as a way of referring to a significant shift in the ways in which software applications were developing and the ways in which users were adopting and adapting these applications. New applications were tending to become easier for the non-expert to use and more interactive, thus widening the scope for participation in online communities - it was becoming possible for those with relatively unsophisticated technical skills to create and share content over the internet. The popularity of blogs as a medium for individuals and groups to publish and discuss their concerns, news, and interests (whether frivolous or serious) is testimony to the popularity and everyday currency of the Web 2.0 phenomenon (Davies and Merchant, 2007; Carrington, 2008). And so, the increased availability of broadband, together with the development of more responsive and user-friendly software has led to a greater recognition of the internet as a place for social interaction, a place for collaboration, and a place for strengthening and building social networks. Web 2.0 commentators have drawn our attention to the 'social' and 'participatory' nature of contemporary life online (Lessig, 2004) whereas innovators and early-adopters are just beginning to glimpse the educational possibilities of these new development.

Not only do educators need to understand and capitalize on these new ways of being and interacting, they also need to investigate the educational potential of social networking. In order to do this, there is a pressing need to conceptualize the difference between casual and frivolous online interaction and those kinds of communication that have the characteristics of 'learning conversations'. Whilst there has been considerable development in our knowledge about the characteristics of learning conversations in face-to-face interaction in classrooms (Mercer, 2005; Alexander, 2007) there is little equivalent work in the field of online social networking.

Can these new spaces for shared communication provide an arena for the more systematic and structured interactions that are associated with formal education? This chapter addresses this question by both drawing both on the literature and my own research and writing, highlighting how new kinds of software not only involve new literacies but also changing roles for teachers and learners. Most of the material is drawn from classroom studies with children in the 7-11 age range and includes email partnerships, literacy work in virtual worlds, educational blogging and wiki building.

TECHNOLOGY AND LITERACY

Children and young people are growing up in a rapidly changing social world - a social world that is marked by the spread of new digital technologies. The impact of these technologies on the toy and game industry, on mass entertainment and communication, and on the ways in which many of us live and work has been little short of transformative. In schools, despite a substantial investment in computer hardware and software, there is still unevenness of provision and access, and considerable professional uncertainty about how to integrate new technologies into the curriculum and how to develop appropriate pedagogies. Nowhere is this uncertainty more keenly felt than in the area of literacy. Literacy educators, it has been suggested, need to assess the significance of new communication technologies and the ways of producing, distributing and responding to messages that typify them (Lankshear and Knobel, 2003). This involves looking at new genres, emerging conventions of communication and the changes in language associated with them. In doing this, literacy educators will inevitably have to negotiate the tension between notions of correctness and the realities of linguistic change, as well as a whole host of other issues that emerge with the growth of peer-to-peer communication and digitally-mediated social networks. It is against a backdrop of rapid social change and professional uncertainty that the work on digital literacy and new communications technology described in this chapter is placed. The work focuses primarily on digital writing, but partly because of the multimodal nature of this communication, there is an inevitable overlap with the wider area of new media studies.

New trends in digital culture, collectively referred to as Web 2.0 (O'Reilly, 2005), have begun to emerge over the last few years. These have ushered in new kinds of social participation through user-generated content, exchange and playful interaction. Of particular note here are individual and group blogs; sites which are designed for collaborative authorship (such as wikis); sites for generating and exchanging media such as music, still and moving image; and 3D virtual worlds. These networking sites provide a context for affinity, and facilitate the development of ad hoc purpose- or interest-driven groups in which self-directed, informal learning can take place. They not only offer us alternative models for envisioning learning communities but also the opportunity, where appropriate, to modify existing practices to fulfill more explicitly educational goals.

Popular networking sites allow geographically dispersed groups and individuals to communicate, exchange information and develop ideas. They also serve to thicken existing social ties by opening new channels of communication for those who are already known to each other, such as family and friends. Furthermore they are places for rehearsing ideas, making new connections, and new meanings. As such, the practices of tagging and the creation of folksonomies are a powerful iteration of the new literacy practices involved (Marlow et al, 2006). For an increasing number of young people, social networking provides ways of communicating with friends and ways of making new friends. This sort of interaction lies at the very heart of online social-networking. As we know, computer systems can store and retrieve huge amounts of data in different media. Harnessing this capacity to enhance communication and collaboration is the life-blood of online social networking. At the same time it is important to recognize that social networking is almost exclusively mediated through written communication and as such constitutes a prime site for future research into digital literacy.

Similar observations could be made about the communicative spaces provided by virtual world technology. 3-D virtual worlds can provide life-like settings for multiple users to interact in real-time. Users are embodied as human (or non-human) avatars in order to explore a virtual environment and interact with each other. Again interaction and collaboration are normally achieved through digital writing – and this often resembles the synchronous conversations of chatrooms (Merchant, 2001) and instant messaging. The most popular of these virtual worlds, Second Life, is already being used for educational purposes, but more established providers, such as Active Worlds have designed purpose-built educational worlds (see: http//:www.virtually-learning.co.uk) as we see later.

Web 2.0 developments raise new questions about digital literacy. For instance: what should we teach children about kinds of online communication that are helpful to relationships and helpful to learning; how can teachers support and encourage peer-to-peer interaction without stifling it, and above all how can we help pupils to become critical readers and writers in online environments? My own research (Merchant, 2001; 2003; 2008) has begun to explore the characteristics of digital literacy and has helped in making sense of new forms of synchronous and asynchronous communication, the changing nature of literacy, and the skills, understandings and attitudes that we will need to encourage in our schools. I suggest that a clearer sense of what is involved in digital literacy will result in teachers and pupils being better prepared for digital futures (Merchant, 2007).

Gaps between real-world uses of technology and new technology in the classroom continue to be a cause for concern. At the centre of this concern is the sense that a whole range of cultural resources fail to be translated into cultural capital by the school system. What is needed now is innovative work in digital literacy and particularly in educational settings to investigate the implications of new forms of social networking, knowledge sharing and knowledge building. And finally, because of the pervasive nature of digital technology, the commercial interest that is invested in it and the largely unregulated content of internet-based sources we also need to begin to sketch out what a critical digital literacy might look like. There is, in short, plenty to be done if we are to prepare children and young people to play an active and critical part in the digital future.

GETTING STARTED: DIGITAL LITERACY AS CONNECTED LEARNING

Information and Communication Technologies (ICTs) provide new opportunities for children and young people in educational environments, and learners can now be connected with the world outside the classroom in interesting and productive ways. Even everyday applications such as email can be used to enhance learning and interaction, providing a significantly different kind of experience to traditional literacies. Listserv applications, which automatically update multiple email addresses, have proved to be a very successful tool for mobilizing individuals around a shared interest and in developing a sense of community. Although widely used in academic and professional circles and to a lesser extent with college students, they have made little impact on the education of younger learners. My own fieldwork in UK classrooms suggests that introducing even the simplest of email practices into the curriculum raises practical and structural challenges that are not always easy to resolve.

There is a growing body of work in the field of young children's uses of email communication in classroom contexts and this has raised a number of important issues. For example in a recent study, Harris and Kington (2004) report on a project which put ten year-olds in email contact with employees at a mobile phone factory some 30 miles away from the school. Those employees (or 'Epals') learnt about children's interests and in turn offered insights into the world of work. Teachers involved in the project commented on how they found out more about their pupils' lives and interests when reading the messages they exchanged. A more formal evaluation showed gains in pupil motivation and social skills.

McKeon's (1999) study of 23 children's email interactions with pre-service teachers looked at the balance between purely social exchanges and topic-focused exchanges (in this case book-talk). Roughly half of the exchanges of these nine and ten year olds fell into each category, leading McKeon to conclude that:

classroom e-mail partnerships may provide students with a new way to learn about themselves as they select information that defines who they are and send it via e-mail to another. (Mckeon, 1999)

From this it seems that digital literacy can provide useful opportunities for exploring identity and relationships whilst also providing a discursive form which depends on purposeful communication with audiences beyond the confines of the classroom. However, other commentators have expressed concerns about the use of e-communication in educational settings, suggesting that a medium that clearly works well for informal social interaction may not necessarily be an effective tool for learning. For example, (Leu,1996) suggests that digital literacy needs to do more than appeal to youngsters just because it is 'cool'.

In a close analysis of the frequency and content of email exchanges between 301 eleven year olds, van der Meij and Boersma (2002) draw attention to the inherently social nature of this communication. However, their work appears to be predicated on professional concerns that frivolous social interaction could undermine learning exchanges rather than blend with them. Nevertheless, this work emphasizes the importance of using email as a communicative tool rather than as an explicit focus in its own right (as is sometimes the case in skills-based ICT instruction). The researchers draw attention to the need for more work in this area, observing in passing that 'email is not yet the integrated communication tool that it is in business settings' (van der Meij and Boersma, 2002). In short, the ubiquity of interactive written discourse in work and leisure – and even in some educational settings - finds few parallels in most primary classrooms.

There is less work on the processes of digital writing. Matthewman and Trigg's (2003) report on children's use of visual features in onscreen writing. Their study suggests that visual elements (such as font size and colour, layout and use of image) may be significant at all stages of composition. Similar findings are reported by Merchant (2004) whose analysis of children's onscreen work focuses on the production of multimodal texts. This on-going attention to the visual appearance of text at all stages in its production contrasts with traditional models of writing which associate presentational features with the production of a final draft. These studies show some of the characteristics of children's digital writing and their use of e-communication and suggest some important lines of enquiry. A transformative approach would need to be both sensitive to these, as well as the literacy capital of the pupils themselves (Bearne, 2003). Importantly, previous analyses of children's onscreen writing have provided evidence of children's expertise, willingness to learn from each other and to solve problems through creative and playful interaction (Merchant, 2003; Burnett et al, 2004).

My own study of how teachers of 8-10 year olds set out to provide opportunities for pupils to explore digital literacy in ways which were meaningful to them involved setting up email links between children in geographically dispersed schools (Burnett et al, 2006). The project involved pupils from two very different primary schools emailing each other as a preparation for producing a joint PowerPoint presentation on children's views and interests to a group of trainee teachers. Although the focus was on pupils' use of digital literacy, there was a strong feeling from the class teachers involved that the social benefits - in terms of breaking down stereotypes and widening horizons - were positive by-products of the project. In order to facilitate an initial exploration of views and interests, pupils in both classes were provided with a shoebox to collect artifacts that were of significance to them (an idea first developed by Johnson, 2003). These children then used email to get to know their partners, attaching digital photographs of items from their shoebox as a starting point for their interaction. This use of image acted as a prompt for the receiver who responded by asking questions to find out more about the items and their significance.

This project illustrates one way of embedding the use of new communication in the primary classroom. It also suggested that email partnerships can be worthwhile and provide experience of an important medium of asynchronous communication. Furthermore, such partnerships can help to 'dissolve the walls of the classroom', and provide new purposes and audiences for children's writing. School and student partnerships provide opportunities for early exploration of two key characteristic of new media – interactivity, multimodality. But beyond this, the sort of work described here underlines the need to re-interpret the writing process in relation to the production of digital texts – and even more importantly, it suggests ways in which teachers may need to design and choreograph learning experiences that encourage meaningful and educational interaction between peers in different locations.

MOVING ON: WEB 2.0, PARTICIPATION AND LEARNING

As the earlier discussion of email and listserv applications suggested, the use of ICTs to promote learning through participation pre-dates Web 2.0. In fact, a number of commentators have observed that the term Web 2.0 is best seen as a way of describing a gradual change or evolution in online communication (for example: Elgan, 2006) Although not normally described as Web 2.0, listservs and discussion forums do display the characteristic of added value through participation - as user-generated content aggregates information and develops ideas. The development of learning platforms (Virtual Learning Environments and

Course Management Systems) shows how emerging technologies have been assimilated into online and blended learning. So, for example, many learning platforms now allow administrators to embed discussion boards, to create student blogs and wikis and to enable RSS feeds.

Web 2.0 applications allow users to create and share multimedia content over the internet with a relatively light demand on their technical knowledge. From the point of view of the end-user a commonly used phrase 'the read-write web' is useful in capturing the shift that O'Reilly (2005) describes as Web 2.0. The phrase suggests a change of emphasis - one in which web-based activity is no longer simply about storing and accessing information but more about interaction, providing a place in which individuals 'converse', react to each others' ideas and information, and thereby add to the stock of knowledge. User-generated content can vary enormously in topic and can exploit the affordances of different media from written text, to still image, moving image, and sound - and any combination of these. At the same time, user-interaction can be encouraged through applications that allow for such things as profile pages, messaging facilities, group formation, and category tagging. More sophisticated sites also allow you to see which of your friends are online, provide information on the latest changes to your favourite sites (through RSS feeds) and give users the choice of modifying or personalising their home pages, changing their look and the features included.

From this brief overview it should be clear that Web 2.0 pre-supposes a more active user – one who is encouraged to design an online presence (an identity, or a set of identities) and to participate, to a greater or lesser extent, in a community of like-minded users. Whether or not the social networks produced can be described as 'communities of practice' (Wenger,1999) and how we can best describe the informal learning that takes place in Web 2.0 environments is the subject of much current research activity.

The blog format offers a range of interactive and collaborative possibilities for individuals and teams. Some of these possibilities derive from features that are part of the architecture of blogs. During the last five years, a period in which the blogosphere has undergone a rapid expansion, diversification and innovation have been of central importance. So, for example, Lankshear and Knobel (2006) offer a provisional taxonomy of blogs identifying 15 different kinds of blogs, at the same time as recognising that blogs are an unstable form, as they continue to mutate and hybridise. There is clearly no standard way to blog. Arguably, the single defining feature of a blog is that of date-ordering (Walker, 2003). Although periodic updating is also a feature, some established bloggers post daily whilst others are less frequent. The sequential, chronological characteristics of the blog format suggest how it can be useful in capturing such things as the development of a narrative, the design and implementation of a project, the progress of research, emerging processes, the aggregation of links or references, and observations or reflections which develop over time (Davies and Merchant, forthcoming). Blogs, as multimodal texts, also allow us to represent these activities in written, still and moving image or audio format – and of course some of the most interesting blogs are a judicious combination of these modes. Educational blogging can capture learning as it unfolds over time and this has obvious benefits for both learners and teachers. In this most basic sense a blog can provide an analytical record of learning, or an online learning journal (Boud, 2001). Writing in 2003, Efimova and Fielder noted that alongside the 'diary-like format' blogs kept for family and friends there was a:

…growing cluster of weblogs used by professionals as personal knowledge repositories, learning journals or neworking instruments. (Efimova and Fielder, 2004:1)

They go on to suggest that these newer blogs not only serve the needs and interests of those writing them but also display emerging ideas in a public space. This suggests the development of more open learning journals which can be interlinked and commented upon within an emerging community of learners.

As Richardson (2006) points out, blogging can also involve users in an important and distinctive kind of learning; one that he characterises as: read- write- think -and -link. Richardson suggests that a blogger develops a kind of practice that he describes as 'connective writing' in which active reading, and involvement through comments and hyperlinks work alongside regular posting in the co-construction of meaning through social participation. This view accentuates the significance of a community of bloggers, either in the form of a cluster of related blogs or a team blog. From this point of view we can see blogging as a way of supporting a community of practice (Wenger, 1998) or an affinity space (Gee, 2004a). The growing number of educational blogs provide a variety of examples of how the perceived affordances of blogging can be used to support learning. For example, in my own work I describe how a teacher of 10 year olds used team blogs in the context of work on pollution in the environment (Davies and Merchant, forthcoming). The teams' initial posts were used to document their existing opinions on the topic. As the project developed, search results and hyperlinks provided a record of their learning and evaluation of web-based sources. Later, on a field visit, the students took digital photographs of environmental hazards such as fly-tipping, invasive non-native flora, and industrial effluent, and uploaded them to their blogs. Towards the end of the unit of work, students used their blogs to reflect on what they had learnt and share it with the wider school community. Where this project was based on the work of students in one particular school setting, providing a record of their learning over time, other projects have harnessed the potential of Web 2.0 to work collaboratively across settings.

Using wiki software, which allows multiple users to co-create interlinked pages, students in geographically dispersed locations can learn about each other and collaborate on shared interests. An example of such work is the partnership between the Helen Parkhurst School in Almere, in the Netherlands and the Gostivar Secondary School, in Macedonia (the MacNed Project). This project is developing intercultural understanding through the use of ICT as students share and analyse their own production and consumption of media. The MacNed Project illustrates how the new ways of communicating and collaborating that characterize Web 2.0 can be used to develop learning. Whilst it could be argued that the same kinds of understanding could be developed through more traditional approaches, the possibility of co-constructing text in different geographical locations, exchanging and commenting on work in different media creates a heightened sense of interactivity and a more overtly participatory space for learners. The work also begins to point to a changing role for educators who, in this case, needed to co-ordinate the work and provide the context for interaction – in short, to design a new kind of learning experience and to encourage participation and peer-to-peer dialogue.

FROM REAL CLASSROOMS TO VIRTUAL WORLDS

Similar issues of learning design are beginning to emerge from educational work that is based in virtual worlds, and in this section I explore and illustrate some of these issues. Schroeder (2002) describes a 3D virtual world as:

..a computer-generated display that allows or compels the user (or users) to have the feeling of being present in an environment other than one they are actually in… (Schroeder, 2002)

3D virtual worlds could well enhance or transform learning, but although recreational virtual world play continues to attract public attention, empirical research that investigates their learning potential in classrooms is still in its infancy. Although there are a number of claims about the high levels of learner engagement in gameplay (Squire, 2002) and the construction of 'powerful learning environments' in virtual worlds (Dede, Clarke, Ketelhut, Nelson and Bowman, 2006) there is clearly scope for more empirical evidence to back these claims. Despite the fact that some researchers have claimed that immersive environments may lead to a loss of focus and distraction (Lim, Nonis and Hedberg, 2006), there is, as yet, insufficient evidence to reach firm conclusions. Early studies such as those of Ingram, Hathorn and Evans (2000) focused on the complexity of virtual world chat. Fors and Jakobsson (2002) investigated the distinction between 'being' in a virtual world as opposed to 'using' a virtual world, but little rigorous attention has been given to their learning potential. The work of the Vertex Project (Bailey and Moar, 2001), which involved primary school children in the UK, makes some interesting observations on avatar gameplay, but placed its emphasis on the ICT learning involved in building 3D worlds rather than the learning and interaction which might take place within them.

An educational virtual world project, initiated by a UK local authority in Barnsley, aims to raise boys' attainment in literacy by an adventurous and innovative use of new technology that foregrounds digital literacy (Merchant, 2008). In partnership with the company Virtually Learning (http://www.virtuallylearning.com.uk), the project team – a group of education consultants and teachers - designed a literacy-rich 3D virtual world which children explore in avatar-based gameplay (Dovey and Kennedy, 2006). The children, in the 9-11 age range, work collaboratively to construct their own narratives around multiple, ambiguous clues located in the world and, as a result, engage in both on- and off-line literacy activities. The virtual world, called Barnsborough, is a three dimensional server-based environment which is explored from multiple but unique perspectives through local Active Worlds browsers. Navigational and communicational tools are built into the Active Worlds browser, enabling avatars controlled by the pupils to move around in virtual spaces such as streets, buildings and parks, to engage in synchronous written conversations, and in this particular example, to discover clues in order to build their own narratives.

Pupils in 10 different project schools have been using this 3D virtual world, interacting with each other using the Active Worlds' real time chat facility. The world itself consists of a number of interconnected zones which are life-like and familiar - in fact they are often modelled on real world objects. The zones include a town, complete with streets, alleyways, cafes, shops and administrative buildings some of which can be entered. There is also a park with a play area, bandstand, boating lake, mansion, woodland and hidden caves; a residential area with Victorian and contemporary housing, a petrol station and various local amenities and an industrial zone with old factories, canals and so on. In some of the connecting zones pupils may encounter other sites such as a large cemetery, a medieval castle and a stone circle. Rich media, tool-tip clues, hyperlinked and downloadable texts provide clues about the previous inhabitants of Barnsborough, suggesting a number of reasons why they have rather hurriedly abandoned the area. Some possible story lines include a major bio-hazard, alien abduction, a political or big business disaster or suggest something more mysterious. The planning team has seeded these clues throughout the Barnsborough environment, drawing on popular narratives such as Dr Who, Lost, Quatermass, the Third Man and Big Brother.

In this example, a 3D virtual world provides a stimulating environment for online exploration and interaction. Barnsborough is *designed* as a literacy-rich environment. To enter Barnsborough is to become immersed in a textual universe and to participate in what Steinkuehler (2007) has described as a 'constellation of literacy practices'. The following is a list of the main kinds of digital literacy encountered in the virtual world. These are not directly used for literacy instruction, with the exception of the hyperlinked texts, which are quite deliberately tied to national literacy objectives.

Environmental Signs and Notices

This material forms part of the texture of the 3D virtual world and is designed to create a real-world feel to the visual environment and also to provide children with clues. Examples of this include graffiti, logos, signs and notices, posters, and advertisements.

Tool Tips

These give additional explanations or commentaries on in-world artefacts and are revealed when 'moused over' with the cursor. Tool tip messages that draw attention to environmental features ('looks like someone's been here'); hold navigational information ('you'll need a code to get in'); or provide detail ('cake from Trinity's') are shown in text-boxes.

Hyperlinked Texts

Mouse-clicking on active links reveals a more extended text. Examples include an oil-drilling proposal (a Word document); a child's diary (a Flash document); and a web-page on aliens. Some of these links are multimedia (such as phone messages and music clips) whereas others provide examples of different text types, such as text messages and online chats.

Interactive Chat

This is the principle means of avatar interaction and involves synchronous chat between visitors to the world. Comments are displayed in speech bubbles above the avatars heads as well as in scrolling playscript format in the chat window beneath the 3D display.

The Barnsborough virtual world experience foregrounds some important dilemmas relating to engagement with digital literacy in the classroom. The most significant of these dilemmas stem from the fact that it introduces pupils and teachers to new ways of interacting with one another. So, for instance, in-world pupil-pupil interaction is not only conducted in the emerging informal genre of interactive written discourse (chat), but it also disrupts ideas of conventional spelling, turn-taking and on-task collaboration. New relationships between teachers, pupils from different schools and other adults have been significant in this work. Issues about authority and what kinds of behaviour are appropriate in a virtual environment were quick to surface, and this in turn has raised new issues for teachers who are understandably concerned about the safety of their pupils as well as how they might monitor children's online experiences and interactions. Onscreen digital practices can therefore give rise to uncertainty, particularly where these practices do not easily fit into established classroom routines. Squire, in an article on the educational value of video-gaming, suggests that:

…the educational value of the game-playing comes not from the game itself, but from the creative coupling of educational media with effective pedagogy to engage students in meaningful practices. (Squire, 2002)

This observation could apply equally to 3D virtual worlds as well as the other communicative spaces described in this chapter. In and of themselves, these technologies cannot *create* new forms of learning, but as educators become more familiar with their affordances, and the ways in which they are being used in recreational and work contexts, they can begin to experiment with educational uses, to design specific environments, and to envision new pedagogies.

CONCLUSION

In this chapter I have explored the ways in which the digital literacies that are central to new kinds of social practice can be incorporated into classroom settings. I have also shown how literacy continues to play a central role in social participation and knowledge-building – particularly in Web 2.0 environments - and how digital connection allows this to happen in ever more fluid and distributed ways. The question of whether the new communicative spaces described can provide an arena for the more systematic and structured interactions that are associated with formal education is not an easy one to answer. After all, classrooms are quite distinctive social contexts in which patterns of interaction and the availability of communicative tools are often restricted or carefully controlled (Kerawalla and Crook, 2002), and so, adopting and adapting digital literacies easily disrupts traditional classroom practices in ways that are unsettling to teachers. Indeed, as Carrington (2008) suggests alternative learning designs and pedagogies are required, and these may only be achieved through more far-reaching school reform.

There are also some important concerns about pupil safety that need to be addressed. Protecting school students from bullying, verbal abuse and inappropriate online behaviour cannot be passed over lightly. The tensions between adult supervision and surveillance, and trust and pupil autonomy become crucially important. Teachers and researchers involved in such work must ask themselves some key questions:

- How easy is it to leave the comfort zone of conventional, classroom-based pupil-teacher relationships and experiment with new and fluid online interactions? Teachers will have to take risks in using this sort of technology and both teachers and researchers need to document the new ways of working that emerge.
- What are the implications of working in an environment in which some pupils are more experienced or confident than the teacher? As in many other applications of new technology, children tend to be more experienced and more adaptable than their teachers. Although this is not always the case, teachers do need to be prepared to learn from pupils and to value their experimentation.
- How can this sort of work be justified and defended in an educational environment which regularly lurches back to a pre-occupation with 'the basics' and traditional print literacy skills? New and important digital literacies can be introduced through Web 2.0 work. Experience of these is likely to have a positive impact on learning in general, and on literacy in whatever form. Again more evidence is needed to support this case.
- How can the level of immersion and flexible online access required by such work be operationalised within the constraints of current resource and timetable structures? As others have observed (eg Holloway and Valentine, 2002) schools need to re-think the location, access and use of computer hardware. In common with other digital literacy practices, Web 2.0 work invites a more flexible approach to curriculum organisation and online access.
- What additional planning and co-ordination work is necessary to make the most of online work, to facilitate exchange between year groups and interactions between schools? One of the most important features of digital literacy is its potential to connect learners with others outside the immediate school environment. This will involve careful co-ordination and planning

between teachers in different locations.

- What real or perceived risks may be faced by engaging in Web 2.0 practices (eg: child protection; parental censure etc)? New projects need to pay careful attention to issues of online safety. Parents need to be kept informed, and teachers need a carefully rehearsed educational rationale for the work they undertake.

New literacy practices in the classroom contrast starkly with the educational routines of book-based literacy, as well as with the dominant ICT pedagogies. The former privilege print-based routines which, whilst still significant, are insufficient preparation for an increasingly digital future, whereas the latter reify centralised control through teacher-led use of whiteboards, instructional software, and highly structured learning platforms (VLEs and CMSs). Collaborative, peer-to-peer interactions, including communication with those not physically present in the classroom, suggest a very different set of resources and educational concerns. In short, everyday uses of new technology, and particularly recent Web 2.0 developments, raise new questions about digital literacy and its role in education.

Teachers concerns are for a safe and orderly space where controls, both subtle and gross are evoked to maintain a harmonious learning environment. Moreover, the classroom world is a world in which these relationships have traditionally been mediated by a set of schooled print literacy practices and instructional routines, powerfully structured by curriculum discourse. Disturbing this fragile ecology is a risky business – but experience shows that the use of emerging technologies can often destabilize. Consequently, strong support and sensitive professional development are required if we are to move beyond some of the curriculum constructs and pedagogical conventions that narrow our vision of learning through digital literacy. Teachers need not be the docile operatives of an outdated, centralised curriculum – as some of the work described in this chapter suggests - they can also be innovative in responding to the potential of powerful new technologies.

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KEY TERMS AND DEFINITIONS

Digital Literacy: This term has been defined in different ways. I use it to describe written or symbolic representation that is mediated by new technology (Merchant, 2007). Whilst recognizing that many online texts are multimodal, digital literacy places the focus on the semiotic of written communication.

Folksonomy: Related to the term 'taxonomy', this describes the way in which participants in a Web 2.0 space have assigned tags or labels to content. These tags identify the prevalent themes, topics or areas of interest for individuals in that particular environment. Aggregating these tags creates a folksonomy. Visitors to the site can then search 'by tag' and see all the objects labelled by that specific tag.

Interactive written discourse: This is a term used to describe computer-mediated communication (CMC) that is based on two or more people 'taking turns'. These conversational exchanges range from email replies, to forum exchanges and synchronous chat.

Learning platform: A catch-all term for online learning environments designed for the education market. These are usually closed or controlled intranet systems. Alternative designations are Learning Management Systems or Virtual Learning Environments. Some Learning Platforms also include student-tracking and assessment data – sometimes these integrated systems are called Managed Learning Environments.

Multimodality: This term is used to describe the different modes of human communication (visual, verbal, gestural etc). In many web-based texts, meaning is communicated through a subtle interplay between different expressive modes.

This work was previously published in Handbook of Research on New Media Literacy at the K-12 Level: Issues and Challenges, edited by L.T.W. Hin & R. Subramaniam, pp. 1-13, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.15
Metacognition on the Educational Social Software:
New Challenges and Opportunities

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ABSTRACT

In recent years, we have witnessed an information revolution. This revolution has been characterised by widespread access to the Internet and by the emergence of information which has been generated by end-users–the so-called user-generated content. The information thus generated has been supported by Web 2.0 applications or social software. These changes in the information society have had an important impact in education, with more and more adults enrolling on life-long learning programs; moreover, the availability of distance learning courses has grown in line with this increase in demand. In this emergent educational paradigm, the new 2.0 technology context implies new competencies for learners. These competencies include literacy in information and communication technology (ICT), learning autonomy, self-regulation and metacognition, while at the same time expanding the opportunities for metacognitive development. We will consider in this chapter these two perspectives of the 2.0 context; on the one hand, the new requirements provided by the environment and, on the other hand, the new learning opportunities which this environment brings.

DOI: 10.4018/978-1-60566-826-0.ch003

1. INTRODUCTION

The development of information and communications technology (ICT), and the Internet in particular, are producing a paradigm shift for the diffusion of information and the creation of knowledge. This revolution is even more pronounced in the context of the user-generated approach of Web 2.0. It is interesting to note that the "2006 Time Person of the Year" was none other than *You*. The reason for this surprising choice was the growth and influence of user-generated content on the Internet during the early years of the 21st century.

In education, this technological revolution is occurring in a context of globalisation, which challenges higher education organisations to structure and harmonise the length of their programs in order to improve quality standards and facilitate student mobility. In the context of the European Community, these changes are outlined in the Bologna Agenda, which sets targets for convergence within the European Higher Education Area (EHEA). This agenda imposes a greater responsibility on the learner – the learner's autonomy is to be developed by a shift from a system of teacher-driven provisions towards a student-centred approach.

From a teaching and learning perspective, we are experiencing two important changes. Firstly, the focus on knowledge construction by the learner, mostly through collaborative contexts; secondly, the willingness to globalise and standardise the information exchanges, the learning processes and the tools. In this new context, it is essential to become the manager of one's own learning. The challenge for the learner is about learning to learn; about developing individual skills for self-regulated learning and for enhancing metacognitive abilities. For this purpose, it is useful to take advantage of the new opportunities offered by Educational Social Software (ESS).

Metacognition, the knowledge about knowledge and how we learn, can be promoted by the social construction of knowledge and by its diffusion. This social construction and diffusion is facilitated by ESS, which provides new opportunities to develop inter-subjective awareness. However, the new facilities offered by Web 2.0 require learners to develop new competencies (ICT literacy, autonomy, metacognition, ...). At the same time, social software is expanding the opportunities for the development of the competencies of learners in the 21st century. Thus, we will consider in this chapter these two perspectives of the new 2.0 context – on the one hand, the new requirements provided by social software and, on the other hand, the new learning opportunities which this new context brings. Thus, in the first part we explore the changes in both learning and in social software. In the second part, we focus on the implications of Educational Social Software in regard to the needs created by ESS for the new competencies the learner must develop in order to succeed. Lastly, we will focus on the opportunities that ESS provides for the development of metacognitive learners.

2. TOWARDS A NEW LEARNER IDEAL: SELF REGULATION, METACOGNITION AND ENGAGEMENT IN LIFE-LONG LEARNING

The profound changes in the information society have also transformed the learner ideal. In a context of growing obsolescence of knowledge (Brandsma, 1998), subjects and organisations must learn throughout life (life-long learning), developing a willingness to learn continuously, encouraged by educational bodies at the highest national and international level (UNESCO, OECD, European Commission). In this context, autonomous learning is now regarded as a social issue (Moisan and Carré, 2002) fostered by ICT possibilities.

The rapid growth of the Internet in recent decades and the emergence of Web 2.0 have together developed a set of new learning opportunities. This has been achieved through a revolution in the social relations of learning, which can now take place at different times and in different places. These profound changes reshape the competencies of the 21st century learner; these competencies must now include a greater degree of autonomy. Learning skills need to be self-regulated; there is a requirement for a better metacognitive development and an increasing need for those following life-long learning courses to be able to use ICT. The latter implies a certain computer literacy. Learners in the 21st century should develop a complex set of skills before starting to take advantage of the learning potential offered by ICT solutions, and more specifically by social software. Next, we will continue the discussion by analysing four main ESS prerequisites, with special attention to the prerequisite for metacognitive competence.

2.1. Prerequisite I: The Use of ICT

Technology enhanced learning involves the use of technologies to aid learning, and a growing number of courses use Information and Communication Technologies (ICT). In the case of blended learning courses, ICTs are a technological complement to traditional face-to-face learning. With virtual distance courses, ICTs become the main learning environment. However, to take part in distance learning, learners must develop ICT skills in order to navigate through the information, choose the best sources, communicate with peers and professors and contribute to co-creation or information tagging. Computer literacy has become a basic skill for life-long learning and professional integration. In an ICT society, and even more in a 2.0 perspective, ICT skills are a prerequisite.

2.2. Prerequisite II: Learner's Autonomy and Self-regulation

Students engaged in distance learning courses are free to participate at the time and place of their choice. This freedom is both an opportunity and a heavy responsibility in terms of autonomy and self-regulation. Learner autonomy involves the ability to work alone without external regulation (teacher's instructions, timetables, etc.). Being a self-regulated student implies being able to manage one's own learning times and rhythms, planning one's own activities and their execution (revision, work, ...) and even managing emotions and motivations during the learning process.

2.3. Prerequisite III: Learner's Metacognitive Development

In order to manage his learning, the student must be aware of his current knowledge and should know his strong and weak points. This awareness of one's own cognition and the control of the cognitive processes is known as metacognition. For Marzano (1998) "metacognition is the engine of learning". A student with a good metacognitive development will be able to assess his own achievements, self-evaluate what he knows and what he still needs to learn or review, thus allowing him to plan and regulate the process. Having acquired the metacognitive skills to manage his own learning, he becomes manager of the task and gains a strategic approach to knowledge acquisition.

Learners with good metacognitive development will more than likely be "*people who possess self determination or autonomy in learning and problem solving. They will be able to refer to the what, how, when, where and why of learning when carrying out complex cognitive activities*" (Gordon, 1996). Metacognition has been defined as the "*conscious control of learning, planning and selecting strategies, monitoring the progress of learning, correcting errors, analysing the effectiveness of learning strategies, and changing learning behaviours and strategies when necessary*." (Ridley et al, 1992), but also as *"cognitive strategies"*, (Paris and Winograd, 1990), *"monitoring of cognitive processes"* (Flavell, 1976), *"resources and self regulating learning"* (Osman and Hannafin, 1992) and *"evaluating cognitive states such as self appraisal and self management"* (Brown, 1987).

In other words, being a metacognitive student also means becoming a strategic learner who will choose a strategy to plan and regulate his learning. In this way, if I plan to master the English irregular verbs and know that I find it useful to read aloud, I will avoid the library, where silence is required, and find a place without such a restriction.

In a context of autonomous learning, metacognition is an important factor for learning performance (Osborne, 2000; Zimmerman and Martinez-Pons, 1990; Pintrich, 2002). In the context of distance learning, metacognition is also a key factor of success (Houssman, 1991). Learning with social software requires learners' metacognition to deal with the non-linear mass of information without wasting time and losing the learning objectives.

2.4. Prerequisite IV: Learner's Willingness to Engage in Life Long learning

However, there is a risk that the proliferation of learning opportunities will be meaningless unless participants and those offering such programs are willing to develop a new approach to learning. In a knowledge society, learning is an on-going requirement for citizens and businesses – both risk losing their competitiveness if they do not update their knowledge on a regular basis. This involves creating a new approach to learning – one not solely confined to secondary education. ICTs have contributed both to the consolidation of the knowledge society as well as to the development of e-learning and blended learning solutions. More informally, the emergence of social software helped to build learning communities (Lave and Wenger, 1991).

To sum up, a pre-requisite for the emergence of continuous learning and the use of ICT is a set of higher order skills – these skills must be acquired before the new e-learning opportunities can be exploited. Next, this chapter will focus on metacognition as a pre-requisite for effective learning in social software. In addition, Educational Social Software (ESS) will be stressed as a great opportunity to enhance metacognitive development activities.

3. METACOGNITION ON EDUCATIONAL SOCIAL SOFTWARE

3.1. The Emergence of New Learning Theorie Towards the ESS Approach

The 2.0 revolution opens up new educational opportunities based on collaborative learning and collective intelligence co-construction, going further than the mere transmission of information. For some authors, traditional pedagogical models no longer serve to explain learning in the context of social technologies. Instead they propose the introduction of a new learning model – connectionism.

From the earliest days of information technology, computers were considered as potential tools to facilitate learning and thus enhance human capabilities. The first approaches tried to implement the behaviourist approaches, creating DILL (digital and library learning) and practice programs (Bottino, 2004). These were followed in turn by MicroWorlds (Papert, 1980) and some educational interactive tools. With the development of the Internet, professors viewed the possibilities of the global network for publishing their learning resources, even if these resources were mostly designed for a traditional face-to-face use in the classroom, without the reengineering needed to fulfil web-based learning specificities (e.g. file formats and weight, human computer interaction and ergonomic rules, etc.). Broadly speaking, this consisted of PowerPoint presentations exported as pdf, and then uploaded into web sites or specific learning platforms. Fortunately, this approach has been modified and gradually enriched. Educational institutions and professors are beginning to reconsider the model in order to exploit the interactive possibilities of the Internet. The Internet is now seen as a tool for social construction of knowledge recommended by the socio-constructivist approach. Groupware has emerged and a new generation of Learning Management Systems (e.g. Moodle - *Modular Object-Oriented Dynamic Learning Environment*) has started to allow the development of constructivist learning through collaborative activities such as forums, co-constructed glossaries, wikis, or even, WebQuests. This decisive step has brought about the ESS revolution, breaking the learning and learners' atomization which had been imposed by traditional educational software and platform-based approaches. The activities and the learner community have been extended into a wider sphere. The World Wide Web as a global network promotes interaction among users and the collective intelligence generated by large communities of practices and learning. In this context, the emergence of social technologies is a great opportunity to develop the connectionist learning approach.

The connectionism (Siemens, 2004, inspired by Rumelhart and McClelland, 1986) considers learning as the result of connecting different sources of information, adopting a non-linear learning structure. In this approach, learning is a dynamic process – a process that requires our knowledge to be up-dated in order to take into account the evolution of information in the network. Consequently, the *"capacity to know more is more critical than what is currently known"* (Siemens, 2004). That places self-regulation and metacognitive abilities as a key factor for learning performance in a pervasive knowledge network which exhibits information in a continuous state of flux.

3.2. Metacognitive Requirements when Learning with ESS

The pre-requisites for 21st century learners to respond to the new opportunities for learning with ICTs were addressed at the beginning of this chapter, where ICT competence, autonomy and self-regulation and metacognitive development are identified as important. In this section we will explain the metacognitive needs related to ESS specificities: the complexity, the non-linear structure of knowledge and the continually changing network of people involved in the production and development of knowledge.

Metacognition is highly important for learning in complex situations. Students must manage their own learning in a context of continuous change where they need to regulate themselves as learners and take a large number of decisions concerning both their learning objectives and structure (what to learn and in which order) and the learning modalities (individual or collaborative learning, study time and rhythm, etc.). In urgent situations, metacognition could be supported by just-in-time context-aware mobile devices (Romero and Wareham, 2009), allowing flexible learning solutions adapted to the context.

The learning complexity with educational social software is due to the specificities of 2.0: a network-based structure of non-linear information and interactions. Already, in traditional educational software and web 1.0, interaction and information were limited by the software top-down approach of information workflow. In the bottom-up approach of social software, the number of participants and their contributions makes the system very complex.

The traditional web is already a complex metacognitive challenge for students (Veenman, Wilhelm and Beishuizen, 2004) because of the vast amount of information available and all the possible choices. This complexity is even more important in the case of Web 2.0, where we have an almost infinite number of knowledge contributors and their contributions. In this networked architecture, the information is not always displayed by its original author. Thus, we often reach information aggregations displayed in third sites. Websites like NetVibes or Google News can show a personalized information aggregation for each user. It is no longer a direct source of content, but a remix of external information sources. *"The content disappears behind the architecture. Speech is no longer anchored in a device (technology) but the device anchors speech."* (Ertzscheid, 2005). The information architecture as recovered by a search engine (e.g. Google, Kartoo ...) is also an information aggregation. In these levels of information remix, the original author of the content is often lost. In this sense, we can observe that the aggregation structure becomes even more important that the content structure (Saffer, 2005).

It is already difficult for learners to identify the structure of a linear content in an unknown area of knowledge. For this reason, identifying the information structure and the author in non-linear 2.0 aggregates of information presents a major challenge. Learners' metacognitive capabilities are required in social software more than in the traditional learning context, where the progressive linearity of teacher-led contents transmission, require fewer metacognitive capabilities.

Because of its complexity, ESS involves some learning risks that Thalheimer (2008) has summarized as follows:

1. Learners can learn bad information.
2. Learners can spend time learning low-priority information.
3. Learners can learn the right information, but learn it inadequately.
4. Learners can learn the right information, but learn it inefficiently.
5. Learners can learn at the wrong time, hurting their on-the-job performance.
6. Learners can learn good information that interferes with other good information.
7. Learners utilize productive time in learning. Learners can waste time learning.
8. Learners can learn something, but forget it before it is useful.
9. Previous inappropriate learning can harm learners' on-the-job learning.

To avoid these difficulties, learners need to be placed in the role of managers of their own learning. This implies taking into account the learning objectives, choosing what they will learn, then, planning and regulating their learning process. Learners who are not able to work in this level of complexity will have difficulties taking advantage of 2.0 learning opportunities.

Thus far, we have analysed the ESS learning requirements, and more especially, the metacognitive pre-requisite. From this point, we will address ESS proactively, as an opportunity to develop the metacognitive abilities of learners in order to better exploit the learning opportunities of this specialised software.

3.3 Metacognitive Development Opportunities in ESS

As metacognition has been a key issue in successful learning, and autonomous learning contexts in particular, many authors have studied how to develop learners' metacognitive capabilities. The nature of the learning interventions for the development of metacognitive learners is mainly based on the awareness of the learning process during the resolution of a specific task. Awareness implies the learner's ability to be conscious of the learning process. The learner must be conscious of his own knowledge – his metaknowledge (the knowledge about knowledge and the way we learn) – and of his own learning strategies. This awareness can be developed through metacognitive guidance, modelling activities or even collaborative dialogues.

In the field of ICT, the work of Jonassen (1990) introduced computers as cognitive tools and extended research has been done in the field. Recently, Azevedo (2005) introduced the potential of computer environments in the development of metacognitive learners. Until now, consideration of the use of computers for metacognitive development has held computers in a traditional perspective, without exploring the new possibilities of social software. This is probably due to the novelty of the 2.0 approaches.

Next in this chapter we will explore the various possibilities of ESS for metacognitive development. First, ESS could be considered as a metacognitive development opportunity because of its social aspects. Secondly, we will focus on activities that can be designed to develop the metacognitive abilities of the learner.

3.3.1 ESS: Social-Based Opportunities for Metacognitive Development

Collaborative activities play an important role in the development of metacognition. Social interaction is considered a pre-requisite in the learning of metacognition (Von Wright, 1992). According to Marzano (1988) metacognition is, initially, the result of a process of social interaction which, gradually, becomes internalized. According to Marzano, language and social relations play an important role in the interactions which will lead to metacognition. Manion and Alexander (1997) also demonstrated that collaborative work helps the development of metacognitive strategies.

We could consider three main social perspectives of metacognition. The first is the consideration of metacognition as an essential part of collaborative work (Salonen, Vauras, and Efklides, 2005). The second considers metacognition as a social interaction product (Goos et al, 2000). In the third perspective, metacognition is considered as socially distributed (socially shared metacognition) (Iiskala, Vauras and Lehtinen, 2004). The first two approaches are mainly accepted by the scientific community. However, a metacognition approach which is socially distributed faces the same criticism as that faced by distributed cognition; for example, the consideration of an external consciousness. For a large number of authors, cognition and metacognition are individual processes that could occur in a social context, but nevertheless remain individual functions because they are produced in one's brain.

Taking the same approach, Pata (2008) suggests that awareness or inter-subjective consciousness (inter-subjective awareness) could reflect the awareness of the individual cognitive and metacognitive process of others. Ligorio, Pontecorto and Talamo (2005) tried to develop metacognition during a distance learning collaborative activity. In this activity, Greek and Italian students were required to write a fairy tale. According to Ligorio and his colleagues the development of metacognition during this activity helped to foster interdependence among participants during the task.

3.3.2 Metacognitive Development through ESS-Based Learning Activities

The previous sections discussed the potential of ESS in metacognitive development because of its associated social aspect. However, despite the opportunities of their context, learners do not necessarily develop all their potential metacognition naturally (Hofer, Yu and Pintrich, 1998). We will now consider activities that could foment and support metacognition learning through the use of Educational Social Software.

A. Metacognitive Development through Tutored use of ESS: Metacognitive Dialogue and Modelling

During the learning activity, teachers and tutors could go beyond the traditional role of information transmitters and become metacognitive coaches, helping learners to develop their potential through metacognitive dialogue or modelling activities. Metacognitive development through dialogue helps to develop the awareness of learning strategies already used by the learner (Paris and Winograd, 1990).

Metacognitive modelling aims at a gradual internalization of metacognitive strategies through an initial explicit example given by the teacher or tutor. In this way, the teacher could show how to search for and to select information in Wikipedia or other 2.0 websites, making explicit the cognitive strategies he followed during the process of the planning, execution and regulation of this learning task. Thereafter, learners could try to reproduce the same cognitive and metacognitive strategies, describing their strategic behaviour in a written form or expressing it as a thinking aloud process. The explanation allows the teacher to check if the modelling activity served correctly to transfer the cognitive and metacognitive strategies to the learners.

B. Metacognitive Development through the use of ESS during Peer Tutoring Activities

In a certain way, peer tutoring could become a metacognitive development activity, assigning a *"metacognitive tutor"* role to some learners. That could be achieved by putting learners into pairs where one plays the *"metacognitive tutor"* while the other performs the task. This activity could have collaborative variations and be done by groups of learners or by assigning more specific roles (planning tutor, regulation tutor, ...) that could later be reassigned to another group member.

Metacognitive peer tutoring facilitates metacognitive development because of the closest zone of proximal development (ZPD) between peers. This ZPD allows a more effective metacognitive dialogue because of the close language and references employed between students of the same level. In such situations, learners may explain some examples of the ways they could use the social software that they already use (e.g. MySpace, Facebook) for achieving their learning tasks; they could also make explicit their strategic use of ESS solutions (e.g. Slideshare).

C. Metacognition Development through the Multiple and Complexity Perspectives of Social Software

Computers as cognitive tools allow outsourcing and expliciting knowledge in multiple perspectives (e.g. texts, static and interactive graphics, videos,...). For Clements and Nastasi (1999), using a microworld such as LOGO engenders a high-level type of conflict resolution involving coordination of divergent perspectives. In this situation, the teacher can explain the metacognitive experience. On the other hand, Witherspoon, Azevedo and Baker (2007) consider learning as the result of the confrontation of multiple representations, particularly effective in the context of external regulated learning (ERL). In the case of Web 2.0 applications, knowledge develops a myriad of different perspectives during a continuum of information which is continuously evolving. In this continually changing information, knowledge continues to evolve. For example, a definition in Wikipedia may change frequently during a single day. Thus someone who read the article at 9 am will get different information from that obtained by a person who reads it at 5 pm.

To foster learning through these multiple perspectives, and taking into account previous research, we suggest that the use of ESS as a source of multiple representations should be led by the teacher or tutor at primary and high school levels in order to make sure that the activity is correctly modelled. If not, there is a risk that the complexity of representations will render learning through multiple perspectives counter-productive.

D. Development of Metacognition through the Active Contribution to Web 2.0 Content Production

Participation in social software can contribute to the development of metacognition in different manners. The first way we could consider is the learner 2.0 participation that could be oriented to the sharing of metaknowledge about learning strategies of individual learners. During these activities, learners - individuals or teams - may communicate to the community (e.g. class, school, Internet) their learning process as they perform specific tasks. For example, how to find information by asking experts found in social networks. This metaknowledge sharing activity may also be achieved with distant learners. An example of this might be two students learning a foreign language and sharing their *"metacognitive tips"* or strategies for language learning. It may have even greater significance, and a real external impact, if students contribute to a Wikipedia article after previous work done in class or autonomously. In this set of metacognitive activities based on 2.0 participation and contribution, it is essential to ensure the explanation of metacognition strategies and the metaknowledge gained and developed during the activities. This will ensure a correct transfer to other learning situations.

CONCLUSION

The information society and the emergence of new social web approaches has changed our approach to teaching and learning and, more especially, changed the metacognitive strategies and metaknowledge that we engage when using social software for educational purposes. It has now become necessary to engage in a life-long learning approach, both at the individual level and at the organizational level. This implies a new relationship to knowledge – a relationship where we need to move to higher-level, becoming not just learners, but also managers of our own learning. This involves developing metacognitive skills in order to act more strategically when planning and regulating our learning. However, it also implies integrating social software as a potential life-long learning opportunity.

Throughout this chapter we addressed ESS from a metacognition point of view, first, analysing the metacognitive challenges of ESS, and secondly, considering ESS possibilities for learning and metacognition development. In a context where learning is no longer enough and we must learn to learn, the use of social software for educational purposes adds, firstly, new cognitive and metacognitive prerequisites to the learning process. At the same, ESS opens up new opportunities for metacognition development and life long-learning. Henceforth, learning passively will not be enough to maintain our competitiveness as knowledge workers or learners. We will need to develop our metacognition for learning strategically in an inter-connected world – a world where knowledge evolves permanently, but where we have a new universe of learning opportunities through social software.

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This work was previously published in Educational Social Software for Context-Aware Learning: Collaborative Methods and Human Interaction, edited by N. Lambropoulos & M. Romero, pp. 38-48, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 8.16
Digital Energy:
Clustering Micro Grids for Social Networking

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ABSTRACT

Since energy use is a type of consumer behavior reflecting the interests to maximize some objective function, the human being activities seen in energy terms might be used to create the social aggregations or groups. Electric energy generated from ecologic sources brings some unpredictability. Authors model the unpredictability of the distributed generation in order to create a tool for minimization. Authors propose the novel method to build real life smart micro grids in the distributed generation context characterized by zero emissions. The proposed tool becomes an instrument to create the social aggregation of users and negotiate locally the "social" energy in real time, strengthening and mastering a virtual neighborhood of the local community.

INTRODUCTION

Electric energy distribution networks were designed to distribute the centrally produced energy, considering the top-down structures and the Supervisory Control And Data Acquisition (SCADA hereafter) systems to manage them. One possible analogy with the human body gives the blood system, distributing oxygenated flows towards the cells (consumers) starting from the central heart/lung node (producer). The brain like any SCADA ensures the constant blood pressure (load balancing) analyzing the peripheral oxygenation thanks to the nervous lines. The system sends the stimuli to the heart/lung, keeping itself well functioning within certain limits even when infusions/drawings are administered.

The renewable energy, for instance the photovoltaic one, depends on the natural factors, such as clouds, wind, and ephemeredes. The alternative sources of energy introduce some entropy because their contributions have a certain extent of unpredictability. The photovoltaic power is generated during the daytime, and the flow intensity depends on the weather condition, adding some complexity to solve by modeling (Mellit, 2006). The eolic energy production is possible only during the windy condition, which is variable as well. Consequently the released power is uncertain, unpredictable in some extent, and it adds some instability to the power grid, simply because of the physical nature of the underlying phenomena, and might be seen as topic to deal with in load balancing perspective. Due to the higher unpredictability and uncontrollability an imbalance between supply and demand of electricity has to be settled by someone, leading to the extra costs, consequently these factors could finally result in a drawback for the integration of renewable energy sources (Frunt, 2006). The load balancing in the context of an unpredictable energy in power grids is ecologically expensive, because of the compensation coming form the instant, non eco-friendly, generators. The electric energy generated from the distributed renewable energy generators might be instantly consumed locally instead of flooding into the distribution network, eliminating specific controlling interventions. From the free energy market perspective, the best option appears also the immediate consumption of the locally produced energy following the well-known short chain "producer-to-consumer" because of the possible penalties for the Service Level Agreement (SLA hereafter) violations. Even if the ecologic alternative energy production today might be stimulated by incentives, however someone (the transmission system operator or the Society) has to pay for the imbalance induced by the unpredictable energy injection. In the liberalized market context the load balancing might become more expensive than the generated economic value, requiring the solution for the minimization of the impact induced. Moreover it becomes necessary adding the unpredictability/uncertainty indicators instead of characterizing nodes by power thresholds only.

The electric energy distribution network is notably storage free, requiring the adoption of the (a) real time load balancing, which is possible monitoring constantly the digital energy in real time (REMPLI project, 2008), or using the (b) user socialisation toolkit locally in order to establish the "social condominium", or (c) negotiating the energy locally, to avoid the accounting of the transits towards the main distribution backbones. The most interesting option from the social point of view is the creation of the local (virtual or not) community of human being, presenting common social and living patterns, e.g. those contributing to consume locally the renewable energy, consequently decreasing the energy demand.

An electric micro grid (Gellings, 1981) could be defined as a low voltage distribution network with distributed energy sources altogether with storage devices and loads, which could be operated, either interconnected to the main grid or either isolated from it, by means of a local management system with a communication infrastructure allowing control actions to be taken following any given strategy and objective. The social community of human being belonging to the above-mentioned topology might be organized to exploit better the possible synergies and benefits. Consequently we investigate on the possible optimization of the above-mentioned topology trying to minimize the uncertainty by the total local consumption of the produced energy. We create the cohesion between the human actors belonging to the said topology through the new concept of the "social" electric energy. Unlike traditional energy, the social one is locally produced and locally consumed by the micro power grid, thanks to the direct interactions among producers and consumers.

Human being is social by its nature and consumes energy to achieve the goals. The artifacts created by humans, such as houses, offices, electric vehicles, and other representative devices/appliances, might have some social meaning, because explicit the relationship with the community, a certain living standing and a social status. Local energy stakeholders reflect the membership in the modern society. Social group memberships might deliver some benefits also in energy terms, helping to save some energy or resources.

The human behavior is representative of the interests, goals, and the life style. Since energy use is a type of consumer behavior reflecting the interests to maximize some objective function, the human being activities seen in energy terms might be used to create the social aggregations or groups. Humans use the electric energy for heating, cooling, various household uses, devices and electric appliances, transportation, office activities, and industry. Humans influence the energy use indirectly through their purchase decisions, impacting on the amount of energy used to produce and maintain goods and services: let us remember the energy efficient appliances. To understand and manage energy demand one can analyze the energy-using behavior of users: individuals, households and other categories. Our analysis is not relying on a conception of energy as a commodity, but on the producer/consumer behavior. We have assumed that energy users are conscious and act in their own interests to maximize or minimize some objective function. The energy is not free introducing a budget optimization function for the demand side, there is the ecologic motivation to use the renewable energy, and we can envisage an additional function leading to the new aggregation of energy consumers to maximize some social objective function. It appears intuitive that energy users do not always take the actions maximizing the individual or collective benefits due to the incomplete information to guide decisions, or because of the market constraints.

MODELING

Researchers (Chan, Broehl, Gellings, 1981) have produced several load shaping models through the adoption of the econometric, statistical, engineering and combined approaches. Load shaping of the different categories of users, industrial, tertiary, and especially of the residential ones, is a highly complex task (EPRI, 1985), because it is linked to the lifestyle and related psychological factors, not precisely defined and subjective by their nature. It is known also that the definition of the standard behavior of the various types of customers through statistical correlations undertaken by the load management research in the domain of the electric engineering does not solve the problem, failing to consider the variability of the demand, which is the random factor. We start from the assumption that the human being is social by the nature, and all the activities undertaken daily needs some energy, consequently the load profile manifested reflects the lifestyle and the social inhabits appropriately. The manifestation of the common patterns among the portfolio might be used to cluster the social groups using the similarity principles.

The human actor behavior can be described by its **objective function** correlated with the goal's achievements. The set of resources used includes money, energy, vital resources, time, information, and knowledge. The determination to reach the above-mentioned goals becomes the motive and the sense, while the degree of the goal

$$\Theta (t) = \sum_{i=1,m} \gamma_i (t) (Fact_i (t) / Targ_i (t)) / m \rightarrow Max \qquad (1)$$

$$Targ_i (t) = \varphi (t, x_i, y_i, z_i, g_i, \boldsymbol{\Omega}_i) , i \in [1,m] \qquad (2)$$

$$Fact_i (t) = \psi (t, x_i, y_i, z_i, g_i, \boldsymbol{\Omega}_i) , i \in [1,m] \qquad (3)$$

$$\sum_{i=1,m} x_i(t)<x_0 (t), \sum_{i=1,m} y_i(t)<y_0(t), \sum_{i=1,m} z_i(t)<z_0(t), \sum_{i=1,m} g_i(t)<g_0(t) \qquad (4)$$

achievements, reflected by the objective function, determines the personal satisfaction. We denote with i the index of the goal, m - the number of the goals, γ_i - the importance of the goal i, $Targ_i$ – the planned achievement level of the goal i, $Fact_i$ – the real achievement of the goal i, x_i – the amount of material resources (money, food etc.), y_i – the amount of energy, z_i – the amount of time available, g_i – the amount of the information/knowledge available to materialize the goal i, Ω_i - the quality of the institute needed to achieve the goal i, while the φ and ψ represent the functions linking the vital resources with obtained results and describing the product/service. We assume an actor owns initially the asset $\{ x_0, y_0, z_0, g_0 \}$. The statement (1) defines an Objective function, with (2) and (3) representing the functional limitations, and (4) describing the resource limitations. The resources are consumed to achieve the goals, the activities undertaken by human being fit the model, and the resource limitations reflect the consumption dynamics.

Let us define the **Social Condominium** (SC hereafter) as an aggregation of the human actors presenting the common and complementary living patterns, and including the energy producers and consumers, which respective energy profiles – reflecting the living ones - consume totally the local energetic resources. The human actors being aggregated in the social condominium present the similar and complementary living patterns: those having a lunch at home from 1 PM to 2 PM, those looking after the children in the afternoon time, Small Office/Home Office Entrepreneurs (SOHO here after), and other similar cases. An interesting characteristic of the entity is the presence of the direct interactions among members and the explicit semantic descriptions labeling the aggregation, which contribute in the social cohesion. SC - being seen from the social point of view - includes a group of people showing similar patterns in their living activities. Geometrically, SC is a small sub-graph of the electric energy distribution network with qualified nodes embracing a number of energy stakeholders (Producers and Consumers) positioned in a given geographic area. The concept is useful for creating a virtualization of the real individual profiles through a new entity manifesting different load patterns.

The social network concept is well-known and simple: it is a number of individuals, or actors, becoming the nodes of the network because of the various relationships linking them. We use the social network concept to emerge and to show explicitly the existing relationships of the particular "society", the electric energy market, analyzing the patterns and correlations in the digitized electric load streams. The concept of social network was proposed by J. Barnes in 1954, however till now it was never applied to the non-industrial distributed electric energy generation stakeholders.

The interactions among energy market participants in real time are apparently invisible and almost virtual. The Internet with its impersonalized contacts and the Internet of Things technology give a right paradigm to obtain a virtualized social network, and precisely the online one. The inclusion criteria can be elicited from the load data because of the user behavior contained as tacit knowledge, which can be made available by the soft computing methods. The above-defined SC social network is the real world entity of neighbors comprising a renewable energy producer plus some consuming members.

The energy profile is defined by the digital energy measured using digital meters $P(t_i)$, with the digitization which might happen every 1 sec., 1 min, 1 hour and so on: $\{ P(t_0), P(t_1), P(t_2), \ldots, P(t_i), \ldots\}$. In the past the manual energy measurement of the individual consumers was used for billing purposes only. The digital energy technology thanks to the time wrapping properties has enabled new features permitting to reveal the behavioral patterns, not detectable in the past. To understand the potential of the frequent sampling let us compare the traditional 25 frame per second video camera with the high-speed one filming a balloon explosion at 3000 frames per second rate. The first technology cannot detect the event, while the second one shows it. For example the residential meters in Italy produce 96 samples per day sets, being the data generated every 15 min. To simplify the analysis, in this study we consider 24 hourly samples per day reporting the aggregated values, however for the real time operations we suggest the 1 sec. sampling.

Fuzzy Set theory (Zadeh, 1965) permits the gradual assessment of the membership of elements in a set, described with the aid of a membership function valued in the real unit interval [0, 1]. Fuzzy Logic (Baldwin, 1981, Kruse, 1994, and Halpern, 2003) deals with reasoning that is approximate rather than precisely deduced from classical predicate logic, becoming a way of processing data by allowing partial set membership rather than crisp set ones, e.g. a problem-solving control system methodology providing a simple way to arrive at a definite conclusion based upon vague, ambiguous, imprecise, noisy, or missing input information. The model is empirically-based, relying on an operator's experience rather than their technical understanding of the system. For example imprecise terms like "IF (Consumption rises significantly) AND (lunch time) THEN (User has a lunch at home)" are very descriptive and meaningful of what must actually happen. Fuzzy Rules are linguistic IF-THEN constructions that have the general form "IF A THEN B" where A (*premise*) and B (*consequence*) are collections of propositions containing linguistic variables. In effect, the use of linguistic variables and Fuzzy IF-THEN rules exploits the tolerance for imprecision and uncertainty. In this respect, Fuzzy Logic mimics the crucial ability of the human mind to summarize data and focus on decision-relevant information. In a more explicit form, if there are *i* rules each with *k* premises in a system, the i^{th} rule has the following form (5), where $\boldsymbol{a}$ represents the crisp inputs to the rule, and $\boldsymbol{A}$ and $\boldsymbol{B}$ are linguistic variables, while $\boldsymbol{\Theta}$ is a Boolean operator AND, OR/XOR or NOT. Several rules constitute a Fuzzy rule-based system. Uncertainty is a fundamental and unavoidable feature of real life. In order to deal with uncertainty intelligently, we need to be able to represent it and reason about it. Further reading is available in (Halpern, 2003). Many of existing systems need the rules to be formulated by an expert.

$$\textbf{IF}\ (a_1\ \textbf{IS}\ A_{i,1})\ \Theta\ (a_2\ \textbf{IS}\ A_{i,2})\ \Theta \ldots \Theta\ (a_k\ \textbf{IS}\ A_{i,k})\ \textbf{THEN}\ B_i \qquad (5)$$

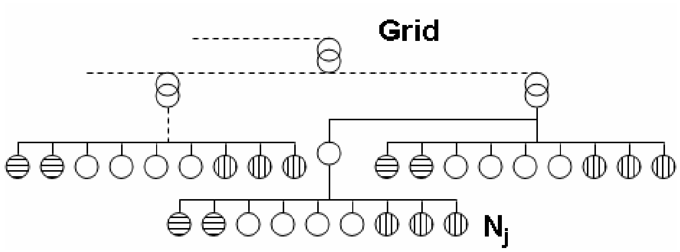
Let us consider a LV/MV/HV segment of a power grid G (Figure 1) composed by nodes denoted as N_j with $\boldsymbol{j} \in [0,m]$, where $\boldsymbol{m}$ is the total number of nodes in the topology.

The grid partitioning is possible combining nodes is many different ways, denoting resulting subsets or sub-topologies as micro grids M_i. Any M_i is the combination of some N_j. The grid G, being the union of N_j, becomes also an union of M_i, or $G = \mathbf{U}\ N_j = \mathbf{U}\ M_i$, where $\boldsymbol{i} \in [0,k]$. Please note there are several possibilities to do it, depending on the practical needs and goals to pursue, consequently the number $\boldsymbol{k}$ is unknown a priori. The adoption of different clustering techniques would lead to the different automated partitioning schemes, demonstrating very different real life performances, especially those in terms of load balancing.

It is common to distinguish between the residential, industrial, tertiary and other types of nodes in electric energy distribution networks. In real life a commonly used approach in grouping is the aggregation of end-users behaving as Condominium - as a single entity – e.g. micro grid. Intuitive form the traditional flow dynamic viewpoint approach is not helpful in the distributed generation era: all customers have a very common energetic profile, excluding a chance to balance automatically the production from a local producer.

To enable a new electricity market segment – a local energy exchange – we need two components: an instrument to account the local exchanges, and

Figure 1. Power grid



the tool to aggregate the local "market". The first instrument is a digital energy; the second one is a method to build the micro grid, while the additional one is the software framework controlling the new entity (like SCADA). After the adoption of the distributed generation, different classes of nodes are available in the power grid: Producers, Consumers and Prosumers - generating, consuming and releasing the exceeding energy into the grid. Traditional techniques for load management, forecasting and control should be complemented by new instruments to deal with such a complex and entropy charged components in order to simplify the grid's behavior and achieve some performance optimization, so authors propose a way to aggregate stakeholders in a way, ensuring the optimal consumption of the local renewable energy resources.

Let us consider a number of stakeholders (A) acting as nodes of a power grid, having the roles of Producer (P), Consumer (C) or pRosumer (R). Consequently $G = \mathbf{U}\, N_p(j_p)\ \mathbf{U}\, N_i(j_i)\ \mathbf{U}\, N_r(j_r)$, having/showing different user profiles. Each M_j represents one class of the topology, populated by actors with roles denoted as P, C and/or R.

Let take $M_j = \{ N_j \}$ a cluster of end user's nodes aggregated together and logically seen as an Unit. The research question we try to answer to is how to aggregate nodes $\mathbf{N_j}$ - in real life populated by physical neighbors - logically optimizing the cluster $\mathbf{M_j}$ in a way to make non positive the outgoing energy flows. Maximizing the local consumption of the energy generated at local nodes, it enables the local energy market and supports respective commercial models.

On each node in the real life topology a digital energy meter is installed, communicating with the utility company, generating "digital energy", e.g. real-time messages exchanged between the energy market actors, comprising producers, consumers, and Prosumers. Each N_j generates a stream of measurements AMR(N_j, t, date), becoming a right tool to undertake the data-warehousing for optimization purposes and/or similarity clustering. Typically there are 96 measurements a day coming every 15 min. To be more precise, we introduce in the model the uncertainty of the power expressed as Fuzzy function: P(t) = { AMR(N_j, t, date), E(t)}, where E(t) is the uncertainty of the load profile for the point t. The AMR stream for M_j will be calculated as the sum of respective values for each N_j.

PROPOSITION

From the energy point of view the proposed approach delivers a new mathematical model describing the electric energy distribution network in terms of the transits through the qualified arches $\mathbf{M_j}$, instead of the nodes $\mathbf{N_j}$, enabling the minimization of the uncertainty because of the local energy consumption. Till now, the traditional models deal with the characterization of the nodes in energy terms referring a specific role: Producer or Consumer. The daily load consumption shape, which becomes an array of finite number of scalars after the digitization, is an attribute of the Prosumer entity. It becomes less important after the process clustering some nodes in one micro grid. The representative – virtual - nodes $\mathbf{N}_{j,1}$, $\mathbf{N}_{j+1,1}$, $\mathbf{N}_{j+2,1}$ shown on Figure 2 exemplify the transits towards the micro grids and automatically hide all the attributes of the nodes. In behavioral terms the new entity manifests the new social identity of the aggregation and the collective behavior in both social and energy terms.

We propose a method adding to the power grid one or more local smart micro grid components to reduce – or eliminate, whenever possible – the uncertainty. It is commonly understood that the aggregation of several nodes in a micro grid is beneficial because leveraging the behavioral phenomena and reducing the intermittent pumping between the micro and macro grids. It is less clear how to build the micro grids in order to achieve the above-mentioned result. The proposed algorithm to build a micro grid embeds local nodes in a way, leading to hide the disturbance effect introduced by alternative sources of energy.

We start from the N(j) populated by actors with roles denoted as P, C and/or R having ***k*** members: $j \in [0,k]$. Each N(j) is a set of ***l*** samples characterizing the energy. Initially we have to profile the users to define the possible similarity clusters. Producers (Figure 3A) add the positive values, while Consumers (Figure 3B, 3C) contribute by negative ones.

Let us undertake the similarity clustering (Figure 4) of each existing LV sub-net portfolio, obtaining the initial partitioning of the grid in "n" clusters by user profile's similarity $\{ M_{j1} \}$. It might be done using evolutionary programming permitting to obtain the semantic characterizations. This partitioning should be done without considering the physical distance between the nodes. The outcome is the number of similarity clusters showing how many different behavioral models we have in the topology.

Second step is the characterization of each entity in terms of Fuzzy rules, understandable by human actor, deriving them from the manifestations of the lifestyle reflected by load patterns. It might be done empirically, on case-by-case basis, or using specific tools like GAMUT (Sammartino, 2000), or using any other technique. The outcome is a set of rule collections, annotating each cluster $[M_{j1}, \{FR_{j1}, FR_{j2}, \ldots, \}]$. Every participant acquires now the role semantically characterized by the respective load profile, which might be done using the descriptive, Fuzzy or crisp, rules. Figure 4 exemplifies four different user models C_1, C_2, C_3 and C_4. The outcome is a set of rule collections, annotating each cluster.

Now we try leveraging among clusters in order to obtain more homogeneous aggregations compensating unbalancing, obtaining the micro

Figure 2. Power grid partitioning

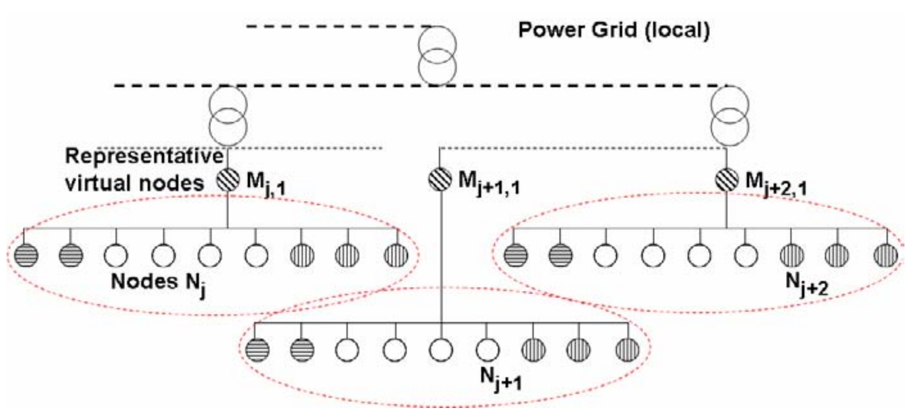
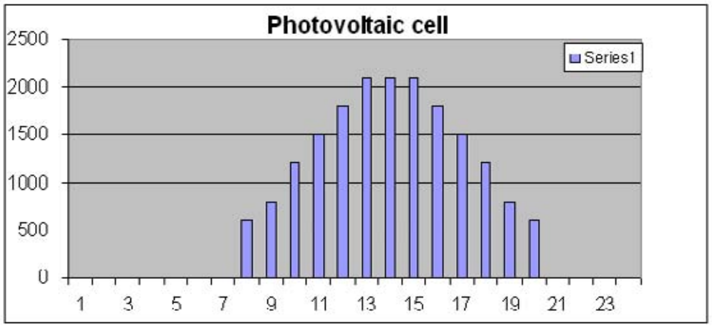
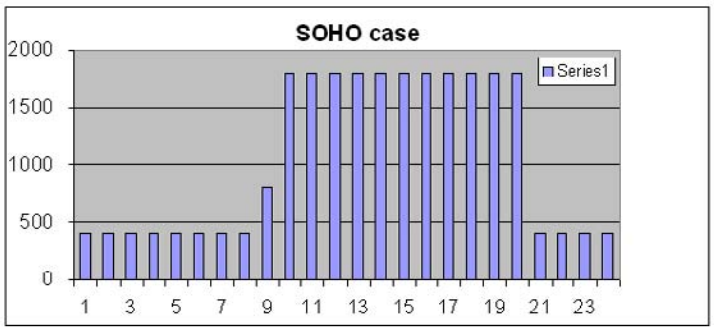


Figure 3. Load profiles



(a)



(b)

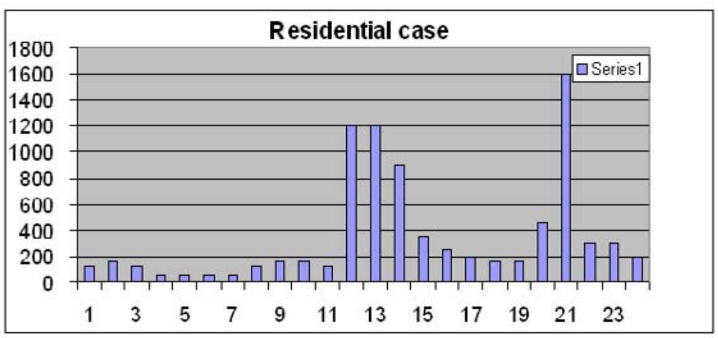
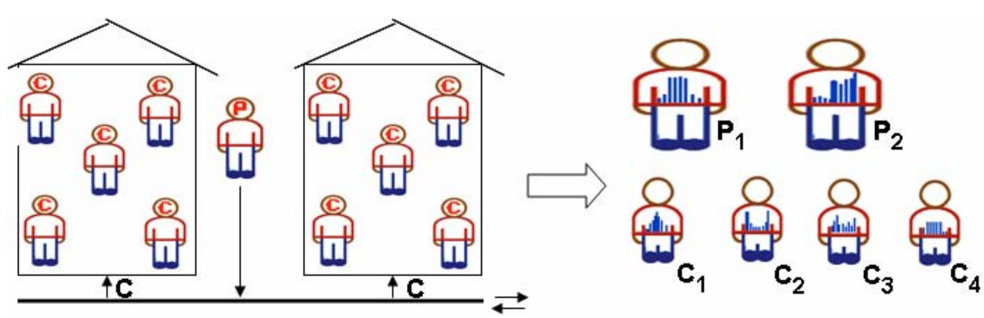


Figure 4. User profiling



grids G_k. The objective now is to make non positive the outgoing flows generated by P_i grouping several C_j. for each G_k.

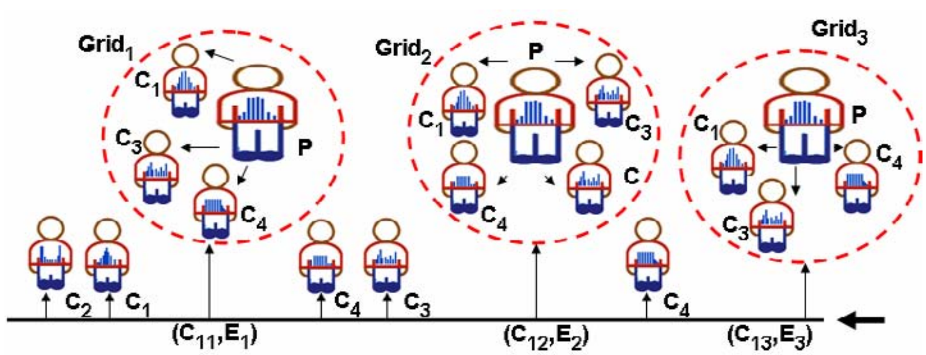
Third step is the characterization – by Fuzzy rules as well - of the Prosumer's nodes belonging to a given sub-net, which becomes the new gravity centers (of new partitioning). [M_{p1}, {FR_{p1}, FR_{p2}, … , }]. The number of Prosumers in the topology is the upper limit of clusters being created by the partitioning. It is possible to include more than one Prosumer in a micro grid being the nodes neighbors in real life. For illustrational purposes only let us build the simplest partitioning considering a micro grid G_l around each Prosumer R_m. To do it, we have to assess the similarity between {FR_{j1}, FR_{j2}, … ,} and {FR_{p1}, FR_{p2}, … ,} varying each index in [0,k], and build sub-groups to "neutralize" rules, e.g trying to minimize the number of resulting FR_j components in the micro grid characterization. We try to do it using advanced datamining techniques, applying the same soft computing tool. Once the optimal combination is found and fixed – by the terminal condition – we have the candidate technique releasing a criterion permitting the optimal composition of the micro grid.

Next step is to add consumers to the micro grid (Figure 5) until the maximum generated power becomes equalized by the sum of the consumptions. This operation considers all the samples of the digital energy (24 samples per day in our case), ensuring no one being positive: $\forall\ P_i < 0.001$. This step is different because now we have to consider the physical distance between the local nodes, in order to create a real life meaningful neighborhood. We have to fix the maximum distance between nodes, or consider simply the belongings to the same LV segment, or set up any other parameter we wish to use for grouping, simply labeling entities by an additional crisp value - becoming a new column in an array of data.

It is important to note that thanks to this procedure, the above-mentioned algorithm generates the micro grid behaving as a normal consumer, eliminating the hybrid role of the Prosumer. However the predictability of the load curve is not guaranteed suggesting to add an additional parameter ***E*** to the digital energy being exchanged – the uncertainty or entropy. From outside the micro grid, the virtual aggregated node will be always characterized by the same representation {AMR(N_j, t, date), E(t)}, as any real physical node, adding the value of the local automated leveraging of both maximum and minimum power.

Even if it is known that for a number of consumers lower than 10 – 20 the load power variations at any given time are significantly high and strongly depending on the number of consumers and the type and lifestyle of the family groups

Figure 5. Aggregation in micro-grid



(Walker, 1985, Capasso, 1994, and Cagni, 2004), the minimization of the variations is not the aim of this study, because our objective function to solve is $P(t) = P_i(t) + C_{i1}(t) + C_{i2}(t) + \ldots <0.001$, e.g. to ensure all the produced energy being consumed locally. The social aggregation created using the above-mentioned algorithms is meaningful because of the social cohesion capable to create the stable aggregation. The minimal micro grid, satisfying the above-mentioned equation might be complemented by the arbitrary number of other consumers to obtain a valuable social group, and in this configuration the redundant number of participants might lead also to the mitigation of the load power variations. Figure 6 shows an example of the unbalanced combination $P_1 + C_1$, $P_1 + C_2$, while the "balanced" one $P_1 + C_1 + C_2$. Aggregating an home user plus a SOHO gives the minimal micro grid we speak about: at any t it emits no energy outside consuming all the power locally.

Around each cluster produced by evolutionary algorithms we can expect a neighborhood populated by similar load patterns, following the normal distribution shown on Figure 7A. In our case the concrete family of patterns is shown on Figure 7B. More reading about the probabilistic characterization of the residential profiles is available in (Carpanetto, 2007).

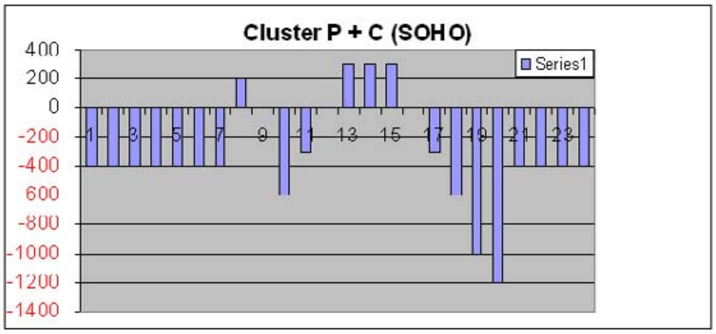
EXPERIMENTATION

To implement the previously stated considerations, genetic procedure adaptively and dynamically analyzing and grouping together consumer profiles with a certain degree of similarity in their temporal evolution has been considered. In fact, the use of a direct approach can be very difficult if the data structure is very complex and with a relevant number of profiles to be extracted. Alternatively, one can use indirect procedures, based on a pseudo-casual algorithm, as the evolutionary algorithms are. The advantage of using evolutionary optimization algorithms is that it is possible to vary simultaneously several parameters, in order to optimize different quantities.

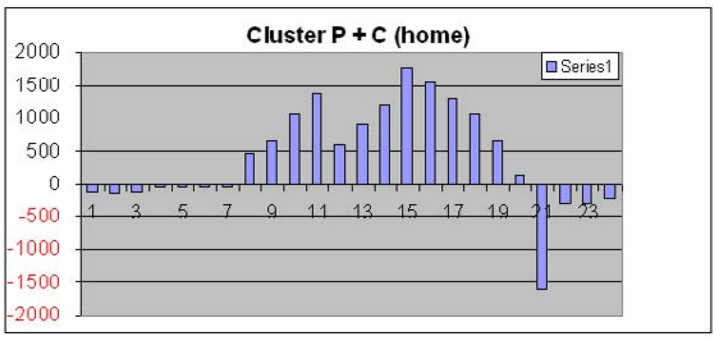
Evolutionary algorithms apply an indirect synthesis of Fuzzy parameters, by randomly choosing the parameters of interest and evolving their values towards a solution that is considered optimal; the fitness function, in particular, is the only link between the physical problem and the optimization procedure.

The most effective class of evolutionary algorithms developed until now is Genetic Algorithm (GA hereafter) that is now quite familiar to the scientific community and widely used (Goldberg, 1989). Genetic Algorithms simulate the natural evolution, in terms of survival of the fittest, adopting pseudo-biological operators such as selection, crossover and mutation. In GA, the set of parameters that characterizes a specific problem is called an individual or a chromosome and is composed of a list of genes. Each gene contains the parameter itself or a suitable encoding of them. Each individual therefore represents a point in the search space, and hence a possible solution to the problem. For each individual of the population a fitness function is therefore evaluated, resulting in a score assigned to the individual. Based on this fitness score, a new population is generated iteratively with each successive population referred to as a generation. The GA uses three basic operators - selection, crossover, and mutation - to manipulate the genetic composition of a population. Selection is the process by which the most highly rated individuals in the current generation are chosen to be involved as "parents" in the creation of a new generation. The crossover operator produces two new individuals (i.e. candidate solutions) by recombining the information from two parents. Crossover operation occurs in two steps. In the first one, a given number of crossing sites, along with the parent individual, are selected uniformly at random. In the second step, two new individuals are formed by exchanging alternate pairs of selection between the selected sites. The random

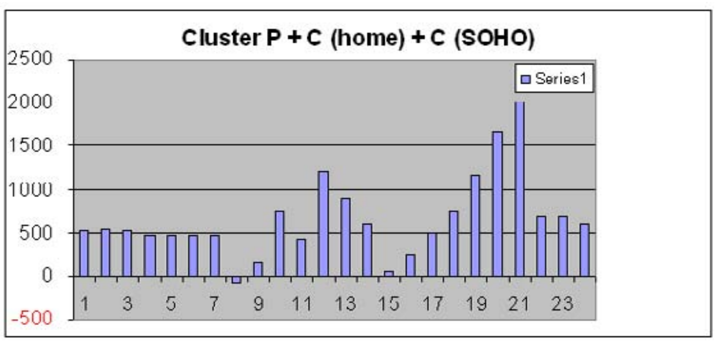
Figure 6. Balanced loads



(a)



(b)

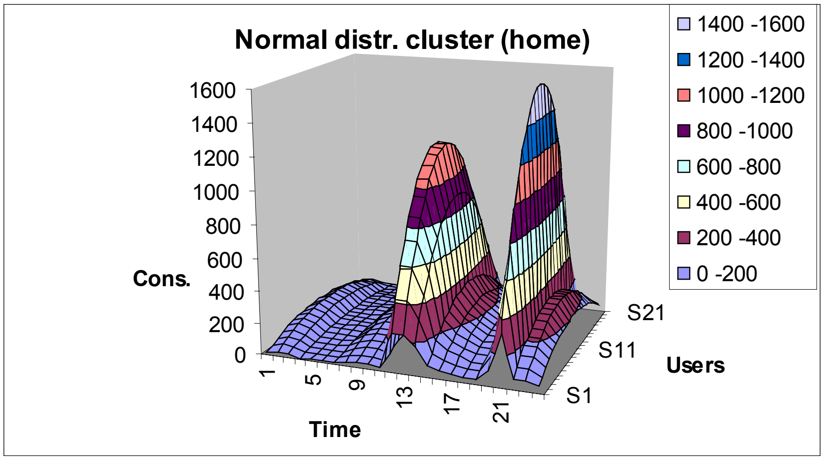


mutation of some gene values in an individual is the third GA operator. The allele of each gene is a candidate for mutation, and its function is determined by the mutation probability.

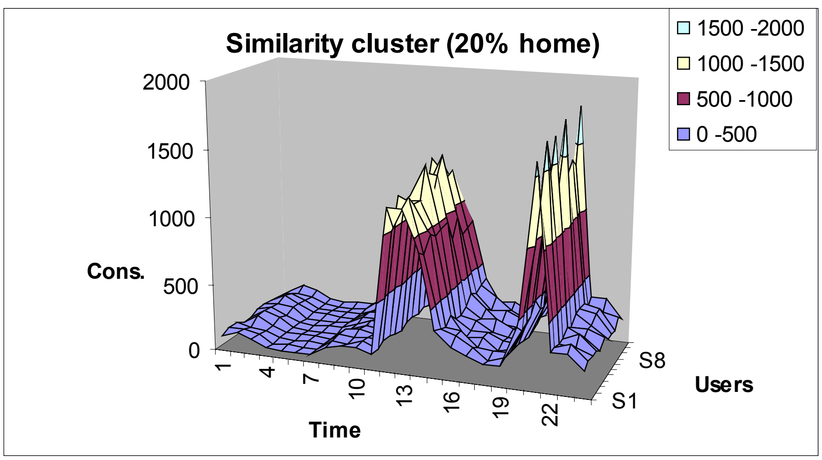
The Genetic Algorithm developed for this application is a standard implementation with real encoded genes (that represent the parameters of the specific problem, i.e. fuzzy parameters), since for high number of variables they result in faster than binary ones in convergence towards the maximum value. In this implementation, relevant operator parameters are the crossover probability P_c=0.8, the mutation probability P_m=0.1, the tournament selection and the elitism: these parameters have been used to speed up the convergence in the real coded GA.

To proceed with the evolutionary-assisted adaptive clustering, a pre-processing phase is performed first, where data are analyzed by a covariance matrix approach. Normalization and

Figure 7. Hyperplane of users



(a)



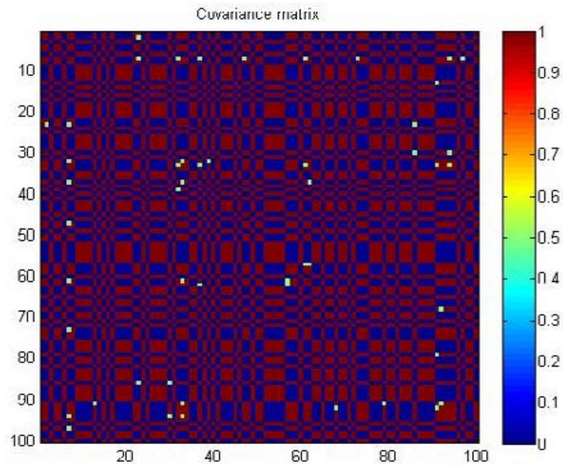
(b)

a set of Fuzzy threshold are applied to these results in order to roughly identify general behavior trends in several consumer profiles. Once this preliminary analysis is done, GA proposes a particular distribution of Fuzzy parameters to cluster together the different power consumption curves: the corresponding results are evaluated by the fitness function that, according with constrains defined before, assigns a score to the corresponding chromosome. The fitness score is the parameter that drives GA towards the optimum. After a certain number of evaluations, depending on the number of curves and of classes of consumers, a final classification is provided, with curves of different power consumption behavior being grouped together by the evolutionary algorithm and a Fuzzy set of rules for classification is provided too.

VALIDATION

To explore the performances of the proposed method for adaptively clustering consumer pro-

Figure 8. Results of data pre-processing



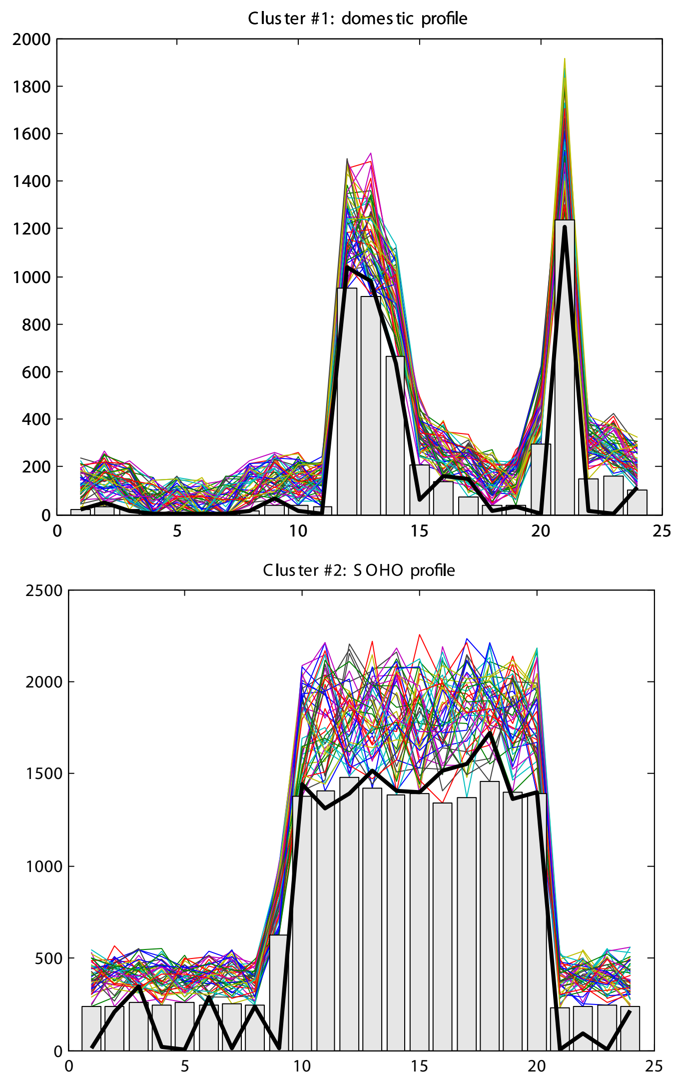
files, we chose to analyze a case-study considering - for the sake of simplicity- two possible typologies of (consumers) users: households and small offices. A set of randomized power consumption curves has been generated according to the pre-defined patterns previously described, in order to have a significant number of realistic consumer profiles. The results of the pre-processing phase are reported in Figure 8, where an image of the covariance matrix is shown: the values are normalized and filtered in order to show similarities between the considered randomly generated power consumption curves: red means that profile similarity is high, green that it is medium, blue means that profile similarity is low.

Once the similarities among different curves have been identified, the adaptive clustering phase takes place, according to the previously described evolutionary-assisted method. Results of this phase are reported in Figure 9, where a number of considered curves is reported in two separate panels: on the left side we have the residential-like set of curves, on the right panel we show the curves recognized as instances of the SOHO class. Two additional set of parameters have been reported in both plots: a continuous red line representing the class consumption behavior extracted by the evolutionary tool from the set of considered curves and a set of blue bars, to be used as the threshold for the Fuzzy logic classifier to be implemented. These very simple results are here reported for the sake of simplicity, but several other simulated evaluations have been conducted confirming that the proposed evolutionary-assisted procedure is capable to successfully identify and to cluster together different profiles presenting similar behavior.

CONCLUSION

Actors interacting on the energy market, e.g. individuals manifesting similar energy profiles can form a social network based on the cohesion criteria expressed in Fuzzy rules terms qualifying the electric load patterns (Figure 10). Authors have described the computational method, an algorithm, and a software tool helping to build a local virtual micro community optimizing the electric energy consumption locally, obtaining the equivalent of the short agricultural chain producer-to-consumer. There are three enablers: a smart real time metering giving the real life energy profile, the Fuzzy reasoning about the

Figure 9. Results of adaptive clustering operation



energy production forecast and the clustering technique creating the optimized local minimum. The Fuzzy system becomes criteria for the social cohesion of the newly proposed community, while the aggregated load profile represents the collective grid behavior.

The social aggregation proposed to physical persons is intentionally made virtual because of the nature of the transactions. However it might become real because of the motivation for grouping coming from the Fuzzy rules describing the objective function Θ (t) rewritten in lifestyle terms "people having the lunch at home" instead of the energy ones like "energy consumption rising between 1 and 2 PM". The minimal grouping ensuring the full local energy consumption can be easily extended adding an arbitrary number of new members to improve the social cohesion of the group. A minimal group achieves the main social goal of the total local energy consumption. Moreover an aggregation of a seniors looking after the children in the afternoon, a daytime working

Figure 10. Relationships and semantics

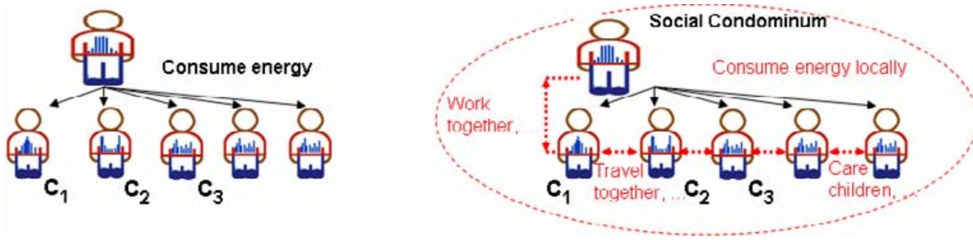


Figure 11. Software toolkit with energy features

SOHO, plus some students coming back home to have a lunch, might create an efficient cooperative environment improving the collective safety of the Condominium. At the end, the above-mentioned communities become useful to leverage loads charging three phases lines inside buildings.

The most important finding confirmed in experimental settings, even if intuitive a priori, is the fact that each cluster M_j should comprise at least two different categories of users. The best legacy performance of the micro grid is achieved grouping the photovoltaic residential Prosumer with a small industrial user, fully confirming the initial assumption about the daytime generation – consumption. The resulting minimal threshold shown by the micro grid becomes very close to the traditional minimum of the residential load curve, if we add the correction coming form the local weather forecast for +1 day (tomorrow). The eolic component is less predictable; however the uncertainty might be reduced replacing 1 day forecast in photovoltaic case by shorter hourly interval.

Authors precise that no real time data elaboration was possible because of the lacking interface with the existing AMR devices: in Italy the Telegestore system is based on SITRED data exchange protocol, which is not publicly available. Authors have used the datasets of the measurements complemented by the randomly generated geo-referencing simulating the real life situation, also because of the privacy protection constraints. To set up the working vendor-independent interoperable solution, an alternative in-home device, like a media-server equipped by the digital Wattmeter, exchanging the data among the social condominium over IP (PLC) should be considered, which might become the future work.

The mathematical modeling of the energy micro grids as Internet of Things entities, designing the procedures ruling local markets extends the proposed research. Micro grids are the Internet of Things entities. A "long" ipv6 address would hide local intelligence exposing only the model MGrid = [{AMR(N_j, t, date), AMM(N_j, t, date), E(t), ID(t)}, M-class]. The micro grid behavior will be described by M-class in the remote Ontology.

The MGrid digital energy might bring only AMM and ID events, because of the encapsulation – all internal accountancy might be computed locally, discharging the net. MGrid becomes a valuable abstraction for the semantic management of micro grids.

Following the proposed approach, a new model describing the network in terms of the transits through the qualified arches $\mathbf{N}_j$, instead of the nodes $\mathbf{M}_j$, enables the minimization of the uncertainty because of the local energy consumption. A method building a micro-grid containing one Prosumer - the generator and the consumer of the renewable energy plus some other nodes - hide the complexity and eliminate the effect from the uncertainty. The above-mentioned toolkit might offer also the possibility to negotiate in real time the social electric energy among local consumers, instead of the transactions on the main energy market, proposing the further work (Figure 11), in which the Near-energy service becomes represented by the following event chain:

```
Notify _ event ( From, To, Expected _ power,
     Start _ At, End _ At, Now)
Sell _ energy  (  From,  To,  Amount _ Power,
     Start _ At, End _ At, Now)
Buy _ energy  (  From,  To,  Amount _ Power,
     Start _ At, End _ At, Now)
```

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This work was previously published in International Journal of Virtual Communities and Social Networking, Vol. 1, Issue 3, edited by S. Dasgupta, pp. 75-93, copyright 2009 by IGI Publishing (an imprint of IGI Global).

Chapter 8.17
The Social Semantic Desktop:
A New Paradigm Towards Deploying the Semantic Web on the Desktop

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ABSTRACT

This chapter introduces the general vision of the Social Semantic Desktop (SSD) and details it in the context of the NEPOMUK project. It outlines the typical SSD requirements and functionalities that were identified from real world scenarios. In addition, it provides the design of the standard SSD architecture together with the ontology pyramid developed to support it. Finally, the chapter gives

DOI: 10.4018/978-1-60566-112-4.ch012

an overview of some of the technical challenges that arise from the actual development process of the SSD.

INTRODUCTION

A large share of everybody's daily activities centres around the handling of information in one way or the other. Looking for information, digesting it, writing down new ideas, and sharing the results with other people are key activities both in work as well as in manifold leisure activities. The abundance of PCs and the Web in today's world result in new numbers and qualities of information exchange and interaction which are seen both as chance and as threat by the users. Supporting personal and shared information handling is thus a highly requested but yet unsolved challenge.

In traditional desktop architectures, applications are isolated islands of data – each application has its own data, unaware of related and relevant data in other applications. Individual vendors may decide to allow their applications to interoperate, so that, e.g., the email client knows about the address book. However, today there is no consistent approach for allowing interoperation and a system-wide exchange of data between applications. In a similar way, the desktops of different users are also isolated islands – there is no standardized architecture for interoperation and data exchange between desktops. Users may exchange data by sending emails or uploading it to a server, but so far there is no way of seamless communication from an application used by one person on their desktop to an application used by another person on another desktop.

The problem on the desktop is similar to that on the Web – also there, we are faced with isolated islands of data and no generic way to integrate and communicate between various Web applications (i.e., Web Services). The vision of the SW offers solutions for both problems. RDF[a] is the common data format which builds bridges between the islands, and Semantic Web Service technology offers the means to integrate applications on the Web.

The Social Semantic Desktop (SSD) paradigm adopts the ideas of the SW paradigm for the desktop. Formal ontologies capture both a shared conceptualization of desktop data and personal mental models. RDF serves as a common data representation format. Web Services – applications on the Web – can describe their capabilities and interfaces in a standardized way and thus become Semantic Web Services. On the desktop, applications (or rather: their interfaces) will therefore be modelled in a similar fashion. Together, these technologies provide a means to build the semantic bridges necessary for data exchange and application integration. The Social Semantic Desktop will transform the conventional desktop into a seamless, networked working environment, by loosening the borders between individual applications and the physical workspace of different users.

By realizing the Social Semantic Desktop, we contribute to several facets of an effective personal information handling:

- We offer the individual user a systematic way to structure information elements within the personal desktop. Using standard technology to describe and store structures and relations, users may easily reflect and express whatever is important in their personal realm.
- Standardized interfaces enable the integration of all kinds of available desktop applications into the personal information network. Investments in programs, data collections, and hard-learned working

styles are not lost but augmented and connected into a comprehensive information space.

- Based on the SW technology basis, all kinds of automated and semi-automatic support are possible, like, e.g., text classification services, image categorization, document relevance assessments, etc.
- The exchange of standard data formats between individual work spaces is supported not only on the technical level (e.g., standard communication protocols), but also on the semantic level (via sharing and alignment of ontologies and the corresponding annotated information elements). The integration with formal ontologies eases the sharing and understanding between different persons.
- Ultimately, we thus contribute to a solution for the initialization problem of the SW: As the individual user will receive immediate benefit from the semantic annotation within the personal workspace, the motivation is high to invest the necessary structuring and formalization work. As the standards used allow for an effortless sharing of such work, the amount of semantically annotated information which can be made available in the Web grows dramatically – which in turn makes it worthwhile to develop new SW-based services.

In this chapter we describe in detail the core components which are necessary for building a Social Semantic Desktop. We illustrate the necessary standard framework and describe the role and structure of the ontologies which support the spectrum from personal to social information handling. We outline the implementation decisions which need to be observed in order to realize a consequently ontology-oriented system, which is able to deal with the numerous flexibilities required within the Semantic Web. Finally, we show examples of the benefits obtained from the realization and use of an SSD.

The ideas and implementation principles presented in this chapter are distilled from our experiences in the NEPOMUK Project[b]. For each section we will describe the general motivation and principles and then give details on how the particular challenges have been solved in the NEPOMUK project.

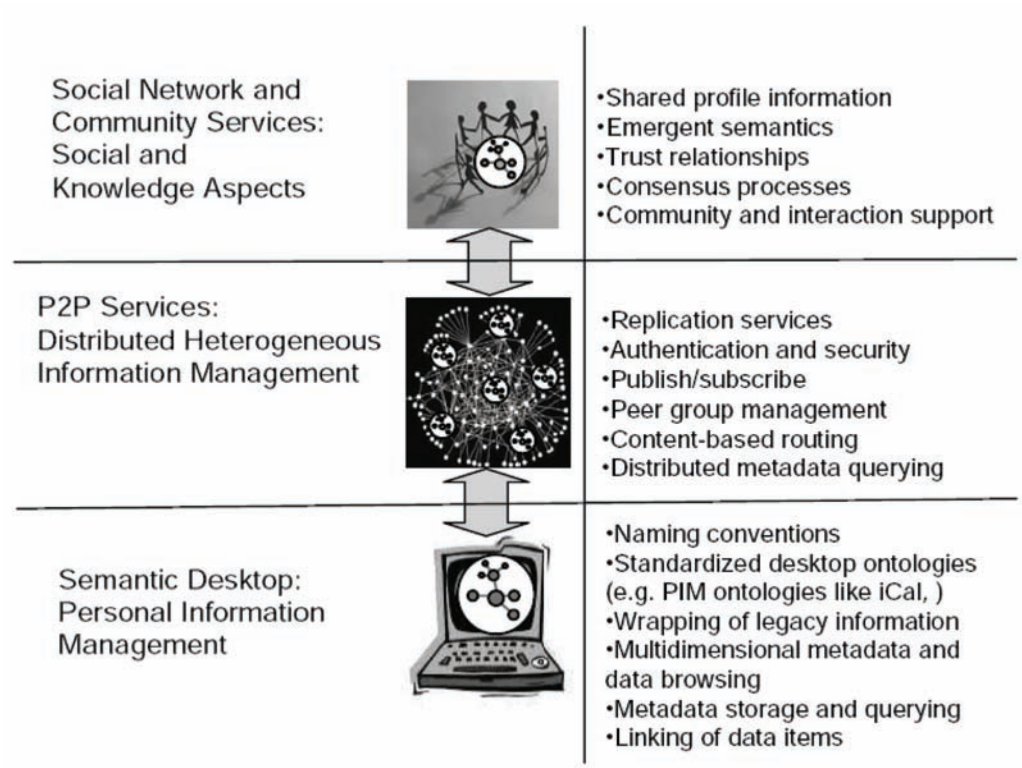
BACKGROUND

The Social Semantic Desktop vision has been around for a long time: visionaries like Vannevar Bush (1945) and Doug Engelbart (1962) have formulated and partially realized these ideas. However, for the largest part their ideas remained a vision for far too long, since the necessary foundational technologies were not yet invented – figuratively speaking, these ideas were proposing jet planes when the rest of the world had just invented the parts to build a bicycle. Only in the recent years several technologies and research streams began to provide a foundation which will be combined and extended to realize the envisioned collaborative infrastructure of the SSD.

Figure 1 shows the highest-level architecture and connections between components of the SSD, i.e., the social networks, the P2P infrastructure, and the individual desktops. Traditional semantics, knowledge representation, and reasoning research are now interacting. While none of them can solve the problem alone, together they may have the explosive impact of the original Web:

The Semantic Web effort provides standards and technologies for the definition and exchange of metadata and ontologies. Available standard proposals provide ways to define the syntax (RDF) and semantics of metadata based on ontologies (Web Ontology Language – OWL(McGuiness

Figure 1. Component architecture of the Social Semantic desktop



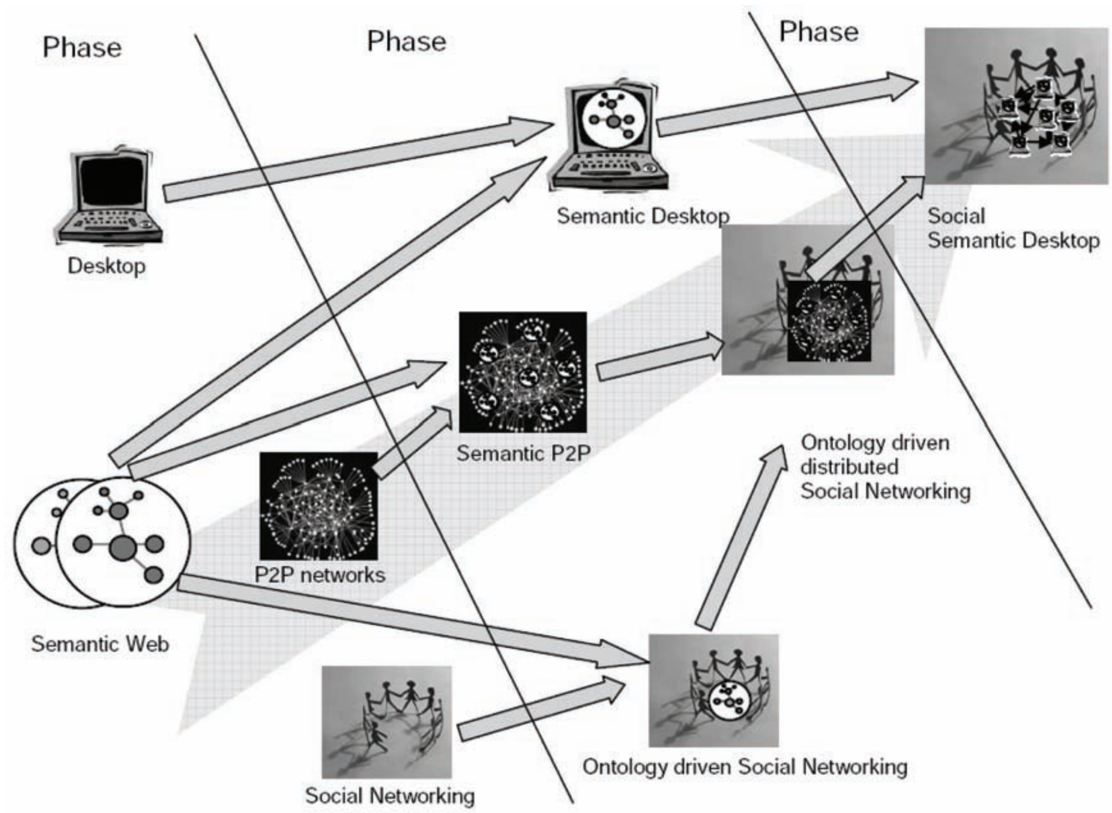
et. al, 2004), RDF Schema – RDFS). Research covering data transfer, privacy, and security issues is now also under development.

Social Software maps the social connections between different people into the technical infrastructure. As an example, Online Social Networking makes the relationships between individuals explicit and allows the discovery of previously unknown relationships. The most recent Social Networking Sites also help form new virtual communities around topics of interest and provide means to change and evolve these communities.

P2P and Grid computing develops technology to network large communities without centralized infrastructures for data and computation sharing. P2P networks have technical benefits in terms of scalability and fault tolerance, but a main advantage compared to central sites is a political one: they allow to build communities without centralized nodes of control, much as the Internet grew as fast as it did because it was based on reciprocity – it avoided political debate as to who gets to own big, expensive central facilities. Recent research has provided initial ways of querying, exchanging and replicating data in P2P networks in a scalable way.

By projecting the trajectory of current trends, we can simplify this picture by stating that next generation desktop applications will support collaboration and information exchange in a P2P network, connecting online decentralized social networks, and enabling shared metadata creation and evolution by a consensus process. The result of this process will be the Social Semantic Desktop. Figure 2 depicts the phases in which the relevant co-evolving technologies are combined to achieve the final goal, i.e., the realization of the Social Semantic Desktop.

Figure 2. Phases towards the Social Semantic desktop



SCENARIOS

Before we move on to the specific functionalities that a Social Semantic Desktop supports and discuss how they are implemented, we will first present some scenarios that will illustrate what an SSD is, how it will be used, and how it will change the way we do knowledge work. We chose the scenarios such that they illustrate the different dimensions of an SSD: Sect. *The Semantic Dimension* describes example usage that shows the use of semantics on the desktop, and Sect. *The Social Dimension* will show the social dimension of an SSD, i.e., the interaction between desktops of different users. The scenarios give an overview of what is possible and how the SSD presents itself to the user.

The Semantic Dimension

A typical use of a single Semantic Desktop is to organize ones data: files, emails, pictures, etc. Users are able to tag those information resources with concepts from a network of ontologies. The ontologies also contain relations (or properties, to use RDF terminology), which can be used to link information resources on the desktop. Organizing information resources in this way helps users to find what they are looking for quicker, and makes it possible for the Semantic Desktop itself to aid the user in their daily work. When a user first begins using the Semantic Desktop, many often-used concepts and properties are already present. E.g., there are basic concepts such as **Person**, **Meeting** or **Place**, and properties such as **knows** or **located-in**. Also, we can assume that useful things like an ontology of all countries are already in place. Then, as the need arises, users can extend the existing ontologies – e.g., they can add concepts for a particular meeting they attend or people they know, such as **Executive-Committee-Meeting-07/06/07**, **Jane-Doe** or **Hans-Schmidt**. The following two scenarios give examples of this kind of Semantic Desktop usage. We will use two imaginary users (*personas*[c]) flesh them out: Dirk, who works in a research group for some company in Germany, and Claudia, who is the group leader and his boss. Both Dirk and Claudia work on a project called Torque.

Organizing pictures (*Annotation*). Dirk just got back from his holidays in Norway, where he took a lot of pictures. Using his Semantic Desktop, he now wants to organize them, so that he can later find the pictures he wants to easier, generate photo albums for particular topics, etc. A lot of the important concepts probably already exist on his desktop, such as Norway, or the cities he has visited: **Oslo**, **Bergen** and **Trondheim**. Other concepts will be added by Dirk himself, such as **Holidays-in-Norway-2007** and tourist sights like **Preikestolen** or **Holmenkollen**. Since these concepts are more than just tags, Dirk can also say things *about* them, e.g., that **Holidays-in-Norway-2007** was a **Trip** and took place in **2007**, and that **Preikestolen** is a **Location** in **Norway**. Dirk even managed to take a picture of Prince Håkon and Princess Mette-Marit, so he creates two more concepts **Håkon** and **Mette-Marit**. There are many ways in which Dirk can link (or tag) his pictures to the relevant concepts – however, part of the Semantic Desktop are intuitive user interfaces, which hide most of the intricacies that go on under the hood from the user. E.g., Dirk might have an application that shows all the concepts that he is interested in the form of a tag cloud. Linking the pictures would then simply require him to drag them onto the desired concept in the cloud.

Planning a trip (*Context*). Later, Dirk finds out that he has to go on a work trip: a conference in Oslo. The Semantic Desktop assists him in planning and organizing this trip, through the notion of *context*. Dirk can create a new **Trip** object **Trip-to-OOC2007-Oslo** and tell his desktop that he is now in the context of this trip. This means that everything he does from this moment on will be interpreted as happening in that context, until he quits the context again. When he books a flight in his Web browser, the destination field will automatically be filled in with "Oslo", similarly the departure field. Afterwards, when he books a hotel room, he will be assisted similarly. Dirk will receive a number of email confirmations, such as the flight itinerary and booking confirmation for his hotel. These emails and their attachments will automatically be filed as belonging to the **Trip-to-OOC2007-Oslo** context, so that Dirk can easily find them again later. Once he knows his exact flight dates and where his hotel will be, he enters this information into his calendar, which is also context-aware and will therefore remember that these entries belong to Dirk's trip.

The Social Dimension

Users will have a lot of benefit from just using the Semantic Desktop on their own. However, by connecting to others, a number of additional possibilities arise.

Assigning tasks in a group (*Social Interaction*). In the previous scenario, Dirk found out he had to go on a business trip. In fact, he found out about this because he was notified by his boss Claudia, who also uses a Semantic Desktop. Claudia plans to travel to the OOC2007 conference in Oslo to present a research prototype her group has developed as part of the *Torque* project. She does not want to travel alone, so she first needs to find out who of her group members are available while the conference runs. Through the network of Social Semantic Desktops, her calendar application has access to the calendars (or parts of them) of all her contacts. She can ask the calendar to give her a list of all people in her group (**My-Research-Group**) who are working on the *Torque* project (**Torque-**

Table 1. Functionalities of the Social Semantic desktop

Desktop	Annotation, Offline Access, Desktop Sharing, Resource Management, Application Integration, Notification Management
Search	Search, Find Related Items
Social	Social Interaction, Resource Sharing, Access Rights Management, Publish/Subscribe, User Group Management
Profiling	Training, Tailor, Trust, Logging
Data Analysis	Reasoning, Keyword Extraction, Sorting and Grouping

Project) and are free when OOC2007 is on. She finds out that Dirk is free at the desired time. Just like Dirk in the previous scenario, she creates a **Trip-to-OOC2007-Oslo** object and makes it her current context. She also links the trip to the **Torque-Project**. Now, she creates a new **Task** object **Dirk-Prepare-Trip-To-OOC2007**, with a subtask **Dirk-Prepare-Presentation-Slides** and afterwards sends an email to Dirk, asking him to accompany her to the conference, book flights and hotel rooms, and prepare slides for the conference presentation. Her email and the task will of course be automatically linked to the proper context. Also, in this version of the scenario, Dirk no longer has to create the **Trip-to-OOC2007-Oslo** object himself – instead, it will be added to his Semantic Desktop automatically when he gets Claudia's mail.

FUNCTIONALITIES

In this section we describe a list of functionalities that are needed to support the scenarios mentioned above, as well as other scenarios developed during the NEPOMUK project. The SSD is a platform used to develop different kinds of social and semantic applications. These applications share common functionalities which must be supported by the SSD. We have divided them into five groups, which can be considered different aspects of the SSD. Tab. 1 shows the five different aspects and the individual functionalities within each group. Below we briefly describe the use of each functionality.

Desktop. At the *desktop* level, the semantic functionality common to most applications is the ability to add information about any resource. **Annotation** comprises the facilities to store and retrieve semantic relations about anything on the desktop. When Dirk annotates his photos from his trip, he does it from his most favorite photo application (such as Picasa or iPhoto), the annotations are then stored by the SSD. We name this functionality **Application Integration**; applications interact with the SSD by means of different services. When Dirk got notified about the trip to Oslo, this was an example of **Notification Management**. The SSD handles different kinds of mechanisms such as emails, RSS, or text messaging. When Dirk creates a new concept or even a new file on the SSD, the application he uses interacts with the **Resource Management** facilities of the SSD, creating the needed semantics according to the current context and setup. Some of the information Dirk needs when booking his trip are stored on Claudia's desktop. If she is not connected to the network, the **Offline Access** facility exports the relevant information to another desktop. **Desktop Sharing** is the ability for different users of the SSD to work on the same resources. Claudia might write a report of the trip together with Dirk: the resource management is done on Dirk's desktop, but Claudia can access and edit it remotely.

Search. The semantic network created on the desktop unleashes a whole new way of searching on the SSD. **Search** uses the semantic relations as well as social relations to retrieve relevant items. Once an item is found a user can also **Find**

Related Items. For instance, when Dirk searches for a flight to Oslo, he can also search for related items and may find out that another company is actually cheaper, based on the experience of his social contacts.

Social. The SSD provides different means of **Social Interaction**, e.g., the embedding of semantic information in emails or text messaging, or the ability to annotate another user's resources. Some desktop level functionalities such as desktop sharing and offline access require the SSD to enable **Resource Sharing**. When Dirk and Claudia collaborate on the trip's report, Dirk might make it accessible to the whole group by adding it to a shared information space. When sharing resources or information on the network, the **Access Rights Management** of the SSD provides ways to define specific rights relations between users, groups and resources. The SSD's **User Group Management** system makes it easy for the rapid creation of new groups from a list of users. These groups can then be used to modify access rights or for resource sharing in a shared information space. E.g., some of Dirk's friends may have subscribed to get notifications of new pictures that Dirk annotates and makes available. The **Publish/Subscribe** mechanism of the SSD facilitates the creation of feeds of relevant information.

Profiling. If enabled, the **Logging** functionality of SSD logs user activity, which may help to detect the current user's context. The *profiling* of the SSD can be done automatically by **Training**: the SSD learns to predict the user's behavior. The user can still **Tailor** the SSD's intelligent behaviors: some learned contexts can become irrelevant and may need to be re-adapted or removed. The notion of **Trust** on the SSD between people or information sources is also a result of the profiling of the desktop. Dirk might define that he trusts Claudia's information, or Claudia's SSD might learn that Dirk is a trustworthy source of information regarding the *Torque* project.

Data analysis. To support the training behaviors of the SSD or querying related items, the SSD provides different *data analysis* mechanisms such as **Reasoning**. For instance, when Dirk tags a picture with **Preikestolen** and **Norway**, the SSD may infer that Preikestolen is in Norway. This information can later be reused for search. **Sorting and Grouping** supports applications that perform search. The SSD returns items from many sources and people and sorts and groups these items regarding different criteria, using the semantics defined on these resources. The **Keyword Extraction** from resources such as text resources is useful for automatically tagging or summarizing.

ONTOLOGIES

Ontologies form a central pillar in Semantic Desktop systems, as they are used to model the environment and domain of the applications. The common definition of an ontology is "a formal, explicit specification of a shared conceptualization" (Gruber, 1995)

We distinguish four levels of ontologies for the SSD: *Representational*, *Upper-Level*, *Mid-Level and Domain*. The main motivation for having these layers is that ontologies at the foundational levels can be more stable, reducing the maintenance effort for systems committed to using them. A core principle of the Semantic Desktop is that ontologies are used for personal knowledge management. Each user is free to create new concepts or modify existing ones for his *Personal Information Model*. This modeling takes place on the domain-ontology level, but the user is of course free to copy concepts from the other layers and modify them to fit his or hers own needs. In order of decreasing generality and stability the four layers are:

Representation(al) Ontology. Representational ontologies (i.e., ontology definition languages) define the vocabulary with which the other ontologies are represented; examples are RDFS and OWL. The relationship of a representational ontology to the other ontologies is quite special: while upper-level ontologies generalize mid-level ontologies, which in turn generalize domain ontologies, all these ontologies can be understood as instances of the representational ontology. Concepts that might occur in the Representational Ontology level include: classes, properties, constraints, etc.

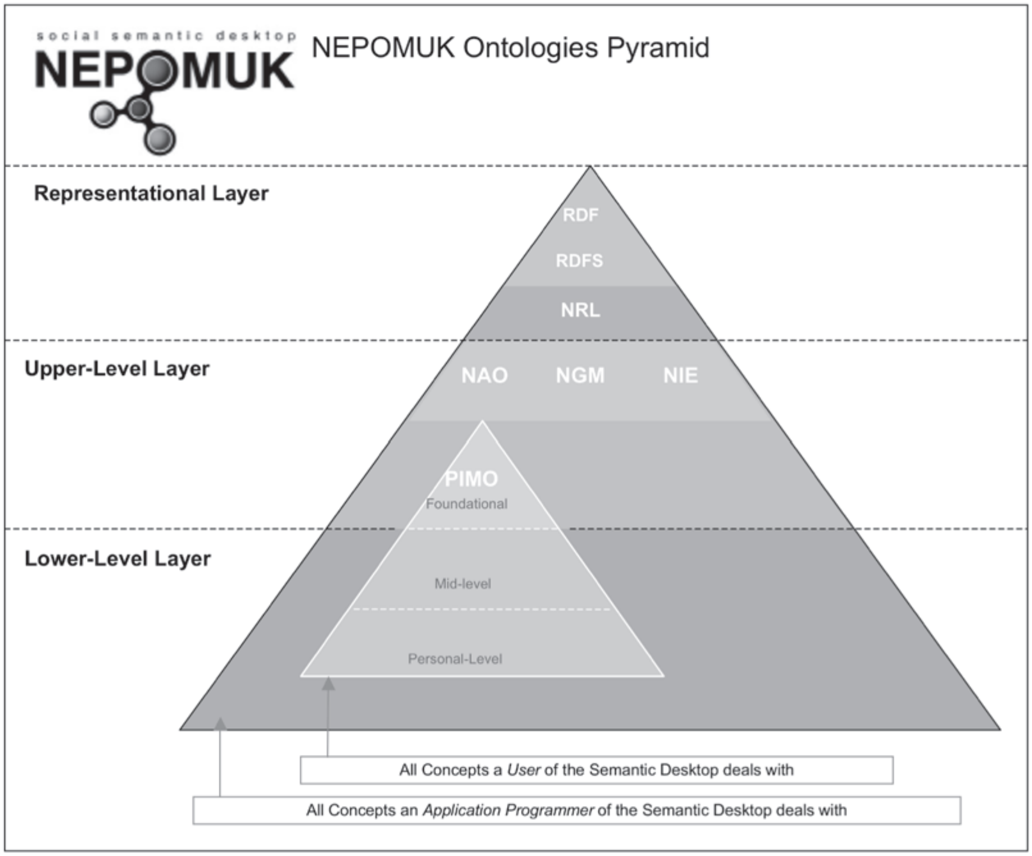
Upper-Level Ontology. "An upper ontology [...] is a high-level, domain-independent ontology, providing a framework by which disparate systems may utilize a common knowledge base and from which more domain-specific ontologies may be derived. The concepts expressed in such an ontology are intended to be basic and universal concepts to ensure generality and expressivity for a wide area of domains. An upper ontology is often characterized as representing common sense concepts, i.e., those that are basic for human understanding of the world. Thus, an upper ontology is limited to concepts that are meta, generic, abstract and philosophical. Standard upper ontologies are also sometimes referred to as foundational ontologies or universal ontologies." (Semy et. al, 2004) In the upper-level ontology you will find concepts like: **Person**, **Organization**, **Process**, **Event**, **Time**, **Location**, **Collection**, etc.

Mid-Level Ontology. "A mid-level ontology serves as a bridge between abstract concepts defined in the upper ontology and low-level domain specific concepts specified in a domain ontology. While ontologies may be mapped to one another at any level, the mid-level and upper ontologies are intended to provide a mechanism to make this mapping of concepts across domains easier. Mid-level ontologies may provide more concrete representations of abstract concepts found in the upper ontology. These commonly used ontologies are sometimes referred to as utility ontologies." (Semy et. al, 2004). The mid-level ontologies may include concepts such as: **Company**, **Employer**, **Employee**, **Meeting**, etc.

Domain Ontology. "A domain ontology specifies concepts particular to a domain of interest and represents those concepts and their relationships from a domain specific perspective. While the same concept may exist in multiple domains, the representations may widely vary due to the differing domain contexts and assumptions. Domain ontologies may be composed by importing mid-level ontologies. They may also extend concepts defined in mid-level or upper ontologies. Reusing well established ontologies in the development of a domain ontology allows one to take advantage of the semantic richness of the relevant concepts and logic already built into the reused ontology. The intended use of upper ontologies is for key concepts expressed in a domain ontology to be derived from, or mapped to, concepts in an upper-level ontology. Mid-level ontologies may be used in the mapping as well. In this way ontologies may provide a web of meaning with semantic decomposition of concepts. Using common mid-level and upper ontologies is intended to ease the process of integrating or mapping domain ontologies." (Semy et. al, 2004). Domain ontologies consist of concepts like: **Group Leader**, **Software Engineer**, **Executive Committee Meeting**, **Business Trip**, **Conference**, etc.

Figure 3 shows how these four layers relate to the four ontologies created and used in the NEPOMUK Project. As detailed in Sect. "*Technology*", we were hesitant to make use of OWL for the representational ontology level in NEPOMUK, and in its place we developed the NEPOMUK Representational Language(Sintek et. al, 2007) (NRL). NRL defines an extension to the semantics offered by RDF and RDFS; the main contribution of NRL is the formalization of the semantics of named graphs. NRL allows multiple semantics (such as open and closed world) to coexist in the same application, by allowing each named graph to have separate semantics. The NEPOMUK Annotation Ontology (NAO) is a basic schema for describing annotations of resources, this is essentially a formalization of the tagging paradigm of Web2.0 applications. A specialized part of NAO is the NEPOMUK Graph Metadata schema (NGM)

Figure 3. NEPOMUK ontology pyramid



which allows the description of named graphs, defining meta-data properties such as the author, modification dates and version data.

Finally, the NEPOMUK Information Elements ontology (NIE) contains classes and properties for describing objects found on the traditional desktop, such as files (Word documents, images, PDFs), address book entries, emails, etc. NIE is based on existing formats for file meta-data such as EXIF for image meta-data, MPEG7 for multimedia annotations, ID3 for music files, iCal, and others.

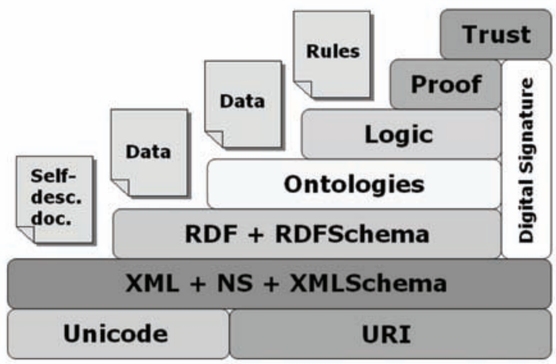
TECHNOLOGY

The Social Semantic Desktop deploys the Semantic Web on the desktop computer. Therefore, the technology stack proposed for the Semantic Web (the famous "Layercake"[d] adapted in Figure 4) is adopted for the SSD as well.

However, there are some specific considerations for the desktop scenario: everything on the desktop should identifiable by URIs. This is partially solved for files, where RFC1738[e] specifies the form of file:// URIs, but requires considerable care for other applications which may not represent their data entities as individual files, such as address books or email clients.

Secondly, one can note that for the single desktop scenario there are fewer requirements on

Figure 4. The Semantic Web technology stack

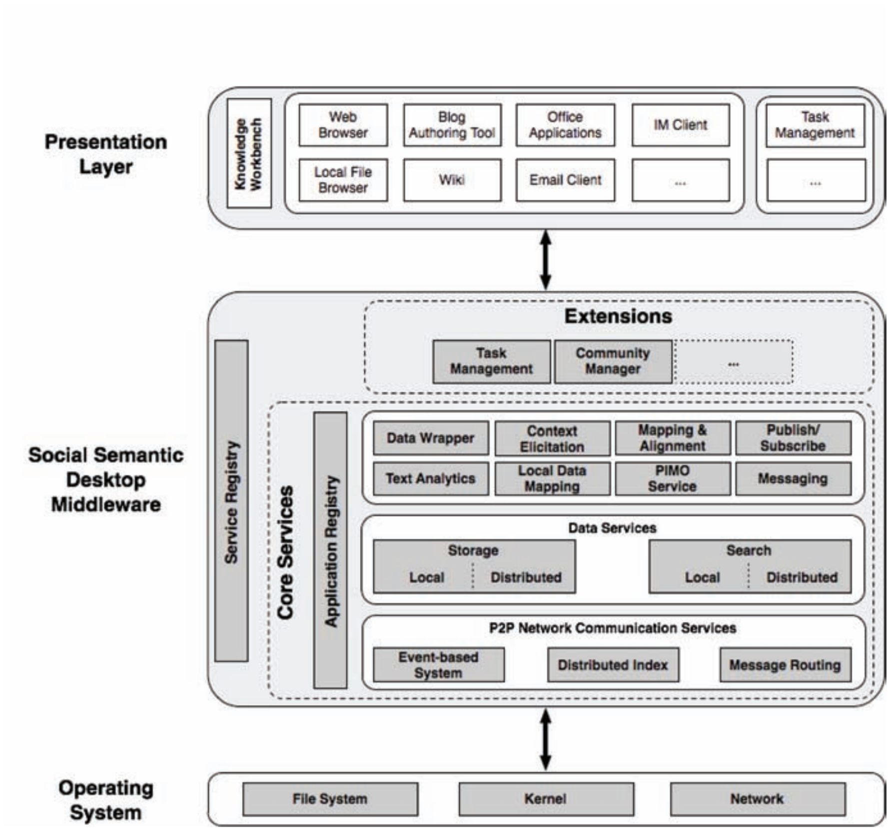


aspects such as trust, proof, and signatures. When one progresses to the Social Semantic Desktop, which involves interactions between many users, these aspects must be considered again.

In NEPOMUK we chose not to use the Web Ontology Language (OWL)(McGuiness et. al, 2004) as an ontology language, because of the challenge of dealing with (and implementing) OWL correctly; because our ontological modeling requirements were modest, and, most importantly, because OWL enforces an open-world view of the world, which did not seem to be appropriate for the (local) Semantic Desktop. In a World Wide Web context it is impossible for an application to read all available data, and an open-world assumption is natural, since additional data can be discovered at any moment. However, the open-world assumption makes it impossible to adopt negation as failure (Clark, 1978) which makes practical application development difficult and is also difficult to explain to the end-user. In the context of a local desktop application the situation is quite different, here it is perfectly possible to read all data available, and the closed world assumption makes much more sense. In place of OWL we developed our own ontology specification language called NRL, which uses the closed-world assumption. An additional RDF-based technology that we use widely, but which does not feature in the Semantic Web stack is the concept of named graphs(Caroll et. al, 2005). This allows one to divide a larger RDF store into sets of RDF statements (graphs), where each is identified with a URI (the name). In this way it is possible to make meta-statements about each graph, such as provenance information. Named graphs thus become an alternative to RDF reification, which also allows making statements about other statements, but is harder to implement and creates a significant overhead. NRL does also allows applying different semantics for different named graphs, thus allowing us to integrate the local closed-world with the open-world of the extended Semantic Web.

As noted previously, applications on the Semantic Desktop are analogous to services available on the Web. Each application will offer an interface for exposing the functionality it offers. Although a single desktop is not distributed, a network of SSDs is. It therefore suggests itself to adopt the Web Service stack of tools for inter-service communication for the Semantic Desktop: the Web Service Description Language (WSDL) [f] which is used for describing the interfaces of services offered, XML Schema (XSD)[g] which is used for primitive type definitions, and finally the Simple Object Access Protocol (SOAP)[h] which is used for the invocation of services. In Sect. "*Implementation and Engineering Principles*" we give further details on how these technologies work in relation to the Semantic Web technologies presented above.

Figure 5. Layered architecture of the Social Semantic desktop



ARCHITECTURE

In our vision, the standard architecture comprises a small set of standard interfaces which allow application developers to easily extend it and ultimately lead to an evolving ecosystem. Figure 5 depicts this set of interfaces transposed into services, together with their placement in the NEPOMUK architecture. The architecture has to reflect the two aspects of the scenarios introduced in Sect. "*Scenarios*", i.e., the semantic (which can operate on a single desktop) and the social aspect (which is relevant in a network of desktops). To cover these requirements and the functionalities discussed in Sect. "*Functionalities*", the SSD is organized as a Service Oriented Architecture (SOA). Each service has a well defined WSDL interface and is registered at the *Service Registry*. The social aspect of sharing resources over the network is enabled by the peer-to-peer (P2P) infrastructure of the architecture. In the following we present the services of the SSD.

The architecture, as show in Figure 5, is organized in three layers. Like current desktop systems, the desktop environment builds on top of the *Operating System* core, such as the file system, kernel, and network environment. On the SSD the desktop environment is pooled in the *Social Semantic Desktop Middleware* Layer (SSD Middleware). The SSD Middleware groups the services of the SSD to be used in the Presentation Layer, which provides the user with SSD enabled applications that take advantages of the functionalities of the SSD.

The SSD is made up by individual desktops, which are organized in a P2P fashion. To support the communication between the peers, the SSD Middleware provides *P2P Network communication Services*. To enable information sharing between individual desktops, the RDF metadata of shared resources is stored in the *distributed index* of the P2P system. In NEPOMUK, the P2P system is based on GridVine (Aberer et. al, 2004), which in turn is built on top of P-Grid (Aberer et. al, 2003) and provides a distributed index with RDQL query supports.

Network Communication Services provide an *Event-based System*, which is responsible for the distribution of the events between the SSD peers. On the SSD, the event-based system is used to support the publish/subscribe system. Users as well as other services can use RDF to describe the kind of information they are interested in (e.g., new pictures of Norway become available, the status of a document changes to final, etc.). These subscriptions are stored in the distributed index of the P2P system. An event that was fired carries an RDF query as payload, which is matched against all subscriptions and triggers the notification of the subscriber. In addition, the *Messaging Routing* system uses RDF information to route messages to receiver.

The *Data Services* are responsible to control the insertion, modification, deletion, and retrieval of resources on the SSD. A resource can be a user, a document, a calendar entry, an email, and so on. It provides a service to store the RDF meta-data in the *Local Storage*. Resources and their RDF descriptions can either be added to the SSD manually, or the *Data Wrapper* or *Text Analysis* service extracts the information from desktop applications such as email clients or calendars. Data Wrappers are used to extract metadata form structured data sources (e.g., email headers, calendar entries, etc.). In NEPOMUK, data wrappers are implemented based on Aperture (Aperture, 2007). The Text Analysis service is used to extract metadata from unformatted text (e.g., email bodies, word processing documents, etc.). For local queries and for offline working the RDF metadata is stored in the *Local Storage*. If a resource is shared with other users in an information space, the metadata is also uploaded to the distributed index of the peer-to-peer file sharing system. The *Search* service can either issue a *local* search in the local storage or a *distributed* search in the underlying P2P system.

Before new metadata can be added to the repository, we have to check whether this metadata describes resources that are already instantiated (i.e., an URI has been assigned) in the RDF repository. In this case, the URI of the resource should be reused, rather then creating a new one. This process is known as information integration (Bergamaschi et. al, 2001). The *Local Data Mapper* service takes over this responsibility in the SSD Middleware. E.g., the Data Wrapping service extracts contact information from the address book and stores the metadata in the repository. Since this is the first time information about the contacts is added to the RDF repository, a new URI is generated for each person. If later the Data Wrapping service extracts information from an email header, the Local Data Mapping service is responsible to lookup whether information about the sender of the email is already in the repository and reuse the corresponding URI instead of creating a new one (Sauermann et. al, 2006).

Ideally only one ontology exists for a domain of interest such as contact data, calendar events. In reality, however, we are faced with many ontologies of (partly) overlapping domains (e.g., FOAF and vCard for contact data, or different personal information models). Since individual users share information over the SSD, it is likely to happen that they use different ontologies for their annotations even when talking about similar domains. Therefore, the SSD Middleware provides a *Mapping & Alignment* service that can be used by other middleware services and services in higher layers to translate RDF graphs from a source ontology to a target ontology.

The SSD Middleware logs the actions a user performs on the resources on his desktop. The logged data is stored in the Local Storage and analyzed by the *Context Elicitation* service to capture the current working context of the user. The context can for example be used to adapt the user interface or to suggest meaningful annotations to the users, depending on the task they are currently working on.

As discussed in Sect. "*Technology*", the services on the SSD use RDF to exchange data. Therefore, services need the capability to generate and process RDF graphs. To simplify the handling of the RDF graphs, the *Ontology Service* provides an easy way to create and manipulate concepts in RDF graphs.

The *Publish/Subscribe System* allows users or other SSD services to subscribe to events on the SSD. The subscriptions are stored as RDF graphs in the distributed index. If an event occurs, the RDF query of the event is matched against the subscriptions. When the subscription, i.e., the RDF query, matches the event, the *Messaging* service looks up the preferred notification media (e.g., email, instant messaging, SMS) and delivers the messages. The Messaging System is further used for synchronous and asynchronous communication between SSD users.

The *Core Services* of the SSD Middleware comprise the services which provide the basic functionalities of the SSD. These services can be accessed via the SSD Application Programming Interface (API). If a developer wants to exploit the SSD Core Services to build his domain-specific application, he can do this as an *extension* of the SSD Middleware. An example for such an extension is the *Task Management* which provides functionalities such as creating, delegating, and manipulating of tasks. Finally, the *Application registry* allows applications from the Presentation Layer to register call back methods at the SSD Middleware if they need to be notified by SSD services, e.g., when a message arrives and has to be displayed to the user in an Instant Messaging Client.

The top layer of the architecture is the presentation layer. It provides a user interface to the services provided by the SSD, and is built using the SSD API. Many desktop applications are possible sources for resources that should be managed by the SSD. Therefore, each desktop application should integrate support for the SSD Middleware. Since this assumption does not hold for most of the current off-the-shelf applications, we developed plug-ins and add-ons to enable a seamless integration with existing applications. These plugins for example extract email or calendar data and add them as resources to the SSD. However, within NEPOMUK we also develop dedicated applications that make use of the SSD API directly, such as a semantic *Wiki* or *Blogging Tools*. (Möller et. al, 2006)

In addition, the *Knowledge Workbench* is the central place to browse, query, view, and edit resources and their metadata. In this way the Knowledge Workbench aims to replace current file management tools such as the MS File Explorer. If the SSD is extended by usage extensions, the application programmer also has to provide the corresponding user interface in the Presentation Layer (e.g., for Task Management, Community Management, etc.).

IMPLEMENTATION AND ENGINEERING PRINCIPLES

As detailed in Sect. "*Architecture*". we deem a Service Oriented Architecture (SOA) to be most suitable for the SSD framework. Furthermore, we decided to use the industry standard SOAP (Simple Object Access Protocol) for exchanging messages between our components. For traditional applications the names and structure of SOAP messages is specified using the Web Service Description Language (WSDL), which in turn uses XML schema data-types to specify the form of the objects being exchanged. However, since the formal modeling of the target domain using ontologies is the core idea of a Semantic Desktop application, the best-practices for SOAs are slightly different. In this section we will discuss some important differences from a traditional SOA system.[i] Basing a system architecture on underlying domain ontologies is similar in nature to Model Driven Architectures (MDA)[j]. However, on the SSD, ontologies take the place of UML models.

Working with RDF

Sect. "*Ontologies*" described the substantial effort that went into the modeling of our domains as ontologies in a formal language. These ontologies give us a very powerful and flexible modeling language, although the structure of instances of such ontologies at first sight seem much more constrained than complex XML schema data-types, the flexibility of RDF introduces some additional requirements for developers of components that should handle RDF instances:

- The structure of the RDF instances received may not be fully known at design time. This means one must take great care that the code does not break when encountering unknown properties in the data, and these unknown properties must also be preserved. In general, programming services for the Semantic Desktop is more like programming services for the web, rather than for traditional desktop applications, and one should follow the general rule of web-programming: "Be strict in what you send and tolerant in what you receive."
- Conversely, other services might not be aware of all the properties the local service uses. Therefore each service must be programmed to be tolerant of missing data and do their best with the data that was provided.

Passing Instances in Messages

Normally, when using SOAP in connection with WSDL and XML schema for data modeling, some mapping is used that will convert the XML schema definition to class definitions in the programming language of choice. Furthermore, stubs and skeletons will be generated for the service themselves, so that the details of communication are hidden. Programming against remote services is then indistinguishable from programming against a local object. However, when using services that pass instances for which the structure is defined by ontologies, the mapping is not so straight forward. Although interaction with RDF data can always be done on a completely general level using basic RDF APIs we are interested in facilitating the job of programmers consuming our services, and allowing them to work on a higher level than RDF triples. We identify three alternatives for programming web services where parameters are instances from an ontology:

- Starting with the ontologies, a number of tools[k] can be used to create a set of Java classes from the ontologies. The service interface is written using parameters of these types, and another tool is used to generate the WSDL and associated XML schema types from these. By sharing the URIs of the concepts in the ontologies with the URIs of the XML schema types, the semantics of messages is retained. The benefit of this approach is that much of the SOAP technology is retained, existing tools may be reused. Also, developers who are not familiar with Semantic Web technology will find that developing and using these services is unchanged from a normal Java environment. The main problem with this approach comes from the fact that ontologies are in general more dynamic than Java class definitions. In particular, as noted in Sect. "*Ontologies*", we expect the personal information models to change frequently. This approach requires a complete re-run of the whole tool chain and a recompile of the system when an ontology changes, as well as introducing some constraints on the ontologies.

- On the other end of the spectrum it is possible to bypass the parameter passing of SOAP all together, and rely more on the Semantic Web technology. Each method offered by a service will take a single RDF document (possibly including several named-graphs), and all the details about the message are given in these RDF graphs. An additional ontology for messages and parameters must be constructed, and some named-graph aware serialization (e.g., TriG or TriX[l]) of RDF is used to construct the XML SOAP messages. This approach was, for instance, used in the SmartWeb project[m]. The benefit of this approach is that the effort that has gone into modeling the ontologies is not duplicated for modeling objects. Also, the full expressivity of RDF may be used when modeling, as it not required that the instances fit into another representation. The backside to this flexibility is that it is significantly harder to program with RDF graphs than with simple Java objects, and both service developers and consumers need good knowledge about RDF. One can of course envisage new tools that facilitate programming with such RDF messages, but since all the interesting details are hidden inside the RDF parameter, existing SOAP tools for development or debugging are no longer very useful.
- Finally, a hybrid approach of the two methods is possible. Here each method will retain multiple arguments, but each argument is represented by an RDF resource. We envisage two possibilities for doing this: either each parameter is given as a (*named-graph-uri*, *uri*) tuple pointing into an RDF document given as a special parameter; or, alternatively, each parameter is in itself an RDF graph plus the URI of the actual parameter (each RDF graph may contain several resources). The benefit of this method is that the changes in the ontology do no longer require a recompile of the system, while at the same time allowing slightly more compatibility with existing SOAP tools. The problem with this method remains that both client and server programmers need in-depth knowledge of RDF and the ontologies used.

Regardless of which of the three alternatives one chooses, it remains an important issue to make sure that the formal description of the services (i.e., the WSDL+XML Schema definitions) remain semantically correct and retain the pointers to the ontology concepts which the parameters represent. As mentioned, for the first approach this can be handled by well chosen URIs for the XMLSchema types. For the second and third approach the parameters have the form of simple string objects in both the WSDL definition and the SOAP messages, since the RDF serialization is represented as a string. However, both versions of WSDL available at the time of writing allow extensions to the WSDL format itself[n], and additional constraints on the type or form of the RDF instances contained inside the string parameters may be specified here. This is the approach taken by the *Semantic Annotation for WSDL and XML Schema* (SAWSDL) working group[o] and the NEPOMUK project makes use of their standard.

In this section we have considered a very lightweight approach to semantically enriching SOAP Web Services by passing RDF-based parameters. If a more powerful approach is required, the reader is advised to look into OWL-S[p] and the Web Service Modeling Language (WSML)[q], both defining much more sophisticated frameworks for Semantic Web Services.

RELATED WORK

In the following we review relevant research and development approaches for the Social Semantic Desktop. After providing a brief description, we discuss the lessons learned and state our conclusions.

Gnowsis (Sauermann, 2003) was among the first research projects targeting a Semantic Desktop system. Its goal is to complement established desktop applications and the desktop operating system with Semantic Web features, rather than replacing them. The primary focus of Gnowsis is on *Personal Information Management* (PIM). It also addresses the issues of identification and representation of desktop resources in a unified RDF graph. Gnowsis uses a Service Oriented Architecture (SOA), where each component defines a certain interface and it is available as an XML/RPC service.

The **Haystack** (Quan et. al, 2003) project presents a good example for an integrated approach to the SSD field. Inter-application barriers are avoided by simply replacing these applications with Haystack's own word processor, email client, image manipulation, instant messaging, etc. Haystack allows users to define their own arrangements and connections between views of information, thus making it easier to find information located in the personal space. The Haystack architecture can be split into two distinct parts: the Haystack Data Model (HDM) and the Haystack Service Model (HSM). The Data Model is the means by which the user's information space is represented, similar to what has been discussed in Sect. "*Ontologies*". The set of functionalities within Haystack is implemented by objects in the Haystack Service Model (HSM). Haystack has a standard three-tiered architecture, consisting of a user interface layer (the client), a server/service layer, and a database. Haystack was groundbreaking in terms of the dynamic creation of user interfaces, but the project ended before establishing any standards.

Another relevant personal information management tool is the **Semex System** (SEMantic EXplorer)(Dong et. al, 2005). Like other tools, it organizes data according to a domain ontology that offers a set of classes, objects and relationships. Semex leverages the Personal Information Management (PIM) environment to support on-the-fly integration of personal and public data. Information sources are related to the ontology through a set of mappings. Domain models can be shared with other users in order to increase the coverage of their information space. When users are faced with an information integration task, Semex aids them by trying to leverage data collected from previous tasks performed by the user or by others. Hence, the effort expended by one user later benefits others. Semex begins by extracting data from multiple sources and for these extractions it creates instances of classes in the domain model. It employs multiple modules for extracting associations, as well as allowing associations to be given by external sources or to be defined as views over other sets of associations. To combine all these associations seamlessly, Semex automatically reconciles multiple references to the same real-world object. The user browses and queries all this information through the domain model.

A similar idea is exploited by the **IRIS** Semantic Desktop(Cheyer et. al, 2005) ("Integrate. Relate. Infer. Share"), an application framework that enables users to create a "personal map" across their office-related information objects. IRIS offers integration services at three levels:

- Information resources (e.g., email messages, calendar appointments) and applications that create and manipulate them must be accessible to IRIS for instrumentation, automation, and query. IRIS offers a plug-in framework, in the style of the Eclipse architecture, where "applications" and "services" can be defined and integrated within IRIS. Apart from a very small, lightweight kernel, all functionality within IRIS is defined using a plug-in framework, including user interface, applications, back end persistence store, learning modules, harvesters, etc. Like Haystack, inter-application barriers do not exists, because all applications are made from scratch for IRIS.

- A Knowledge Base provides the unified data model, persistence store, and query mechanisms across the information resources and semantic relations among them. The IRIS user interface framework allows plug-in applications to embed their own interfaces within IRIS and to interoperate with global UI services, such as notification pane, menu toolbar management, query interfaces, the link manager, and suggestion pane.

DeepaMehta(Richter et. al, 2005) is an open source Semantic Desktop application based on the Topic Maps standard[r]. The DeepaMehta UI, which runs through a Web browser, renders Topic Maps as a graph, similar to concept maps. Information of any kind as well as relations between information items can be displayed and edited in the same space. The user is no longer confronted with files and programs. DeepaMehta has a layered, service oriented architecture. The main layer is the application layer, which offers various ways for the presentation layer to communicate with it via the communication layer (API, XML Topic Maps (XTM) export, EJB, SOAP). Finally, the storage layer holds all topics and their data either in a relational database or simply in the file system.

Other relevant projects include **Beagle++**(Brunkhorst et. al, 2005), a semantic search engine which provides the means for creating and retrieving relational metadata between information elements present on the destkop, **DBIN**(Tummarello et. al, 2006), which is similar to a file sharing client and connects directly to other peers, **PHLAT**(Cutrell et. al, 2006), a new interface for Windows, enabling users to easily specify queries and filters, attempting to integrate search and browse in one intuitive interface, or **MindRaider**[s], a Semantic Web outliner, trying to connect the tradition of outline editors with emerging SW technologies. The **MyLifeBits** project by Microsoft Research is a lifetime store of multimedia data. Though the system does not intent to be a SSD, one can learn from it how to integrate data, i.e., how to manage the huge amount of media and how to classify/retrieve the data(Gemmell et. al, 2002). It combines different approaches from HCI (Computer-Human Interaction) and information integration, while it lacks a conceptual layer beyond files. The **Apogée**[t] project deals with data integration in applications related to Enterprise Development Process (ECM). It aims at building a framework to create Enterprise Development Process-oriented desktop applications, independent from vendor or technologies. Finally, starting from the idea that everything has to do with everything, has a relationship with everything, **Fenfire**[u] is a Free Software project developing a computing environment in which you can express such relationships and benefit from them.

Although the systems we have looked at focus on isolated and complementary aspects, they clearly influenced the vision of the SSD presented here. Some of the architectural decisions made in the NEPOMUK project and presented in this chapter are similar to those of platforms like Haystack, IRIS, and DeepaMetha, e.g., in that we present a User Interface Layer, a Service and a Data Storage Layer. The modular architecture, also identified within the Haystack, SEMEX, and DeepaMetha systems, as well as the standardized APIs offer an easy way of introducing new components. Our approach guarantees that each component may be changed without affecting other components it interacts with. The interaction has to suffer only in the case in which the API of the component is modified. The NEPOMUK Architecture also provides service discovery functionalities: the

NEPOMUK Registry providing a proper support for publishing and discovering the existing NEPOMUK Services by using a standard interface.

CONCLUSION

We presented the Social Semantic Desktop as a comprehensive approach to information handling. Oriented at the needs of knowledge workers, this approach centers around supporting the main information-oriented activities: The articulation of knowledge and the generation of new information items; the structuring, relating, and organization of information, and the sharing of formal and informal information within networks of co-operating people. From this, we derived key functionalities of the desktop, but also for search, social interaction, profile building, and data analysis.

Building the SSD relies on basic principles: Whatever appears within the personal workspace is treated as an information item. Content, relations, special services all refer to formal annotations of such information items, which in turn link between information items and personal information models. Unifying the flexibility and personal liberty of expressing whatever concepts seem relevant with the commitment to socially shared conceptualizations results in a layered hierarchy of ontologies which allow the necessary differences in stability, sharing scope, and formality. Integrating the tools of everyday information processing asks for an easy and flexible integration of existing desktop applications. Finally, the adoption of Semantic Web standard technology for representation and communication enables the easy transgression from personal annotated information to shared Semantic Web content.

Consequently, the architecture of the SSD combines standards-based data repositories with a rich middleware, which in particular allows for manifold service integrations and communications. On top of that, various presentation clients and specific applications support whatever activities are performed on the desktop. Such applications may be highly domain-specific, although core functionalities of knowledge work trigger standard applications, e.g., for document processing, task management, communication, etc.

The design decisions presented result in particular implementation and engineering principles; we outlined the adaptation to RDF, the service integration, and the message passing mechanisms in particular.

In summary, the SSD offers the basic technology and tools for everyday information processing by knowledge workers. In order to reach the intended wide acceptance and broad uptake, care was taken to make the central software components available under open source licenses, and to encourage the development and contribution of application-specific enhancements and adaptations. The concept of the SSD is promising and relies on a number of techniques which reach their maturity right now – consequently, a number of research and development projects are under way and contribute to the overall evolution of the concept.

Following the realizations described in this chapter, we see the SSD as a basis for the self-motivated generation of semantically annotated information, which will not only help the individual by allowing multitudes of specific services and support, but will also initiate a wide movement to populate the Semantic Web.

FUTURE RESEARCH DIRECTIONS

Although the ideas of the Social Semantic Desktop are based on solid foundations as presented here, the research areas surrounding this topic are still in their infancies. We will briefly discuss some of the pre-dominant challenges in the coming years:

Trust and Privacy. As pointed out in the Semantic Web technology stack presented earlier, a crucial component for any high-level Semantic Web service is the issue of trust and privacy.

Trust touches on a wide range of issues, from the technical issues of cryptographic signatures and encryption, to the social issues of trust in groups and among individuals. These issues are all as valid for the Social Semantic Desktop as for the Semantic Web in general, or perhaps even more so, as people are less critical of putting personal data on their personal desktop.

User, group, and rights management. When a single personal Semantic Desktop allows easy sharing of information with the network of Social Semantic Desktops, determining access rights for this information becomes very important. The Social Semantic Desktop sets new requirements for distributed authentication, flexible group management, and fine-grained access rights, all the while remaining intuitive and unobtrusive for the end user.

Integration with the wider Semantic Web and Web 2.0. Currently we are talking about the Social Semantic Desktop as a network of Semantic Desktops built on the same standards. It is important to remember that the key benefit of Semantic technology is the easy access to integration with anyone using the same representational languages and ontologies. The growth of feature-rich Web applications is growing rapidly, and ensuring a strong bond between the Semantic Desktop and these services is a continuous challenge.

Ontologies and Intelligent Services. To date ontologies have been used to introduce a common vocabulary for knowledge exchange. On the Social Semantic Desktop ontologies are used to formalize and categorize personal information. This introduces many interesting issues around ontology versioning, ontology mapping, and ontology evolution. Furthermore, using ontologies with well-defined semantics will allow intelligent services to be built (e.g., using reasoning) that allow for much more than just browsing and (simple) searching.

User Evaluation. The underlying thesis of the whole (Social) Semantic Desktop effort is that the added semantics will improve productivity and enable new forms of cooperation and interaction which were not previously possible. In-depth empirical evaluation with real users of a Social Semantic Desktop systems are required to determine if this thesis really holds.

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ADDITIONAL READINGS

Current and recent research and development in the SSD domain has already been presented in Sect. "*Related Work*". However, one influence that has not been covered in this chapter so far, but is closely related to the idea of a Semantic Desktop is the concept of *Semantic File Systems* – file systems in which files are not organized hierarchically, but rather according to their metadata. The concept and an early implementation are described in detail in (Gifford et. al, 2001).

Finally, as another entry point for additional reading, we would like to point the reader to the series of *Semantic Desktop Workshops* which were co-located with the International Semantic Web Conferences in 2005[v] and 2006[w].

From a historical perspective, the most important references in the Social Semantic Desktop domain are those by Vannevar Bush (1945) and Doug Engelbart (1962) which we mentioned in Sect. "*Background*". Another important early influence is certainly Ted Nelson's work on hypertext (Nelson, 1965). A modern vision of those ideas is a paper by Decker and Frank (2004), which also coined the term "Semantic Desktop". Of course, any work that is based on the ideas of the Semantic Web is not complete without references to seminal papers such as (Berners-Lee et. al, 2001) or (Hendler, 2001). In fact, the original vision of the World Wide Web itself already contained the idea of an information space that would reach from "mind to mind" (Berners-Lee, 1999); a thought that is central to the SSD.

Most of the references given in this chapter are of a technical nature. However, one has to keep in mind that the SSD is a tool for *information management* and *knowledge work*, and thus psychological and sociological research into the nature of knowledge work in any form are relevant as well. Oren (2006) provides a detailed overview of literature in this field, with the intention of applying the lessons learned to the development of the Semantic Desktop.

ENDNOTES

[a] RDF: http://www.w3.org/RDF/

[b] The NEPOMUK Project is supported by the European Union IST fund, grant FP6-027705

[c] Within the NEPOMUK Project, these personas were created by distilling typical users from a series of interviews and evaluations with our use-case partners.

[d] Tim Berners-Lee talk, XML and the Web: http://www.w3.org/2000/Talks/0906-xml-web-tbl/

[e] RFC1738: http://tools.ietf.org/html/rfc1738

[f] WSDL: http://www.w3.org/TR/wsdl

[g] XML Schema: http://www.w3.org/XML/Schema

[h] SOAP: http://www.w3.org/TR/soap

[i] In this chapter we make the assumption that a modern object-oriented programming language like Java will be used for implementation, but observations and solutions are equally valid for most other languages.

[j] MDA: http://www.omg.org/mda/

[k] RDFReactor: http://wiki.ontoworld.org/wiki/RDFReactor; RDF2Java: http://rdf-2java.opendfki.de; Elmo: http://openrdf.org, etc.

[l] TriG/TriX: http://www.w3.org/2004/03/trix/

[m] SmartWeb: http://www.smartweb-project.de/

[n] Language Extensibility in WSDL1: http://www.w3.org/TR/wsdl#_language and in WSDL2: http://www.w3.org/TR/wsdl20#language-extensibility

[o] SAWSDL: http://www.w3.org/TR/sawsdl/

[p] OWL-S: http://www.daml.org/services/owl-s/

[q] WSML: http://www.wsmo.org/wsml/

[r] ISO/EIC 13250:2003: http://www.y12.doe.gov/sgml/sc34/document/0129.pdf

[s] MindRaider: http://mindraider.sourceforge.org/

[t] Apogée: http://apogee.nuxeo.org/

[u] Fenfire: http://www.fenfire.org/

[v] SemDesk2005: http://tinyurl.com/yuxpld

[w] SemDesk2006: http://tinyurl.com/2hqfak

APPENDIX: QUESTIONS FOR DISCUSSION

Q: I prefer to handle my photo collection in a web 2.0 photo sharing environment. Is this compatible with the Social Semantic Desktop? May I keep the work I have invested here?

A: Yes. Every photo in your collection can be reached via a specific URI, thus it can be handled as a particular information item in the SSD. You might implement a suitable wrapper to transfer local annotations from your SSD onto the photo sharing platform, if you intend to disclose this information.

Q: The Social Semantic Desktop presupposes that everything is an information item. What about entities which are not information but real-world objects? Can I manage them in the SSD and add comments about them, e.g., about my friend's cat?

A: The solution is easy: Just create an appropriate description of the real world object within your SSD, thus creating an URI for the object in question. Let's say you create an instance of the class pet in your SSD (assuming you have this category within your SSD) and describe it as 'well-known house cat'. Then you can link this instance to, e.g., a photo of the animal, or you add an 'owns' link which connects it to the URI of your friend, and so on. Making an arbitrary object re-appear as a formal instance within the SSD models is often called 're-birthing', btw.

Q: Think about scenarios you encounter every day, and where the SSD can make your work easier.

A: The answer is of course a personal one, but for a typical knowledge worker (researchers, students, journalists, etc.) here are some example ideas:

• Show me related appointments when composing emails to a person, i.e., You also have lunch with Claudia next week.

• Show me previously viewed PDF documents on the same topic when researching on Wikipedia.

• Remember my meal and window preferences when booking flights.

• Remind me of my previous idea of combining topic A with topic B when reviewing my topic A notes.

• Let me connect an incoming email from a student to the colleague who introduced me to that student.

Q: What are the benefits of the Social Semantic Desktop compared to solution such as Microsoft Exchange server or the tight integration of applications on MacOSX? They also fulfil many of the functionalities required by the scenarios outline in this chapter.

A: The Social Semantic Desktop is different because of the standards used to build it. Firstly, by basing the representational layers of the Semantic Desktop on the existing (Semantic) Web standards we enable interoperability by a wide range of existing projects, and secondly, by creating new standards for desktop integration and data-formats we encourage future software developers to build on top of the Semantic Desktop. On the Semantic Desktop both the applications and the data encourages open access, and this exactly the opposite of the vendor lock-in that for instance Exchange Server aims for.

Q: Inspect the current state of the Semantic Web and the data available. What data-sources and/or ontologies do you think could be useful for integration with the Semantic Desktop?

A: The answer will of course change as the Semantic Web evolves, but at the time of writing relevant ontologies include:

• The Friend-of-a-Friend project – http://xmlns.com/foaf/spec

• The Description-of-a-Project schema – http://usefulinc.com/doap

• The Semantically Interlinked Online Communities project – http://siocproject.org/

• Dublin Core for basic meta-data – http://dublincore.org/

Useful data-sources and/or web-services include:

• GeoNames for (reverse) geocoding – http://www.geonames.org/

• DBpedia for a Semantic Web view of Wikipedia – http://DBpedia.org/

This work was previously published in Semantic Web Engineering in the Knowledge Society, edited by J. Cardoso; M. Lytras, pp. 290-314, copyright 2009 by Information Science Reference (an imprint of IGI Global).

Chapter 8.18
Social Media Marketing
Web X.0 of Opportunities

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ABSTRACT

In recent years social media applications, which enable consumers to contribute to the world of online content, have grown in popularity. However, this growth is yet to be transformed into a sustainable commercial model. Starting with a brief overview of existing online advertising models, this chapter discusses the opportunities available for advertisers trying to reach consumers through social media. The chapter focuses on viral marketing as a viable option for marketers, reviews recent viral marketing campaigns, and offers recommendations for a successful implementation of social media marketing. In conclusion, the author examines future trends regarding the utilization of the emerging Semantic Web in marketing online.

INTRODUCTION

The brief history of the World Wide Web is filled with stories of unprecedented commercial success as well as shattered dreams of hopeful online entrepreneurs. It should not be surprising that, just as their predecessors, Web 2.0 and social media also bring about important questions regarding their sustainability. On the one hand, since 2006, social media sites have been growing in number and popularity (Boyd & Ellison, 2007). For example, according to comScore, a leading Internet information provider, as of December 2007 Facebook had close to 98 million unique visitors, and Fox Interactive Media, including MySpace, had more than 150 million. Similarly, recent years have seen a phenomenal growth in the popularity of weblogs (blogs): in 2007 every day, 175,000 new blogs were added to an estimated 67 million blogs that were already up and running (as cited in Rappaport, 2007). On the other hand, skeptics voice their belief that social media, despite their current popularity, may not have the staying power ("MySpace, Facebook and Other Social Networking Sites," 2006).

An important component of skeptics' concerns about the sustainability of social media pertains to the fact that there are no agreed upon ways of monetizing the rising popularity of social media (Allison, 2007; Hall, 2007). Perhaps, the most

DOI: 10.4018/978-1-60566-368-5.ch004

telling example of this problem is Facebook. Despite having a market value of around $15 billion, Facebook's 2007 revenue was $150 million (McCarthy, 2008) – a considerably small share of the $21 billion online advertising industry. Then, the question of whether social media will be more than just a fad boils down to advertisers' ability to utilize the unique opportunities presented by social media. Although advertisers and social media entrepreneurs are yet to agree on a marketing model for social media, recent discussions point to several important requirements that a successful model should accommodate. Given the decentralized architecture of the Internet in general and social media in particular, a central tenet of these recent debates concerns the relative merits of more conventional advertising methods and word of mouth (or word of "mouse") based marketing approaches that cede control to the consumers.

In the light of these debates, this chapter will start by summarizing online advertising methods. After this brief summary, the chapter will focus on the opportunities and challenges for online marketers that are brought about by the development of social media. Finally, the chapter will discuss viral marketing and integrated marketing communication principles to provide a roadmap for realizing the financial and marketing potential of Web 2.0.

BACKGROUND

Online Advertising

In its most traditional sense, *advertising* is defined as a paid form of communication appearing in media, usually with the purpose of reaching a large number of potential customers. Since 1993, when CERN announced that the World Wide Web would be available to anyone free of charge, advertisers experimented with different methods of reaching consumers online. Unsurprisingly, the first reaction of advertisers was to treat the World Wide Web as a natural extension of traditional media, such as newspapers and television. And, just as in conventional mass media, early online advertising methods, such as banners, pop-ups and interstitials, were characterized by intrusiveness and adoption of a one-way stimulus-response model within which information flows from the advertiser to the customer (McCoy, Everard, Polak, & Galletta, 2007; Rappaport, 2007).

However, even in the early years of online advertising, signs of what was to come in interactive marketing were revealed. Shortly after banners became a popular online advertising method in 1994, keyword-activated "smart banners" were introduced. What set smart banners apart from their predecessors was that the contents of the banners were personalized in response to the search words entered by the users. As such, smart banners were one of the first examples of how content variability in new media (Manovich, 2001) can be utilized to customize information to consumers' needs (Faber, Lee & Nana 2007).

Customization and Message Congruence in Interactive Media

As noted by several researchers, content variability and the consequent ability to customize content according to the needs of the consumer are made possible by the interactive capabilities of new media (Baruh, 2007; Faber et al., 2007). Two important characteristics of interactive media are the ability to facilitate a two-way flow of communication and the related ability to track and store every bit of information about how consumers use a system (McCallister & Turow, 2002). Real-time information about how consumers use a medium, especially when combined with other data through data mining, enables marketers to extract profiles about individuals that can then be used to tailor messages and products.

The ultimate aim of this process is to target different consumer groups with specific messages that can tie a product to their informational needs, lifestyles or predispositions. Extant literature on online targeting suggests that consumers will be more receptive to messages that are tailored as such (McCoy et al. 2007; Robinson, Wyscocka, & Hand, 2007). To a large extent, this higher receptivity is the result of being able to promote the "right" product, at the "right" time and place and the "right" tone. A case in point that supports these research findings is the success of Google's AdWords, which accounts for 40% of online advertising spending. The premise of AdWords is that the marketers can reach motivated consumers by providing them with contextual advertising messages congruent with their online keyword searches (and presumably, their interests). Similarly, a widely known feature of online vendors such as Amazon.com is their customized product recommendation systems. The recommendation system these online vendors utilize is based on a data mining system called *market-basket analysis* (also called *association discovery*). The premise of this system is that the marketer can create cross-selling opportunities by identifying the product types that a customer would be interested in (e.g., microwave popcorn) on the basis of other products that he or she has already purchased or is purchasing (e.g., a DVD movie). As such, what the market-basket analysis algorithm does is to identify product clusters that are purchased together or sequentially using the product purchasing history of customers whose tastes are similar to a specific customer.

ONE STEP FURTHER: WEB 2.0 OF OPPORTUNITIES

Customization and Data from Social Media

As can be inferred from the discussion above, collecting information about consumers is an important prerequisite of customizing advertising messages in accordance with the informational needs and lifestyles of consumers. Certainly, data about individuals' online media consumption and purchasing behavior, especially when combined with other sources of data such as credit history, provide marketers with an unprecedented capability to not only determine which customers to target (and avoid) but also when and how to target them.

Within this context, social network sites, such as Facebook, MySpace or LinkedIn, have a potential to extend what is already a large pool of data about consumers. Such social network sites are designed to allow users to create personal profiles and connect with other users, friends or strangers. And through the creation and perennial updating of their profiles, users of social network sites actively participate in the dissemination of information about themselves (Andrejevic, 2007; Solove, 2007). The types of information users of social network sites disclose include: information about their hobbies, interests, likes and dislikes, whom they associate with, a dinner they had a couple of days ago and, sometimes, disturbingly private details about their social and sexual lives. Blogs, another highly popular form of social media, are no different from social network websites. As Solove (2007) points out, any topic, any issue and any personal experience are fair game for more than 60 million bloggers around the world.

The massive quantities of data that social media users reveal online are not left untapped by media companies and marketers. For example, MySpace has recently begun an effort to mine data from its more than 100 million users in order to better target advertising messages. Named as MySpace HyperTargetting, the system initially began mining data about general interest categories, such as sports and gaming, and is now further dividing interests into thousands of subcategories (Morrisey, 2007).

The Community Touch

An important point to note with respect to the types of data available in social media is that the digital goldmine of information is not simply a more detailed version of data collected about consumers' interests and behaviors in other forms of interactive media. Rather, in social media, the available data contain unprecedented details about the network affinities of users. The data about the network affinities of users can be utilized at two levels. First, through the "tell me about your friends and I'll tell you about yourself" principle, marketers can make further refinements to consumers' profiles based on the interests shared by members of the communities they belong to. Secondly, information about the communities that an individual belongs to can be used to identify the paths through which they can be reached.

Recent marketing techniques devised by online vendors and social media outlets illustrate how information about social affinities can be used to reach consumers. For example, Amazon.com's iLike application, a music service that markets new music and concerts to interested listeners, works by scanning the music libraries of its subscribers. The service connects like-minded listeners and promotes new music to users through add-ons such as Facebook's iLike widget. Similarly, Facebook's own Beacon platform tracks purchases Facebook users make on partnering online vendors and then informs users' networks about the recent purchase (Klaassen & Creamer, 2007; Thompson, 2007; Tsai, 2008). In addition to leveraging existing social networks to disseminate marketing messages, some software applications, for example, Stealth Friend Finder automatically generate massive and targeted Facebook Friend Requests to directly connect with the consumers.

Web 2.0 of Opportunities: Viral Marketing in Social Media

These examples of social targeting pinpoint the direction that marketing in social media can take. Rather than being an advertising distribution system, Beacon is a viral marketing tool that lets community members know what their co-members have purchased. In other words, with the Beacon system, the consumer, through the publication of his/her purchasing decision, assumes the role of an influencer. Subramani and Rajagopalan (2003) suggest that consumers may assume such a role either passively or actively. In the passive form, the consumer spreads the word simply by using or purchasing a product (as is the case when an e-mail from a Blackberry user contains a message saying the e-mail was sent using a Blackberry account). On the other hand, active viral marketing requires that consumers participate in the message dissemination process by contacting other potential customers (Clow & Baack, 2007).

An important criticism of passive viral marketing systems in social media is that they fail to utilize an important characteristic of Web 2.0 in general and social media in particular. Instead of being a passive consumer of readily available content, Web 2.0 users are participants in both the creation and dissemination of content. Accordingly, despite utilizing social graphs to target messages more effectively, the "your friend just bought this book from Amazon.com" message is nevertheless an advertising method that affords the consumer very little power as a potential source of influence (Anderson, 2006; Windley, 2007).

Considered from this perspective, a more appropriate way of utilizing the viral potential of social media users is to invite them to actively participate in promoting the product. First, existing research shows that close to a quarter of users of online social networks, such as Facebook, use these sites to influence other users (Webb, 2007). Second, as evidenced by Facebook users' negative reaction to Beacon, social network sites are relatively intimate environments and advertising intrusion (especially given an overall mistrust for advertising messages) is not welcome (Clemons, Barnett, & Appadurai, 2007; Gillin, 2007; Hall, 2007). In contrast, 94% of online social network users find product recommendations from friends to be at least very worthwhile to listen to (MacKeltworth, 2007). This finding is not surprising since recommendations coming from friends, family members, or colleagues are more likely to be trustworthy and relevant to one's needs (Clemons et al., 2007). In fact, according to a recent survey, along with the reputation of the manufacturer, recommendations from friends and family members are the biggest factor that influences purchasing decisions made by individuals (Klaassen & Creamer, 2007). Third, thanks to synchronous connections between multiple users, a computer-mediated word of mouth can reach a larger number of people than word of mouth in the brick and mortar world.

As briefly mentioned before, in addition to these three important advantages of inviting social media users to actively disseminate marketing messages, product information, or recommendations, social media also provide marketers with an unprecedented capability to identify the individuals who would be the best candidates in a social network to act as viral marketers. Domingos (2005) suggests that in addition to actually liking a product, a suitable viral marketing candidate should have high connectivity and should be powerful as a source of influence. Using social network analyses (Hanneman & Riddle, 2005; Scott, 2000; Wasserman & Faust, 1995), data regarding personal affiliations and social network memberships can be utilized to identify opinion leaders ("hubs") who are central to and powerful in a given network.

Recently, there have been several attempts to apply social network analysis to social media to identify social network influencers. For example, Spertus, Sahami, and Büyükkökten (2005) used network data from Orkut.com to identify members who could be used to recommend new communities to users. Similarly, in a study of Flickr and Yahoo360 networks, Kumar, Novak and Tomkins (2006) were able to distinguish between passive users and active inviters that contributed to the extension of the network. And recently, MySpace announced that it is constructing an "influencer" option for advertisers who could be interested in reaching users with active and large networks. To identify potential influencers, MySpace will use data regarding users' group memberships and interests, their friends' interests, level of network activity in a given network and other factors (Morrissey, 2007).

The Integrated Marketing Communications Perspective

In 1976, Wayne DeLozier suggested that marketing communication was a process of creating an integrated group of stimuli with the purpose of evoking a set of desired responses. According to this integrated marketing communications perspective, which has been adopted by many companies since the 1980's, rather than being considered in isolation from one another, each component of the marketing mix should be coordinated to present a unified image to consumers.

Considered from this perspective, fulfilling the viral marketing promise of Web 2.0 and social media requires that the viral marketing effort be part of a greater scheme of corporate communications. In other words, rather than merely focusing on spreading the word, the viral marketing effort should fit the brand personality (Webb, 2007). A particular case illustrating this point is the "Top This TV Challenge" campaign of Heinz®. In this campaign, Heinz® invited consumers to produce 30-second TV commercials for Heinz® Ketchup and submit the commercials on YouTube. The winner of the contest, determined first by a panel of judges and then by the votes of consumers, was awarded $57,000 and a chance to get the commercial aired on national television. The premise of the campaign was not only that it fit the "fun" brand image of Heinz® Ketchup but also that the consumers would play a crucial role in disseminating Heinz Ketchup's name. Just as intended, many of the 4,000 qualified contestants who posted their videos on YouTube (as required) also created MySpace and Facebook pages promoting their own videos and consequently Heinz Ketchup.

Another example illustrating the connection between viral marketing and an integrated marketing communications approach that provides a fit between the marketing campaign and the organizational image is the "Download Day" organized by Mozilla Firefox in June 2008. Mozilla is a not for profit organization that is mostly known for its Firefox Web Browser (a challenger of the market leader, Internet Explorer). The organization is a self-proclaimed open source project that publicly shares the source codes of their own software for the development of new Internet applications. Unlike its major competitors, such as Internet Explorer and Safari, the Firefox Web Browser is positioned as an "organic browser" that has been developed through a collaborative process whereby thousands of software developers – the majority of which are not employed by Mozilla – contribute to the software. Likewise, the dissemination of Firefox largely relies on volunteers "spreading" the software.

In June 2008, Mozilla created a Download Day event to promote the third version of its Firefox Web Browser. The purpose of the Download Day was to set a world record in the number of downloads in 24 hours. To inform would-be users about the event, Mozilla heavily utilized social media and viral marketing. Following the initial announcement, the word of mouth about the Download Day first quickly spread through social news aggregators such as Digg™ and Reddit.com. Then, the links in the social news aggregators forwarded interested users to the Download Day homepage. In addition to asking individuals to pledge to download Firefox on Download Day and providing an update on the number of individuals who pledged to download, the homepage also invited them to engage in viral marketing by inviting their social networks to the event via Facebook, Bebo and MySpace, promoting the event on microblogging Twitter-like websites or organizing "Download Fests" on university campuses.

These two examples provide important insights regarding the criteria for a successful viral marketing campaign online (and in social media):

1. **Campaign-Organizational Image Congruence:** In the Download Day example, the event, the promoted goal (setting a world record) and the method of dissemination of the information of the event (through social media) were in line with Mozilla's overall image as a non-corporate, decentralized and innovative organization that relies on volunteers and users for its promotion as well as software development. Similarly, the "Top This TV Challenge" campaign of Heinz® fits the "fun" brand image of Heinz® Ketchup.
2. **Inciting Virality and Buzz:** This is the key for creating a pull rather than inducing a push in an organization's marketing campaign. An attractive event (in this case a world record setting event) or a message is a crucial component in developing an organic viral marketing process. The ability to create buzz through the event will also increase the chances that the viral marketing campaign will supplement other marketing communication goals: such as, providing material for other promotional efforts or getting coverage in traditional media—the latter being especially important for Firefox given that Mozilla does not have a centrally controlled advertising budget to spend on conventional media. For example, the overwhelming interest in the Top This TV Challenge (with 5.2 million views) also helped create publicity for the company in

the mainstream media and prompted Heinz® to repeat the challenge in 2008.

3. **Getting Consumers to be Personally Invested:** Mozilla's Download Day emphasized not only the possibility of a world record but that the consumers would be an integral part of this unique success. In this case, the prospects of being a part of a possible Guinness World Record-setting activity may have increased the chances that consumers identify with (and are invested in) not only the product or the brand but also the success of the campaign. Perhaps, for the contestants in the Heinz® Top This TV Challenge, the personal investment was even higher because their own success (in terms of getting enough votes to win the contest) partly depended on the popular votes they would get from other consumers.
4. **Creating Levels of Viral Involvement:** In terms of options available for viral marketing, social media not only expand the available options but also create the possibility of multiple levels of viral involvement. For example, in the Heinz® Top This TV Challenge, the level of viral activity of a contestant that promotes his/her video will naturally be higher than a regular YouTube user who happens to come across a challenger's video that is worth sharing with friends. The Mozilla's Download Day event, on the other hand, systematically utilized the social media (and other venues) to create tiers of consumer involvement. For example, an enthusiastic Firefox user could go as far as organizing a download festival whereas a regular user of Facebook or MySpace could invite friends to pledge for the download on the Mozilla's Download Day homepage.

FUTURE TRENDS

As discussed in the preceding sections, a central tenet of the debates regarding the marketing potential of social media pertains to the balance that needs to be struck between the efficiency of automatic recommendation systems and the organic involvement created by the real community touch of viral marketing campaigns that invite consumers to actively participate in the dissemination of the marketing messages. On the one hand, systems such as Facebook's Beacon platform and MySpace's "influencer" option promise to deliver large-scale, automated word of mouth that can expand the reach of viral marketing campaigns. However, the perceived intrusiveness of such systems, as well as their tendency to use consumers as passive hubs to automatically relay marketing messages, may call into question the true virality of such advertising efforts, consequently reducing their appeal for consumers.

Recent discussions regarding "Web 3.0" and the future of the Internet may point to the direction that this uneasy relationship between virality and automatic customization may take. Despite frequent disagreements regarding the definition of Web 3.0, an increasing number of commentators have started to use the concept interchangeably with the Semantic Web – a set of technologies that enable software agents to understand, interpret and extract knowledge from information, making it possible for them to complete "sophisticated tasks for users" (Berners-Lee, Hendler & Lassila, 2001). Michael Bloch provides a simple example explaining how the Semantic Web would work:

You want to go out to dinner…and your car is in the shop… You issue a command for the agent to search for a restaurant serving Indian food within a 10-mile radius…You want a restaurant that has a 4 star rating issued by a well-known restaurant critic. Furthermore, you want the table booked and a cab to pick you up from your place. Additionally you want a call to be made *to your phone once that's all done; but you don't want to be disturbed by the call as you'll be in a meeting - just for the reservation details added to your phone organizer. (Bloch, 2007)*

As this example suggests, the Semantic Web is more than a compilation of web pages. Rather, it is a network of systems and databases that can communicate with each other to perform tasks on an individual's behalf. Moreover, as recent developments suggest, the Semantic Web will have the potential for subtler customization of information in accordance with the cognitive (and perhaps emotional) styles/needs of consumers. For example, an article by Hauser, Urban, Liberali and Braun (forthcoming) from MIT's Sloan School of Management announces an algorithm that uses clickstream data to morph the website content and format to the cognitive style of its users.

As evidenced by recently developed semantic web advertising applications (such as *Semantic-Match™* – a semantic advertising platform that utilizes a natural language processing algorithm to understand content and sentiments and target advertising accordingly), when applied to online advertising, semantic capabilities can enhance customization, decrease errors that are associated with keyword targeted advertising and provide a more conversational interaction between the advertiser and the consumer. With respect to viral marketing, such advancements in language processing and customization can address an important shortcoming of passive virality by making it more personal. Whereas social network analyses aid the identification of hubs that can act as active viral marketers, improvements in natural language processing can prove beneficial in terms of understanding the communicative processes and dynamics within a social network. This information can help the marketing organization create different strategies to reach various potential hubs, create levels of viral involvement depending on the depth and the context of the communicative processes between network members, and customize the webpage that potential customers arrive at as a result of the viral marketing effort.

CONCLUSION

In recent years, Web 2.0 applications that enable web users to contribute to the world of online content have grown in popularity. In 2008, the Top 10 most frequently visited web site list of Alexa Internet – a web traffic information service – consistently included several social media sites: namely, YouTube, MySpace, Facebook, Hi5, Wikipedia and Orkut.com (2008). Despite their popular appeal, however, many of the Web 2.0 initiatives are still struggling to turn their popularity into financial success.

What is important to note is that when it comes to monetizing social media, there are no magic formulas. However, as explained above, the interactive nature of social media, combined with consumers' participation in the creation and dissemination of information, make viral marketing a viable candidate to fulfill the promise of a Web 2.0 of opportunities. In contrast to impersonal advertising methods that consumers do not trust and find intrusive, viral marketing through social media has the potential to be a personal, personable, participatory and trustworthy. source of information. Nonetheless, this should not be taken for granted that any and all viral marketing efforts in social media would be successful.

Extant literature suggests that there are certain prerequisites to a successful implementation of a viral marketing campaign in social media. First, as Webb (2007) suggests, because the company is going to have to rely on consumers to push the message, the message (and the product) should be worth pushing. Second, as consumers grow more suspicious of traditional advertising methods, marketers engaging in viral marketing in social media should pay the utmost attention to keeping viral marketing free from centralized interference that can damage its credibility. For example, Coplan (2007) notes that to remain credible, consumer marketers should be "honest about their opinions good and bad, open about their affiliation – and unpaid" (p. 26). This second prerequisite of success in social media marketing is closely related to the third one: In the world of consumer marketers, companies should learn to "cede control to customers" (cited in Poynter, 2008, p. 12). Partially, this means that viral marketing may be mixed with negative word of mouth and backlash (Gillin, 2007; Giuliana, 2005). At the same time, both positive and negative word of mouth should be considered as an opportunity to engage in a conversation with customers. For example, recently Cadbury PLC decided to relaunch Wispa (a chocolate bar discontinued in 2003) as a response to demands from 14,000 Facebook members (Poynter, 2008). Finally, as evidenced by the recent negative public reaction to the inadequate privacy protection on Facebook, marketers should be aware of the relatively intimate nature of social network sites.

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KEY TERMS AND DEFINITIONS

Content Variability: *Content variability* refers to the notion that new media objects can exist in an infinite number of variations. This characteristic of new media is the result of the digital coding of content and consequently the modular nature of information.

Data Mining: Data mining is a technologically driven process of using algorithms to analyze data from multiple perspectives and extract meaningful patterns that can be used to predict future users behavior The market basket analysis system that Amazon.com uses to recommend new products to its customers on the basis of their past purchases is a widely known example of how data mining can be utilized in marketing.

Interactive Media: *Interactive media* is a catch-all term that is used to describe the two-way flow of information between the content user and the content producer. In addition to enabling consumers to actively participate in the production of content, interactive media also allow for the collection of real time data, which can later be used for content customization.

Semantic Web: The *Semantic Web* refers to a set of design principles, specifications, and web technologies that enable networked software agents to understand, interpret and communicate with each other to perform sophisticated tasks on behalf of users.

Social Network Analysis: Social network analysis is a research methodology utilized in research to investigate the structure and patterns of the relationship between social agents. Examples of sources of relational data include: contacts, connections, and group ties which can be studied using quantitative methodologies.

Social Network Sites: Social network sites are web-based systems that enable end-users to create online profiles, form associations with other users, and view other individuals' profiles. Examples of social network sites include: Match.com, MySpace, Facebook, Orkut, Hi5, Bebo and LinkedIn.

Viral Marketing: *Viral marketing* refers to a form of word of mouth marketing that relies on consumers relaying product information, a marketing message or a personal endorsement to other potential buyers.

Web 2.0: Introduced in 2004, during a conference brainstorming session between O'Reilly

Media and MediaLive International, *Web 2.0* refers to the second generation of web-based content. Rather than merely pointing to technological changes in the infrastructure of the Internet, the concept of Web 2.0 underlines the notion that end-users can do much more than consume readily available content: The user of Web 2.0 also plays a key role in the creation and the dissemination of content. Popular examples include: video-sharing and photo-sharing sites, such as YouTube and Flickr; social network sites, such as Orkut, MySpace and Facebook; and Weblogs (blogs).

This work was previously published in Handbook of Research on Social Interaction Technologies and Collaboration Software; Concepts and Trends, edited by T. Dumova; R. Fiordo, pp. 33-44, copyright 2010 by Information Science Reference (an imprint of IGI Global).

Chapter 8.19
Visualization in Support of Social Networking on the Web

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ABSTRACT

In this chapter the authors explore the contribution visualization can make to the new interfaces of the Semantic Web in terms of the quality of presentation of content. In doing this they discuss some of the underlying technologies enabling the Web and the social forces that are driving the further development of user-manipulable interfaces.

INTRODUCTION

The internet is a communication device. Its interface consists not just of static text but other static and dynamic constructs e.g., tables, images, animations and customised web applications. Some of these elements hold meaningful content while others are used for graphic reasons[1]. The rise of social networking in the form of Weblogs, discussion boards, wikis, and networking sites allows the general public to share content on the web. Such non-technical users require high level web-apps to help design and deliver their content with as little explicit dependence on the technicalities as possible.

Before talking about social networking on the web it is worth considering what this means. The expression 'Social Networking Sites' is used for sites with the primary purpose of supporting or creating sociable relationships, prominently friendships, but we use 'social networking' in a more inclusive way to include the formation of all kinds of networks such as those, for example, that form to collaborate on a task (as with an open source development).

DOI: 10.4018/978-1-60566-650-1.ch009

The naming conventions used within visualization can confuse, this relates to the difficulty in producing a visualization taxonomy which is discussed later. Visualization is a visual means to analyse data and is cross-disciplinary. The name of the discipline normally identifies a particular theme but where the name of the discipline is also the name of a technique the naming convention lacks clarity. For example social networking visualization could be the use of visual methods to show and analyse social networks or could be the use of visualizations in the support of social networking i.e., as a means to help people form and co-ordinate their activities. This chapter looks at the latter, at how visualization can aid communication on the web. Whilst this can include the visualization of social networks (because users of the web may like to understand the social networks they participate in) that is not the primary focus.

In this chapter we introduce visualization, its history and the two main visual paradigms in use, dividing the visualization community between those concentrating on scientific and information visualizations respectively. We survey the technologies that shape the web and the applications running on it. This allows us to look at how the technology shapes visualization systems (the visualization pipeline and the flow of data) and how these can be distributed to work efficiently in web environments. Finally we review some web applications that support social networking and consider what future trends may be.

WHAT IS VISUALIZATION?

The History of Visualization

There is no accepted definition of visualization but it can be adequately summarized for our purposes as using visual means to aid the communication and understanding of information. Modern visualization increasingly uses computer graphics technology to make information accessible. Visualization's long history predates the origin of computers by at least 8 thousand years. Maps are one of the oldest forms of graphical aid whose continued usefulness is demonstrated by the fact that mapping applications are amongst the most popular web-based applications. Before computers visualizations generally were not interactive, though there are exceptions to this as some scientists developed models and pop ups in books to explain their ideas but these were rare and expensive (Tufte, 1997; Tufte, 2001).

The roots of visualization are tangled into our history; a timeline of visualization is available on the internet (Friendly, 2008). Many historical breakthroughs were made possible through visualization, such as John Snow's use (in London in 1854), of maps to show the distribution of deaths from cholera in relation to the location of public water pumps. Visualization has never been an isolated discipline; it has been an integral element of scientific, intellectual and technical developments.

The timeline of visualization shows that the development of visualization has accelerated since 1975, since when important changes have depended upon advances in computing. Improved computer speed and capacity increasingly allow data to be visualized by increasingly intensive computational methods. Computers make visualizations more interactive and allow direct manipulation of data, e.g. selecting data by linking, brushing or using animation in grand tours. Also driving the development of visualization is the fact that visualization methods are being applied to and developed for an ever-expanding array of problem areas and data structures, including web applications that enable social networking.

Modern Visualization

Modern computer-based visualization developed through the accumulation of three specific areas (Schroeder, 1997). Scientific visualization was the first. It is a discipline stemming from computational science and started as an IT support activity. Computational simulations produced digital data representing natural phenomena, for example the weather forecast. Commonly the data has an inherent geometrical shape and the data represents continuous fields within this geometry. The data were produced as large arrays of values that were difficult to analyse by hand or eye. Instead, computers were used to produce images of the data within its native geometrical shape.

'Scientific visualization' is typically categorised by the dimensionality of the data values (number of dependant variables), and whether the data is scalar, vector, tensor, or multivariate (Brodlie, 1992; Schroeder, 1997). However another taxonomy distinguishes by technique between global, geometric and feature-based techniques (Post, 1999).

Subsequently, it was realised that techniques for scientific visualization could be applied to data from the humanities and social sciences. Since this data commonly looks at geographical distributions of populations this field focuses on statistical graphs and thematic cartography. Gradually, the field of data visualization diverged further and information visualization, the final area of visualization, emerged. This field was primarily aimed at visualizing computerised databases so that relationships could be found; commonly using tables, graphs and maps. Currently visual display and analysis of text in the form of academic papers, web pages, and patient records, are included in information visualization. 'Information visualization' can also be classified by data type, common types being multi-dimensional databases (with more than 3 dimensions), text, graphs and trees (Bohm, 2001; Schneiderman, 1996). Similar to scientific visualization, a technique classification system is based upon display styles which include table, or information landscape (Card, 1997; Chi, 2000). However unlike scientific visualization some classifications also look at tasks, for example gaining an overview or drilling down on detail (Schneiderman, 1996).

Over this period visualization has been transforming into an increasingly independent academic subject within the field of computer graphics and is commonly taught in computer science departments, and is divided between two main specialisms categorised as 'scientific visualization' (developing visualizations for purposes of aiding scientific research) and 'information visualization' (providing ways of communicating information generally e.g. in the design and presentation of charts, diagrams, graphs, tables, guides, instructions, directories and maps which can also be used to aid research whether scientific or not). However this division does not best reflect visualizations true nature, and there are attempts to improve on this classification. Tory (2004), complains that the division between scientific and information visualization encourages segregation of different kinds of activities from one another when many visualization problems cross that divide, proposing instead, a systematic scheme 'based on characteristics of models of the data rather than on characteristics of the data itself'. An easy-to-understand taxonomy would be useful to both users of visualization and researchers into visualization and if it existed it would have been presented here.

The application area of interest in this chapter falls mostly within the information visualization paradigm although map based visualization applications are also important but these techniques are on the border of the 2 paradigms drawing from both scientific and information visualization (Tory, 2004). However visual appearance is not the only theme in visualization research of importance to web 2.0. Visualization system design and the distribution of that system are relevant research themes. The web is a distributed computing environment, with users also distributed and if they are to work together then synchronization of their activities must be facilitated by the visualization system. These themes were originally titled 'remote visualization' and 'collaborative visualization', growing out of scientific visualization. To understand the underlying technology and social forces driving the development of the web it is necessary to understand the position of and the relationship between the information visualization and scientific visualization communities.

A Survey of Information Visualization Techniques

There are hundreds of techniques with thousands of low level elements that could be considered. This chapter is too short to take on this task so we aim to give the reader an idea of where to look for further information and an overview of a few relevant techniques. Many information visualization techniques rely on the use of colour, animation and interactive input from the user but in this book only static grayscale images are possible so where possible we refer the reader to websites for examples.

Visualization is a young subject without a definitive text but the selection of papers, books and websites in the references section should provide a suitable starting point. Friendly's timeline of visualization (Friendly, 2008) presents an online timeline of visualization with static images for each entry in the timeline. This site is a good starting point for examples of visualization techniques developed before 2004. Images and demos of information visualization techniques are on the websites of commercial vendors of general purpose information visualization software (although demos are not always available and users may require registration). There are 5 stable information visualization companies known to the authors: AVS (Advanced Visual Systems) has OpenVis (AVS, 2008); Spotfire focuses on business information (Spotfire, 2008); Tableau is similar to Spotfire (Tableau 2008); Steema has TeeChart and TeeTree (Steema, 2008); and finally aiSee is designed for large data (aiSee 2008).

Some key techniques from information visualization are:

- **Graphs:** a 2D plot showing the relationship between parameters. Typically orthogonal axes show the values of the parameters represented in the plot. Harris (1999) illustrates all the visual elements of graphs, tables and other information plots and recent research is available in the Journal of Graph Algorithms and Applications (Tamassia & Tollis, 2008).
- **Trees and Networks:** nodes are connected by lines showing relationships between nodes. If the nodes represent people then the plot represents a social network. These plots can be difficult to understand if many nodes are used. Networks do not occupy a real geography but are optimized by complex mathematics to look good in a 2D display. In information visualization these are considered to be graphs. Freeman (2000) and Bertini (2008) survey the history and applications in this area, and two case studies of social network visualization applications are in Brandes (2001) and Shen (2008).
- **Multiple Related Views:** a number of 2D plots are viewed in one problem solving environment. If the plots are graphs then the plots tend to be arranged so that the horizontal or vertical axis that relate to the same parameter are aligned and a user selection made in one graph can be seen to relate across to the other plots. The next 4 techniques use multiple related views but relationships are made by different user interactions.
- **Drilling:** if the plots are geographical then they may represent different levels of detail of a region the user selects from the higher resolution plot.
- **Brushing:** if a user is interested in the geographic distribution of different age groups within the US then using the histogram and selecting (brushing) regions from the

histogram this selection is displayed on a map.
- **Linking:** many elements are related so colour is used across multiple views to clearly identify each relationship.
- **Grand tours:** an animated tour is given through the data display space so that the user can get an overview of the data.

The Development of Visualization in Relation to Computer Technologies

The development of visualization is driven not only by the development of visualization techniques, but in response to the development of new computer technologies offering new possibilities for visual representation. Changes in computer hardware, graphics hardware, computer display devices, computer input devices, software design, collaborative working environments, remote visualization and visualization services all play an influential part in determining what can be visualized and how the user can manipulate it.

IN TRANSITION FROM WEB PAGES TO WEB APPLICATIONS

The Handbook is about the changes from Web 1.0 to Web 2.0, made possible by a mix of new technologies and approaches. The step changes in technology and user participation are not yet completed. We review the current state of the technology and how it might adapt to provide better graphical tools for the 'semantic web'.

From Static to Dynamic Web Pages

One of the main changes is the development of Content Management Systems (CMS) providing a web page delivery system that replaces static HTML web pages (North 2008). CMS separates two aspects of a web page, the content from the presentation. In CMS the content is separated from the web page as it no longer sits in an HTML file waiting for a user to access it, but is in a database so that the HTML page is dynamically reconstructed for the user when they select that web page.

The change from static to dynamic content has relied on these changes in technology:

1. **Static web pages:** the content and presentation are not only included in the same file but are mixed together throughout the text in the file
2. **Cascading Style Sheet (CSS) web pages:** the content and presentation are separated into separate text files. HTML (Hyper Text Markup Language) is the language encoding the information on a web page. It provides the information as text along with text that defines the style (presentation) of the informational text. The presentation information can be separated from the content information by the use of Cascading Style Sheets. Such CSS enable changes to the look and feel of a whole website through alterations to only one file, rather than requiring the individual rewriting of every page on the site.
3. **Dynamic web pages:** content and web pages are separated.

CMS are powerful because they separate out the responsibility for designing and developing a website from providing the content. CMS[3] build in tools to enable non-technical users to enter and manage their content (which is why CMS are popular for blogging sites). Many social networking websites give the user the option whether to produce their content as text or HTML, which contributes to the control that users now want over web content (manifested by the popularity of open source communities), giving them control over its style. There are in effect two interfaces to a website, one between the site and its non-technical users, the other between the site and those with technical competences. Site providers increasing encourage technically competent users to create and share service specific applications by releasing their API (Application Program Interface) and disseminating technical information which makes the addition of new modules easy.

HTML remains the underlying language that is recognized by web browsers so CMS must reconstruct HTML pages dynamically for the viewer. Even where web delivery technologies, e.g., wikis, have their own markup language or where websites allow plain text entry these inputs are still translated into HTML. Standardising interpretation of HTML across all browsers has taken considerable time and effort, improvements to HTML being coordinated between browser vendors by the World Wide Web Consortium (W3C). It would be too problematic to get the W3C to coordinate this effort and for browser developers to commit the resources for each brand of markup language, so wikis and comparable applications have developed their own markup with special functionality for their relevant formatting and semantic issues. Nonetheless, wiki applications have their own translator to convert that markup into more basic HTML components. HTML has limited functionality with regard to style, so the functionality that handles the graphical content and interactivity important to visualization is provided by supplementing HTML with other languages. These languages commonly provide applications (e.g., web-based games) or structural and navigational tools (e.g., menu systems) for a website. Depending on their specific functionality these languages can create applications that are stored in and served from a database in a CMS site, adding to the CMS functionality or providing style for a static web page. The main languages that contribute to visualization on the web were developed in the 1990's, including Java, JavaScript, VRML (Virtual Reality Modeling Language) and Flash.

The Java programming language was developed by Sun Microsystems (Gosling, 2005; Java Home Page, 2008; Wikipedia, 2008). It is an interpreted language meaning that a program written in Java can run on all the popular computer platforms without any adaption; "Write Once, Run Anywhere". Combined with its other features this makes it ideal for the web so web browsers quickly incorporated small Java programs (called applets) within web pages. Later Java was configured for particular platforms e.g. J2ME (Java 2 Micro Edition) for mobiles. Java Servlets, instead of being embedded in a web page as applets, are used to extend the functionality of the web server, allowing extra content to be added to web pages dynamically from the server. Whilst Applets and Servlets can be used to add important visual content to the web, Java is much more powerful for such a purpose as it has dedicated libraries that handle necessary functionality: the SWING library adds user interface functionality, the Drag and Drop library allows object manipulation by mouse, and the 2D and 3D libraries allow the graphics modeling of 2D and 3D objects.

JavaScript is a scripting language commonly used for client-side web development; the web browsers incorporate the ability to interpret JavaScript programs (W3 Schools, 2008; Wikipedia, 2008). JavaScript was designed to look like Java but has less functionality and is easier for non-programmers to work with. The primary purpose of JavaScript is to embed interactive functionality into web pages, typically to inspect or create content dynamically for that page. For example, a JavaScript may validate input values in a web form, control the opening of pop-up windows or change an image as the mouse passes over it. Because JavaScript code runs locally in a user's browser (rather than on a remote server), it can respond to user actions quickly, making an application feel more responsive. Furthermore, JavaScript code detects user actions which HTML cannot. JavaScript is heavily used in many web-based applications including CMS and those that support social networking through gmail and facebook.

VRML is a standard text file format similar to HTML used to represent 3D interactive objects (W3D Consortium, 2008; Wikipedia, 2008). Developed with the web in mind a browser can interpret VRML by installing the appropriate plug-ins. A number of small geometrical primitives are defined within the format and each of these primitives may have a number of properties that define the visual aspects of the object such as colour or transparency. The shape of large 3D objects are defined by combining the correct geometrical primitives e.g., 3D surfaces are defined as a mesh of triangular primitives. These models are interactive in a number of ways. Web links can be made by clicking with a mouse on a node, timers and external events can trigger changes in the scene and Java or JavaScript can be incorporated into the world (VRML files are called worlds, the term world is used where in other graphical systems the term scene would be used). The VRML format is an open format that has an ISO standard making it suitable for sharing geometrical model data which ensures its popular within academia. Successors to VRML include X3D and 3DMLW (based on XML).

VRML is useful in applications where the 3D shape of an object in important such as teaching anatomical structures to medical students. An early interactive web-based application using VRML was created to teach medical students to perform lumber punctures (John, 2001). A model of the external skin, spinal bones, spinal cord and cerebrospinal fluid (CSF) were combined in one world, enabling the student to manipulate the model in the viewer, viewing it from any angle and altering the transparency of all the elements. The student could then place the puncture needle in the model to simulate taking a sample of CSF. The student would be given feedback on their performance and could alter the transparency to see into the puncture site.

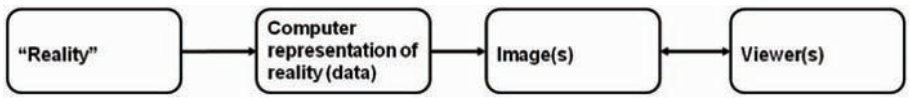
Flash (currently Adobe Flash, previously Shockwave Flash and Macromedia Flash) is a multimedia graphics program used to create interactive animations for web pages (W3 Schools, 2008; Wikipedia, 2008). Its features make it especially suited for a web environment. It uses vector graphics, which means that the graphics can be scaled to any size of display area without losing quality and it supports bi-directional streaming so that it can load into a web page more quickly than animated images. Most web browsers can interpret Flash but the Shockwave Player can be downloaded for free and used as a plug-in. Flash is being ported for use on mobiles and PDA. Flash applications are developed through an authoring tool.

From HTML to XML

HTML provides static content for the web and deals with formatting and style of text. While HTML allows the publisher to present their information in a particular style, Web 2.0 uses XML (Extensible Markup Language) to handle the data that is passed across the internet. XML has a user defined format to handle particular types of data which means that without standardization of XML file formats the variation in XML file content makes them difficult to handle. File formats based on XML and handling data relevant to visualization are developing e.g., the previously mentioned 3DMLW format. While that data does not have to be human-legible both HTML and XML are designed to be human-legible. Currently XML is rendered as raw text in a web browser with no unified display protocol for XML across all web browsers. In order to style the rendering of XML data the XML file must reference a style sheet that can not only give style but can also convert regions of the data into other data formats such as HTML.

Eventually XML may replace HTML and if it does good styling and visual display functionality may be included in the format. However currently the importance of XML is not in how it is rendered but as a way of formatting data to allow machine readable semantic information to be incorporated

Figure 1. An overview for the whole of the visualization pipeline originally given by Haber (1990a) in text and Domik (2008) diagrammatically and refers to computational science. "Computer representation of reality" referred to computer simulation but could refer to a database or any digital data



into the web. The best known function of XML is in price comparison websites, but it could be used to extend content to give information of interest (on when, what and the provenance of information) to social networking sites. Comparisons of large amounts of information where the structure, layout and interaction are important would benefit from visualization techniques.

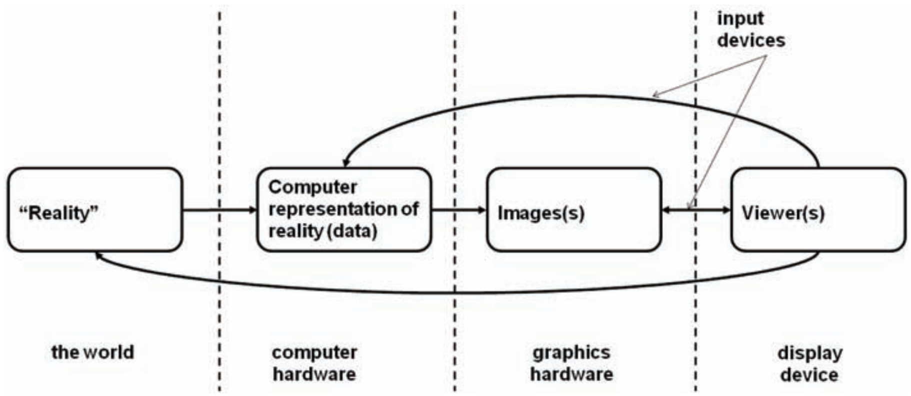
VISUALIZATION SYSTEMS AND THE DEVELOPMENT OF TECHNIQUES

The Visualization Pipeline

The 'visualization pipeline' (Figure 1, from Haber and McNabb (1990a) gives an abstract presentation of the visualization computational process), indicating how scientific simulations are rendered in computerized form and thus made available to computational scientists. While this abstraction was developed for scientific visualization it can be expanded to encompass visualization more generally, and, some argue, covers computation generally. It shows (Figure 2) which parts of the pipeline are dependent on which computer hardware component. The performance of a pipeline is determined by the component with the worst performance called a "bottleneck". Developments in areas of computer technology on which the pipeline depends alter what is possible in the corresponding part of the visualization process. The graphics hardware and the display device are closely tied because the graphics card produces the images seen on the screen and this stream of images is a heavy load. The short dedicated cable connecting graphics processor and screen in a desktop computer is sufficient to enable the graphics card to service an acceptable refreshment of on-screen images—requiring at least 25 frames per second—but this works less well if the cable is replaced by a shared network for example the internet. While software on the pc comes with advice on minimum hardware requirements web-based applications do not, so users with low performance hardware will either have a poor experience of the application or the application must adapt to the user's system. The development of adaptive systems (Brodlie, Brooke, Chen, Chisnall, Hughes, John, Jones, Riding, Roard, Turner, & Wood, 2007) allows the detection of and adjustment for the nature of display systems and network speeds, allowing tailoring of the output so that, for example, a small mobile device could be fed lower resolution images to those fed into a wired pc or home entertainment system.

Physical interaction with a visualization is by two different types of input (Figure 3). Generally speaking interaction with the graphical object held on the graphics hardware is fast and uses a mouse or other device that feels natural. Interaction with the computation that occurs in the pipeline before the data reaches the graphics hardware tends to use application specific menu systems with mouse and keyboards input separated from the visual scene and disruptive of activity as the user must shift concentration from the graphical objects they are working with. Virtual Reality menu systems (Curington, 2001) appear to lessen disruption to the actions of the user but these can cause clutter in the visual scene and to reduce that clutter these menu systems have limited func-

Figure 2. Overview of the whole visualization pipeline in figure 1, but in this case the hardware that each element of the pipeline depends on is identified. Computer and graphics hardware can be part of the same machine but this is not necessarily so, but graphics hardware is normally closely tied to the display device



tionality. A third and dominant, but not physical, interaction is between the functionality of the application and the requirements of the user: if the visualizations do not appropriately represent reality then the user dependent on them may be misled when making their decisions, and if they are not confident that the results are useful they will abandon the system.

The visualization pipeline of the visualization system alone was further abstracted to categorise the interaction with the user and so exhibit the data-flow paradigm that is inherent in the software structure of visualization systems (Figure 4). The data is shown as flowing through the system while transformations are performed to deliver the final image. Haber (1990a) identified three types of transformation. The viewer is able to interact with the visualization and so affect each of these transformations, potentially gaining new insight into the data being displayed.

First, raw data is transformed by a data enrichment step into 'derived data'. Raw data can come

Figure 3. Overview of the whole visualization pipeline in figure 1, but with the 3 main types of user interaction given and numbered to match the order of discussion in the body of the chapter

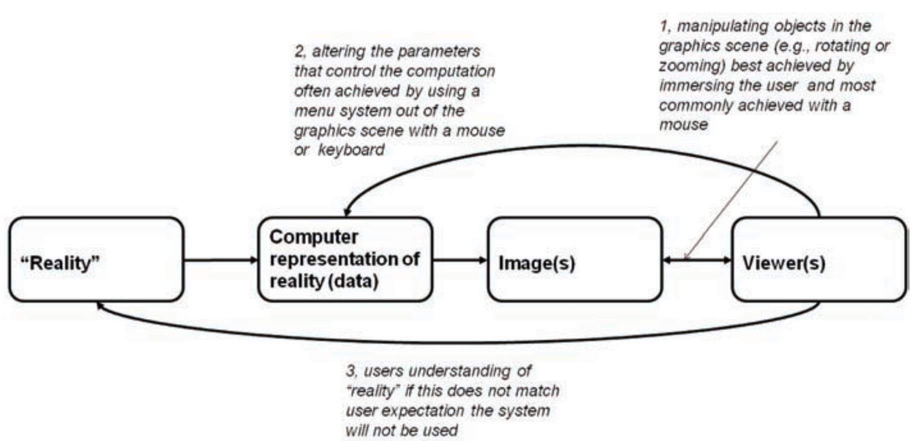
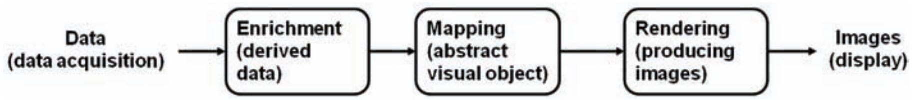


Figure 4. Overview of the visualization pipeline for just the visualization system showing how internally the visualization system handles data-flow (from left to right) and categorises types of interaction by data transformation type



from any digital source such as simulations, data files and databases. Enrichment fits the data to the desired model perhaps including data manipulations such as smoothing, filtering, interpolating, or even hypothetical alterations. Preparing data for visualization can be time consuming and so deter the first time users.

The second transformation, mapping, converts data into an abstract visual object (AVO). Attributes of the data are converted to corresponding geometric features according to a set of classification rules. By adjusting these rules, the viewer can cause distinctions in the data to become perceptually obvious. This step establishes the representation of the data, but not necessarily the final visual appearance on the screen.

The third transformation, 'rendering', ultimately converts the AVO to a displayable image. This involves computer graphics techniques such as view transformations (rotation, translation, scaling), hidden surface removal, shading, shadowing. The transformations at this stage occur on the graphics hardware and alter the perspective on the display, contribute to the overall appearance and dictate what is or is not visible

This pipeline makes explicit the transformations the data must go through to produce images. These transformations must be performed in this sequence. The concept of the data passing successively through each transformation is built into visualization software as 'data-flow'. This pipeline is drawn to reflect generic features of data transformation but specific ones can be drawn for particular applications and used to optimize and/or split the process. This is a common strategy for complex visualization applications such as Google Earth which branch the pipeline and spread the computation across a number of computational resources in a way invisible to the user but designed to improve the functionality and interactivity for the user.

Interactive Rates

Interactive rates strongly constrain visualization strategies. There is no exact criterion for an appropriate interactive rate. In TV and film production there are three different frame rate standards, the slowest at 25 frames per second. Stereographic systems need at least twice this rate as one frame is produced for each eye. On a single unloaded machine[2] a visualization system will maintain a good frame rate up to a threshold in data size where the threshold is determined by the data's geometric composition, the complexity of the visualization techniques used, and the memory usage rather than by the disc space that the raw data occupies. Higher frame rates improve user satisfaction particularly for stereoscopic projection but in exceptional circumstances a rate may be acceptable down to about 10 frames per second, as when the user has no other way of viewing their data, however below this rate the user will prefer static images or animations produced in batch mode.

These issues affect the interactive rate of transformations occurring in the graphics hardware but changes to parameters in the earlier transformations (enrichment and mapping) alter the representation of the data output from a particular visualization pipeline without affecting the frame rate, so the rate that enrichment and mapping are updated is slower. There is no exact figure, but a lag of more than a few seconds causes delays that may confuse the user, who cannot be sure what transformations have already been applied and which are waiting to fed into the scene currently being viewed.

Visualization Systems

Scientific visualization software was initially developed before the idea of web services had taken hold. It mainly consisted in standalone software taking advantage of specialist graphics hardware and specialist display and interaction devices. This close tying of software to hardware improves performance and made this a suitable setting for the development of virtual environments. Scientific visualization started as a support activity for computational science when simulations were run on supercomputers that were administered in computing centers. The need for the visualization of simulations drove the development of computer graphics hardware and virtual reality environments by Silicon Graphics, a supercomputing vendor. Scientific visualization systems exploited local hardware using many processors and optimization strategies to allow the largest possible datasets to be visualized. Initially the display was to a simple screen but larger display areas were developed using projectors or tiled screens so that a number of users could explore and interact with the visualization scene at the same time. New input devices were needed in these environments such as the space mouse (a mouse designed for manipulating objects in a 3D environment by permitting the simultaneous control of all six degrees of freedom) as the users would walk close to the screen and away from the key board and mouse which were then wired into the computer terminal. The 3D scenes produced by the visualization software seemed flat; meaning that information such as the depth of an object was difficult to interpret so stereoscopic output was integrated into these environments to trick the eye into seeing these objects in their "real" 3D form.

When the visualization systems were physically tied to the hardware, the user needed to be in the computing center to take advantage of them. Thus users did not make intensive use of this specialist and very expensive equipment so the idea of remote visualization developed to allow users to stay in their office and make use of the graphics hardware over a network. The first remote visualization systems were developed before the web and were developed alongside the abstraction of the visualization pipeline (Haber, 1990b). Pioneering visualization web services used scientific visualization software on a supercomputer to produce static 3D images from medical scans served interactively through a web browser to medics (Jackson, 2000). Later more dynamic visualizations dependent on specialist graphics hardware again physically located in the computing centre using a product, Silicon Graphics VizServer were developed. However their use was restricted in practice to projects where the visualizations were produced on a proprietary Silicon Graphics supercomputer and a dedicated high bandwidth network was in place; the images produced on the graphics hardware were compressed before passing down a dedicated network to users who could interact with the objects in the images. The Op3D project delivered and projected3D medical visualizations onto the wall in operating theatres so surgeons could compare the patient to the 3D visualizations side by side (McCloy, 2003). Typically specialized research systems produced their software from scratch, in this case developing a user interface employing a joy stick that was easy to use and suitable for a sterile environment. Collaborative visualization allowed users to share their experience either by sharing the results of the visualization on a large display or by splitting the visualization pipeline at some point and distributing the output across the network where it is rendered and displayed for each collaborator. Collaborative environments used for teaching, consultations and group discussions enhance how knowledge is learnt and shared. The idea of adaptive visualization has been furthered by the Grid research initiative which aims to provide computer resources and services to academics across the web (Brodlie, et al. 2007). It is not a visualization system but it is a remote service that supplies users with visualization resources intelligently. In principal the user cannot choose which visualization software they use on which machine but instead define the scene that they wish to interact with and their local resources. As all visualization systems produce visually different results even for the same algorithm the user could find results from different softwares were not comparable. Visualization is a diverse and cross-disciplinary field so that the terminology within visualization and its applications is not consistent and this impacts on the ability to create an ontology or taxonomy for visualization making it difficult creating a visualization modeling language standardised across all applications (Brodlie & Mohd Noor, 2007). Technologies developed by the games industry are now the main driver for collaborative synchronous graphics environments.

Information visualization software followed a different path, developing later than scientific visualization software. Some early visualization systems for viewing social networks were adapted from scientific visualization software for molecular visualization using stereographic displays and VRML (Freeman 2000). However dedicated information visualization software was coded in Java rather than C or C++ and was suitable to integrate with web services from the start. Information visualization like scientific visualization displays large quantities of data often using different display techniques requiring less performance from the graphics hardware. Characteristically information visualization applications are more meaningfully displayed in 2D rather than 3D and use multiple related views that are easy to develop as web services. However such applications are computing intensive in the enhancement and mapping transformations rather than the rendering transformation (meaning that demands on the graphics card are contained). ManyEyes, a research application from IBM (Viegas 2007) is a web-based system that allows users to upload and visualize data through their browser. The visualizations are produced by java applets running asynchronously on the user's computer allowing each user to visualize and comment on uploaded datasets in a social networking environment similar to video and photo sharing in flickr or YouTube. Designed for visualization novices the system uses "ShowMe", a special interface to help users select suitable visualization techniques for their data, eliminating the need for a visualization modeling language. Its developers advocate good design web-based because it increases ease-of-use, as the authors of this chapter agree. Java applets are suitable for techniques that are not compute intensive.

Independently of the visualization community the Access Grid, an internet based video conferencing system, has developed. It is superior to video conferencing because the equipment is cheaper, using 'multicasting' technology that allows many sites to participate, facilitating on-line meetings, seminars and conferences. Access grid works by streaming video and audio over the internet, it is easy to stream visualization scenes across the internet and so include it in a session. This is interactive at the host site but not yet at other sites. Access grid sessions can be recorded and played back using visualization techniques designed to augment the analysis and playback of meetings (Buckingham Shum 2006; Slack 2006).

In Google Earth, a visualization web service combining satellite images, maps and other GIS information, vast amounts of computation are needed to serve the data to the user so that the best results are obtained for each user no matter what their graphics hardware (Jones, 2007). Web services will always be slower than locally run software running on high performance hardware. The distribution of computational resources needs to be balanced between the server and client, which are more noticeable for visualization than for non-graphical and non-interactive web applications. Currently, it is only by providing high performance data serving as in Google Earth that this complex visualization application becomes possible. There are other visualization applications that may be useful to social networking for example the production of large graph trees for particular members of a social networking website, perhaps including a famous politician who has an account on a social networking website. Large graph trees require high computational intensity and a low graphical intensity so the performance of an application aiming to produce such a tree would also require specialist hardware and code optimization, most likely to come from the proprietors of a social networking website rather than the open source community that is extending the functionality of the website. More generally such complex applications are most likely be developed within the commercial sector.

Visualization Design

Understanding visualization techniques is only part of the story. Knowing which techniques to pick, how to combine low level design elements and how to appraise a visualization are also important. Many elements of design are open to debate. Here we give the reader an idea of possible approaches to design and analysis.

The most scientific approach to design comes from psychology. Colin Ware, perceptual psychologist who for a short time worked as an artist before becoming interested in visualization, has studied visualization design from the perspective of the science of perception. His book (Ware, 1999) is the definitive guide to issues such as when to use words and/or images and the possibilities for visual programming languages. Lately techniques from psychology are used to test how "good" a newly developed visualization technique is by a method called 'user assessment'.

Another way to understand visualization design and analysis is through the history of how information has been visually represented. If a number of visual information representations can be understood from throughout history then it may be possible to use that understanding to analyse current visualizations and even to predict future developments (Friendly, 2008; Tufte, 1997; Tufte, 2001; Tufte, 2006; Wainer, 2005). By studying history it is possible to understand better the social context in which the techniques were developed and explain two types of negative outcomes. Firstly, the situation where techniques were developed but at that time it was disregarded only sometime later to become an accepted visual representation. This was the case with William Playfair who in the 16th Century developed the grounding for modern statistical plots 150 years before they were accepted (Playfair, 2005). Secondly, where the poor visual representation of information have contributed to the failure of projects. This approach has been applied to two NASA based projects involving the launch of the space shuttle Challenger and the space flight of the shuttle Columbia in 2003 (Tufte, 1997; Tufte, 2006). To improve his analyses Tufte shares information with a variety of experts who use visual methods to communicate information, creating a moderated web forum for this purpose.

Cross-disciplinary teams can not only be good for analyzing visualizations but also for designing and creating visual representations. The term "renaissance team" was coined in the mid 1980s by an artist, Donna Cox, who worked collaboratively with computer scientists and scientists to find novel visual ways to explore how the universe was formed. Collaborative cross-disciplinary teams including artists trained in design can be used to create novel and visually pleasing techniques. Art criticism is the discussion or evaluation of visual fine arts, and it has been suggested that it be extended for the analyses of the products of visualization i.e., images, animations or virtual environments.

The final approach to visualization design is not a formal design strategy or methodology but is mentioned only because it has the potential to affect the type of visualization applications available on the web. It involves the exploration and testing of technical possibilities for visualization through developing web-based open source applications by experienced graphics programmers who will probably have worked in creative environments reliant on computer graphics who create visualizations for fun, as does Jim Bumgardner who among other things has contributed open source software to flickr, an online photo management and sharing application (Bumgardner, 2008).

A SURVEY OF VISUALIZATION IN USE TO SUPPORT SOCIAL NETWORKING ON THE WEB

The current state of visualization to support social networking is poor. The web pages on social networking sites tend not to be visually novel or pleasing[4]. Good graphic design means some websites have a visually appealing header and menu system though there are arguments that web pages should have little visual clutter and that graphical headers are a distraction. We do not get involved in this argument as it is only how information is structured within the pages and the functionality of web-based applications that is really of relevance.

The layout of the web pages within social networking websites tend to be structured into tabular formats with information structured into long web pages that require scrolling, a typical artifact of CMS. Web pages in a blog style are placed in a list ordered by the date the blog entries were created. In websites primarily handling other types of data relevant to social networking such as images, video, film reviews or web bookmarks, the data are again tabulated but the entities are ranked by some property other than date. Often users of these websites will rate the data or other ways are used to calculate the popularity of the data. One of the features making these websites clumsy for social networking is the way different kinds of data are segregated within them i.e., the separation of images from video and the lack of support for other types of files such as pdf, powerpoint or even applets. While it can make sense to segregate data there are activities such as planning a wedding that require integration of a number of activities which may be carried out through social networking sites. Also, if file formats that can be uploaded and viewed cannot be annotated mean then their features of interest must be described in text that is isolated from the file.

Two web applications offering greater visual diversity are Google Earth/Maps (an online geographical application that combines maps and satellite images) and flickr (an online photo organization application).

Google Earth/Maps have advanced functionality allowing real time manipulation of large amounts of geographical information, with an open API to these applications so that further applications can be developed that extend the functionality for particular sets of users such as recreational runners who may use the MapMyRun website to share routes and to plot graphs of changing elevations over the run. Other information can be added for example 3D models of buildings can be attached to the maps or satellite images or outputs from simulations can be visualized within the Google Earth environment. The API is of commercial value to Google as the professional versions of these applications can be extended further than the non-commercial version.

Flickr also has advanced functionality but it really stands out for its graphical novelty. It has an open API but that is not supported by flickr. There are fewer stand-alone applications extending the functionality of flickr through the API than with Google Earth. One exception is the trip planner, using flickr's mapping functionality to link photos to a geographical location on a map, extended to allow planning trips in a shared environment. Flickr is graphically pleasing and especially within its open source community there is graphical experimentation, perhaps because this community is interested in photography and as such is aesthetically motivated.

FUTURE TRENDS

Though a great deal is happening in the field of Visualization, it is not yet a significant presence in the public life of the internet, though this situation will probably change drastically. With many fundamental problems of making information available over the internet now solved, demand for improvements to both presentational quality of information and to the appearance of websites and stand alone web-based applications will surely increase. This will bring the existing and evolving techniques of visualization to much wider attention. Google Earth and Google Maps, a visualization application, have 'introduced hundreds of millions of users to what have, in the years since Ivan Sutherland's Sketchpad, been concepts at the core of visualization research-projections, 3D user interaction, user feedback, motion models, level of detail, frame-rate management, view-dependent rendering, streamed textures, multimodal data composition, data-driven extensibility, and direct manipulation' (Rhyne, 2007).

Visualization may further facilitate user's access to and control over web content through contribution to the development of code writing. The development of techniques to support this task involves either the use of visualization to aid the writing of textual programs or the development of visual metaphors providing a visual language. In the first case the user must still understand the principals of programming, but techniques from text visualization may be appropriate (Card 2004) or functionality similar to that used in debugging packages could be applied. In the latter case the metaphors will only be helpful if they are apt but harmful if they are not and it is difficult to make them apt (Ware, 1999).

Using the web to aid academic research has been popular from the start but it seems that the semantic web will extend that popularity, aiding researchers in an ever increasing number of ways (Waldrop, 2008). Sharing textual information is the underlying means of communication. However other forms of communication will develop such as the access grid which allows video conference style communication but to multiple users is also popular for the delivery of seminars, conferences and meetings. Visualization could be used to structure information, for disciplines that have a geometrical or geographical dimension (such as engineering, anatomy or archeology) to share shape and location and in fields where there is intense cross-disciplinary activity which is not currently well supported. This trend could result in greater demands for more effective real time display across the internet, involving much greater visual access, and calling for shared visual environments. The semantic web also offers an important means of communication to hobbyists and intelligent lay people requiring similar functionality for different application areas such as football, patchwork quilting and dieting.

Visualization will become more relevant to domestic and leisure uses of the internet as the display and input devices available multiply in form, variety and functionality, with their presentational quality enhanced. With ever larger screens and projection systems used in home entertainment suites social groups and families could benefit from advances made in virtual environments (such as stereographic displays and the space mouse which has similar functionality to the Wii controller) and the access grid allowing groups to socialize through video streaming. Also the increasing array of input devices means that online gaming and training simulators can become more natural.

Comparable opportunities exist with mobile devices, in connection with problems of visualization for small screen spaces, the servicing of touch screens, the development of menu systems and the progressive improvement in interactivity. Google Earth can be accessed on mobile systems and this has the potential to turn any mobile device into a GPS (Global Positioning System).

Visualization can also contribute to the interfaces underlying social networking services. For example, Mayaviz (Roth, 2004) developed a system that uses web-based technology to help synchronize complex logistical efforts similar to planning social events. The ideas used in this product address many of the clunky features noticed in current social networking sites. Work sheet like constructs can be created by users and access can be limited appropriately. Data files of any type can be dragged and dropped anywhere on the sheet (they do not have to be in a tabular layout) and users can make clusters of elements holding related information. Data elements can be drawn on and annotated by the user and changes in data/information can be propagated into other related data without the user having to control these changes. An alternate example is improvements to techniques rather than systems such as to graphical representations of large social networks or to combine both social connectednesses in virtual space with geographic relations on a map.

CONCLUSION

The internet may be on the edge of a golden age for visualization as its techniques find use in many more application areas than those specialized niches within which it has developed. Much of the more complex functionality and varied applications will probably develop commercially but there is still a place for academic research into visualization and for the single open source developer to create interesting visual techniques.

With very powerful levels of functionality now available on the internet, there is the possibility of a rebalancing the emphasis toward more aesthetic and ease-of-use concerns. Future generations of technology will be integrated into the semantic web to provide superior audiovisual experiences. To this end visualization practices themselves will continue to evolve, taking advantage of the new devices and innovative functionality that continues to come on-stream. Not only will visualization become more commercially driven but more frontal emphasis to aesthetic quality is likely as it becomes more intensely cooperative with graphic designers and creative artists in forming the new user interfaces of the semantic web.

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KEY TERMS AND DEFINITIONS

API: (Application Program Interface) contains all the elements that a programmer needs to extend an application.

CMS: (Content Management System) a web delivery system separating content from presentation. These allow users to add content making them popular in social networking sites but the web pages have a tabular form that isolates the elements that make up the content.

Data visualization: The second area of visualization to emerge that focused on statistical plots and thematic cartography has now merged with information visualization.

Flash: is a multimedia web application adding animation and interactivity to web pages by using efficient streaming and vector graphics techniques.

Google Earth: The most popular visualization tool ever. It is a standalone web application combining maps, satellite and GIS information into a meaningful spatial context that gives the user direct manipulation of the applications elements.

Information visualization: The final area of visualization to emerge that aimed to show visually the relationships within databases.

Java: A powerful programming language that adds functionality to the web at the server side and the client (browser) side. Several libraries relevant to visualization are included within Java.

JavaScript: A scripting language that adds interactivity into web pages.

Scientific visualization: The first distinct area of visualization to have developed. Initially computer graphics technology was used to "view" the result of computer simulations which had an inherent geometry e.g., the flow of air over an aircraft.

Visualization: There are many definitions of visualization. In this chapter we use the term to cover the use of computer and computer graphics technology to present data to aid human understanding and communication. Today visualization is somewhat arbitrarily divided into scientific and information visualization.

VRML: is a file format that holds 3D models. Some animation and interactivity is encoded into the file.

ENDNOTES

1 This does not mean graphic design is unimportant or that the structure and layout of information is not part of the aim of visualization. However the original web language (HTML) made no allowance for design so that constructs such as html tables

have been adapted to take on a dual role i.e., one of enforcing a design.

2 Single machine is stated here because the visualization system could run on a cluster where the process is spit over several machines. The 'unloaded' term is more important. On supercomputers there may be other users taking control of resources such as memory, processing power or I/O systems that affect the visualization system's ability to produce the optimum frame rate. On machines dedicated to the use of a single user this may still be a problem. If a machine is running background processes for example installing updates or if the user is using other software at the same time then there may also be a conflict in the sharing of resources affecting the frame rate.

3 The authors have worked with three CMS Joomla!, Zope and BSCW.

4 The authors could not view every possible website however they attempted to view websites that supported as many different activities as possible: YouTube (http://uk.youtube.com/), Flickr (http://www.flickr.com/), Fantasy Football (http://fantasyfootball.metro.co.uk/fantasy-games/), FaceBook (http://www.facebook.com/), LinkedIn (http://www.linkedin.com/), TopCoder (http://www.topcoder.com), ManyEyes (http://services.alphaworks.ibm.com/manyeyes/home), Del.ic.ious (http://delicious.com/), Jango (http://www.jango.com/), Wikipedia (http://www.wikipedia.org/), MapMyRun (http://www.mapmyrun.com/), Fetch Everyone (http://www.fetcheveryone.com/) and Now Public (http://www.nowpublic.com/). A blog was also developed on the blogspot website (https://www.blogger.com/start) that uses Google's blogger interface.

Chapter 8.20
On the Social Shaping of the Semantic Web

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ABSTRACT

Addressed in this chapter is the Social Shaping of the Semantic Web in the context of moving beyond the workplace application domain that has so dominated the development of both Information and Communications Technologies (ICTs), and the Social Shaping of Technology perspective. The importance of paradigms and the values that shape technology are considered along with the utility value of ICT, this latter issue being somewhat central in the development of these technologies. The new circumstances of ubiquity and of uses of ICT beyond mere utility, as a means of having fun for example, are considered leading to a notion of the Semantic Web, not just as a tool for more effective Web searches, but also as a means of having fun. Given this possibility of the Semantic Web serving two very different audiences and purposes, the matter of how to achieve this is considered, but without resorting to the obvious and rather simple conceptual formulation of the Semantic Web as either A or B. The relevance of existing Social Shaping of Technology perspectives is addressed. New thoughts are presented on what needs to be central to the development of a Semantic Web that is both A and B. Key here is an intelligent relationship between the Semantic Web and those that use it. Central to achieving this are the notions of the value of people, control over technology, and non-utility as a dominant design principle (the idea of things that do not necessarily serve a specific purpose).

DOI: 10.4018/978-1-60566-650-1.ch017

INTRODUCTION

When computing and communications technologies merged and moved from the industrial, commercial, academic and government settings in which the technologies initially developed, into society at large, something fundamental and quite profound happened. On achieving ubiquity, Information and Communications Technologies (ICTs) ceased to be the primary preserve of the professional developer and the work-based user, and became, in effect, public property. No more can the use of ICT be perceived as the domain of a select few. And the World Wide Web is the quintessential embodiment of this new circumstance. But it is not just the user community that has changed, for it is also the case that professional software developers also now operate in a world where anyone, potentially, can become a software or applications developer.

However, with the movement of ICT out from, and beyond, the workplace, into society at large, there is a need to look beyond traditional concerns with problem-solving, efficiency, utility, and usability. These are the criteria of the business world, of government departments, and the like, who are single-mindedly focused on delivering against targets set from high above. To these types of organization, computers, software, the Internet, and the World Wide Web are but functional utilitarian tools deployed in the service of profit, in the case of business, or policy as the embodiment of high political principles, in the case of governments.

Step beyond this well ordered world, into the life of an everyday citizen in modern society–the information society–and all these conventional concerns with problem-solving, efficiency, utility and the like, sit side-by-side, often uncomfortably, or are often substituted by, a second dimension representing a whole spectrum of other interests. The defining characteristics of this second dimension to the Web are typically: fun, enjoyment, happiness, fulfillment, excitement, creativity, experimentation, risk, etc. These in turn raise a much wider range of values and motivations than those of business, and embody notions such as freedom, individuality, equality, the human right to express oneself, and so forth. Moreover, these lead to a World Wide Web as a place, not of order, but of chaos, anarchy, subversion, and sometimes, even the criminal. And into this world moves the notion of semantic technologies, potentially transforming this chaotic and unpredictable environment into a place of order and meaning, taming this wild frontier, making it more *effective* and *useful*. But order, meaning, effectiveness, and usefulness for whom?

This paper addresses this rather simple, yet profound question. It is argued that the Semantic Web, as originally conceived, is not, as has been claimed, an improvement upon the first generation of the World Wide Web, but potentially a destructive force. What the Semantic Web may end up destroying is the unpredictability of interactions with the Web. This unpredictability, it is argued, is one of the Web's most appealing characteristics, at least to those who are *not* seeking to be more efficiency, or effective, and the like. And with the loss of unpredictability goes serendipity, which is something that has a value beyond quantification, for both the workplace user and the non-workplace user.

However, this outcome is not inevitable: there is no immutable law which states that the Semantic Web has to be such that all unpredictability in encounters with the Web has to be eliminated. The Semantic Web, like all technologies, can be shaped to produce outcomes (MacKenzie & Wajcman, 1985), and these do not have to be dominated by the need for efficiency and utility. In other words, insights form the social sciences can be used to design a technology that is different from one where purely technical and business considerations dominate.

To understand this perspective it is first necessary to understand how design paradigms influence the development of technology, and how these paradigms have failed to adapt to the age of computers and the information society (Kidd, 2007a). These paradigms, it is argued, are still predominately locked into a world dominated by inflexible electro-mechanical systems, these being technologies which severely limit design freedom and which do not allow designers to accommodate individualism. This, it is further argued, has implications, not just for social users of the Web, but also for business users.

Consideration is also given to values underlying science and technology, which still seem to embody Newton's Clockwork universe, with its belief in predictability and absoluteness, a perspective which sits in sharp contrast to the modern world view of a chaotic and relative universe. The journey will also consider notions of happiness and how this is connected to the concept of *meaning*. Meaning here does not refer to that which is commonly understood in the context of the Semantic Web. What *meaning* implies in this context is something that is strongly linked to the subjective, and key among this is emotions, which are a human trait that surpasses the domains of usability and conventional human factors. Emotions and meaning however are not well understood by software developers, but it has been argued that these are the very things that underlie the success of many of the modern world's most successful products (mobile phones being the classic example). Finally, the discourse will consider the concept of Ludic Systems, Ludic (Huizinga, 1970) being an obscure word meaning playful, but in a very wide sense, including learning, exploration, etc. This perspective does not just characterized people by thinking or achievements, but also by their *ludic* engagement with the world: their curiosity, their love of diversion, their explorations, inventions and wonder. Play is therefore not just perceived as mindless entertainment, but an essential way of engaging with and learning about the world and the people in it.

Bringing these perspectives together, the contribution will then consider the Social Shaping of the Semantic Web, namely the conscious design of the Web such that it accommodates the two very different, but important dimensions of the Web discussed in the chapter. It will be argued that the appropriate perspective is not to view these as competing and opposing views, a case of the Web as *A or B*, but rather the Web as *A and B*, in effect, order co-existing with chaos. And the key to achieving this lies in the development of a different sort of Semantic Web, one with different aims, and this in turn involves adopting a new design paradigm. This new perspective needs to explicitly acknowledge that usefulness, as defined in the classic sense, is not the beginning and end of matters, and that, it is legitimate to design the Web taking into account that not everything has to have a particular purpose. Put another way, as Gaver (2008a) has noted, some artifacts can just simply be *curious things for curious people*. The elements of such an approach will be described, including links to another Web development that goes under the label of *Web 2.0*; specifically context awareness.

BACKGROUND

The Semantic Web can be viewed as a business engendered ICT, that is to say, driven by and shaped by the needs of business. The promise is of a structured information resource from which information and knowledge can be more easily discovered than is the case with the first generation of the World Wide Web. A key requirement for creating the Semantic Web is the organization and classification of web content. In support of this requirement, knowledge-based technologies are needed that will provide a means of structuring this content, adding meaning to it, and automating the collection and extraction of information and knowledge.

Ultimately the goal appears to be transforming the World Wide Web from a chaotic and disorganized place, into an efficient information and knowledge source, providing a basis for the development of value added services based on this Semantic Web. One of the key elements in achieving this goal is the creation of ontologies (Benjamins *et.al.*, 2003), which are in effect agreed and shared vocabularies and definitions, that provide a basis for adding meaning to web content. These ontologies should provide a common understanding of the meaning of words used in different circumstances. One of the essential tasks in the development of the Semantic Web, is to research and define ontologies for specific applications. Another key research topic is that of content quality assurance, for without this there can be no trust that the data, information and knowledge derived are of any value.

There are of course other challenges of a technical nature, including scalability, multilingualism, visualization to reduce information overload, and stability of Semantic Web languages (Benjamins *et.al.*, 2003).

All these issues are recognized as being central to the successful development of the Semantic Web. However there is one more element, perhaps less well appreciated, that is also central to the success of the Semantic Web. This additional factor is the human and social dimension. It can be argued that the handling of this particular area could significantly affect, for better of worse, both the usefulness and the acceptability of the Semantic Web. To understand why this is so, it is necessary to understand something of the bigger picture that provides a contextual background to the development of the Semantic Web. This reflection begins with consideration of the future development of ICTs in general.

Future visions for ICTs are characterized by a belief in the ubiquity of these technologies (e.g. see Wiser (1991), Ductal *et.al.* (2001), Aarts & Marzano (2003)). Phrases such as *ubiquitous computing*, *pervasive computing*, and *Ambient Intelligence* represent visions of computing devices embedded into everyday things, thus transforming these items into intelligent and informative devices, capable of communicating with other intelligent objects. These intelligent and networked artefacts will assist people in their daily activities, whether these are associated with work, travel, shopping, leisure, entertainment, etc.

The prospect of embedded intelligence transforming the nature of everyday objects builds upon the already widespread use of ICTs in society at large. Personal computers, mobile telephones, laptop computers, personal digital assistants, MP3 players, games' consoles, and such forth are ubiquitous in society. And applications such as the Internet and the World Wide Web have provided a new access channel to existing services, and also opened up new activities, like social networking, blogs, instant messaging, personal web sites, and so forth, that were previously unforeseen and infeasible. Moreover, the ubiquity of computing and communication devices along with cheap (some times free) software downloadable from the Internet, has transformed the non-workplace user environment, for those with the inclination, into a *do-it-yourself* development environment. Many of the these developments in ICT can be described as socially engendered ICTs and applications, that is to say, driven by and shaped by social interests.

This is a very new circumstance and not surprisingly this has raised some concerns about the social effects of all this new and networked technology.

These concerns are wide ranging (Kidd, 2007b). They include worries over security, loss of privacy, and the rise of a surveillance society where the state, as well as some rich and powerful corporations, take on the features of the all seeing and all knowing *Big Brother* central to George Orwell's novel *Nineteen Eighty Four*. Other concerns include the fear that society is becoming too dependent upon computers, to the point where the computer becomes the defining feature of reality, and, if the computer says something is so, or not so, then this must be true, even if it is not. There are also worries about peoples' behavior. These range from increased detachment from the real world as people are increasingly drawn into the artificial world of cyberspace, through to concerns about lack of consideration for others, for example, by those using mobile telephones in public spaces without any regard for the affect on those around them (referred to as increasing civil inattention (Khattab & Love, 2008)).

In Europe there is also a worry that citizens will not accept the offered vision of *ubiquitous computing*. As a result of these concerns a different vision has been formulated for *ubiquitous computing*, one that goes by the name of *Ambient Intelligence*.

Specifically, the concept of *Ambient Intelligence* offers a vision of the information society where the emphasis is on greater user-friendliness, more efficient services support, user-empowerment, and support for human interactions (Ductal *et. al.,* 2001). People will be surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects, and their environment will be capable of recognizing and responding to the presence of different individuals in a seamless, unobtrusive and often invisible way. This particular perspective is founded, at least in principle, on the notion of humans at the centre of all this technology, of the technologies serving people, of a human-centered information society.

But even the acceptance of this more human-centered vision by society at large is perceived to be a problem. This has led some senior representatives of the European ICT industry to propose that ordinary citizens become involved in the research, development and design processes that lead to the creation of so called intelligent everyday objects (ISTAG, 2004). This approach, as presented by ISTAG, is quite radical as it advocates design by, with, and for users, seeing these people not just as subjects for experiments, but also as a source of ideas for the development of new technologies and products.

In the USA there is also an appreciation of the importance of the human dimension with respect to ubiquitous computing (Abowd & Sterbenz, 2000). Key among the topics raised with respect to what are called *human-centered research issues*, is that of control. Control in this case means considering circumstances when an intelligent environment should initiate an interaction with a human, and vice versa, or when sharing of control is necessary between users and the system, and also flexibility in the level of control. Other issues raised are deciding which activities should be supported by these intelligent environments, what new capabilities they enable which go beyond current capabilities and activities, and support for task resumption following an interruption.

There is a danger however, that such matters might be seen as either usability issues or those relating to traditional human factors or ergonomics. And Abowd and Sterbenz (2000) do in fact raise matters that are very much in the sphere of traditional human factors. However there is more to *human-centred research issues* than these more traditional concerns. To understand why this is so, it is necessary to consider technologists' and engineers' perceptions of human-centredness.

Isomäki (2007) reports on a study of information systems designers' conceptions of human users. Of note is the observation that these designers occupy a continuum of perceptions. At one end there are those with very limited conceptions, right though to the other end where designers have more holistic and comprehensive perspectives. This tends to support the conclusion that different forms of responses are possible when taking into account people, ranging from ergonomics of human-computer interfaces, right through to designing technologies so that users have full control over the way that the technologies work and the way that they are used.

With different conceptions of human issues, it follows that designers will have different perceptions of the problems that need to be addressed. To those with limited conceptions, traditional ergonomics and human factors is all that is needed to address the human dimension. However, for those with more developed perceptions of the human dimension, of what human centeredness might imply, the scope of designing for the human, has, potentially, much greater scope.

These designer conception issues therefore raise matters of values and design paradigms concerning technologies and the relationships with people, and more broadly with society.

This then leads to the familiar ground of technological determinism (MacKenzie & Wajcman, 1985, page 4), where technology is perceived to lie outside of society, having effects upon society, but being neutral in the sense that the technology is not influenced by subjective elements within society (e.g. such as values). If there is a choice in relation to technology, then it is one of choice between competing inventions, and by virtue of rational assessment and judgments, the best technology can be selected. This chosen technology then has some effect upon society, and matters of human issues just reduce to finding the most appropriate way to interact with the technology.

An alternative view is to consider technology as the product of society, a result of the prevailing economic, political, social and value systems. Technology therefore is not neutral and independent of society, but is shaped by society and its dominant values. And if this is so, then it is possible to shape technology in different ways, depending upon the values that are dominant, which opens up the possibility for the *Social Shaping of Technology*, using insights from the social and psychological sciences to produce different technologies to those that would normally be produced when technologists are left to themselves.

This discussion about the factors that shape technology leads to considerations of design paradigms. Paradigms are comprised of core beliefs, shared values, assumptions, and accepted ways of working and behaving (Johnson, 1988). Technological determinism is part of the framework of beliefs that are held by technologists, and is therefore part of the paradigm of technology development.

It has been argued (Kidd, 2007a) that the shift to the knowledge age, to a world where Ambient Intelligent systems predominate, involves a paradigm shift, not just in technology, but also in terms of the values that technologists bring to the process of designing these technologies. The knowledge era is heralded as a new age for humankind, implying some sort of transition from the past, to a new and different future, one based on the value of information and knowledge. The old age that is being left behind, the industrial era, was, to a large extent, based on subjugation of human skills, knowledge, expertise, and purpose to the demands of a resource-intensive economic system based on mass production. This led to a relationship between people and machines, where the needs of machines were predominant, and technology was designed to, as far as possible, eliminate the need for human intelligence, or to move this need to a select group of people within organizations, such as engineers and managers.

In other ways also, technology design practices have been shaped by the limitations of past technologies. The age in which technology development and design practices emerged and were refined, was primarily characterized by rather inflexible electrical, mechanical, or (a combination) electro-mechanical systems, which severely limited what was possible. In many respects the advent of relative cheap and highly flexible computers, which are in effect universal machines, has done very little to change these established practices, especially when it comes to considering the human dimension. This is the power that paradigms hold over people, trapping them into avenues of thought and practice that no longer have relevance.

But the industrial age view of technology and machine, also reflected the dominant world view of the time, where the universe was seen as a machine, a majestic clockwork (Bronowski, 1973, pages 221-256) and where its workings are defined by causal laws (Newton's), and where, by using reductionist scientific methods, all in time could be understood and be known. Of course, the universe turned out to be a much stranger place than Newton imagined, a place of relativity, chaotic behavior within what were once perceived as predictable systems, and of the quirky behavior of matter at the quantum level.

But in many respects this clockwork view of the world still prevails in the world of technology, for it is far easier to conceive of people as being components of machines, since the alternative is to consider humans in their true light, with all their quirkiness, likes and dislikes, interests, emotions, wants, and so forth. Yet the advent of the information society, the knowledge era, the age of *Ambient Intelligence*, demands just such as shift, for no more can ICT be perceived primarily as technologies for the workplace, where the employees can be subjugated to the needs of employers and the purposes of the employing organization.

And the primary reason for this is the change, is that of a different context for the use of ICT, which is now just as much focused on the world outside of the familiar workplace environment, as it is on the workplace. But this not only has implications for technology and technology design practices, it also has implications for the social sciences. Traditionally, those concerned with the *Social Shaping of Technology* have developed their theories and concepts based on the use of ICTs, as well as early generations of automation technologies, in the context of workplace environments. In other words they have been motivated by business engendered ICTs. This is no longer the prevailing circumstance. ICTs now need to be designed for both the workplace user and the non-workplace user. Business engendered ICTs and socially engendered ICTs have to be accommodated, with an ill-defined boundary between the two, and this provides the *Social Shaping of Technology* perspective with new challenges.

MAIN FOCUS OF THE CHAPTER

Relevance of Existing Social Shaping of Technology Theories and Concepts

To begin to address the Social Shaping of the Semantic Web, it is first necessary to make a detour to consider some key theories and concepts of the *Social Shaping of Technology*, and then to address their potential relevance to the Social Shaping of the Semantic Web.

The *Social Shaping of Technology* has it roots in the understanding that technology is not neutral, and that technology is *shaped* by the values and beliefs of those that influence its development, these being mostly engineers, technologists, and scientists. Change these values and a different technology will result.

While the scientific and technical community tend (and like) to believe that technology is neutral and is not determined by values, many social scientists think differently. As a result there is a body of thought and knowledge in the social sciences, that provides a theoretical and conceptual basis for the *Social Shaping of Technology*. Key among the existing body of knowledge is *socio-technical design*. Another important perspective is *interfacing in depth*.

For completeness, some of the key features of both will first be described. Then, the relevance of these to the Social Shaping of the Semantic Web will be addressed.

The Sociotechnical School developed in the United Kingdom shortly after World War II, in response to the introduction of new technology into the British coal mining industry. Its central tenant is that surrounding technology, which can be regarded as a sub-system, there is also a social sub-system. These two sub-systems can be designed to be compatible, either by changing the technology to match the social sub-system, or modifying the social sub-system to match the technology, or a mixture of both.

The Sociotechnical School of thought has been articulated in the form of principles, (Cherns, 1976, 1987) that embody the values and key features of sociotechnical design. These principles, of which there are 11, are: *Compatibility*; *Minimum Critical Specification*; *Variance Control*; *The Multifunctional Principle–Organism vs. Mechanism*; *Boundary Location*; *Information Flow*; *Support Congruence*; *Design and Human Values*; *Incompletion*; *Power and Authority*; and *Transitional Organization*.

Among the above there is a sub-set of principles that are primarily organizational in nature. These are: *The Multifunctional Principle–Organism vs. Mechanism*; *Boundary Location*; *Information Flow*; *Support Congruence*; and *Power and Authority.*

The *Multifunctional Principle–Organism vs. Mechanism* refers to traditional organizations which are often based on a high level of specialization and fragmentation of work, which reduces flexibility. When a complex array of responses is required, it becomes easier to achieve this variety if the system elements are capable of undertaking or performing several functions. *Boundary Location* is a principle that relates to a tendency in traditional hierarchical organizations to organize work around fragmented functions. This often leads to barriers that impede the sharing of data, information, knowledge and experience. Boundaries therefore should be designed around a complete flow of information, or knowledge, or materials, to enable the sharing of all relevant data, information, knowledge and experience. The *Information Flow* principle addresses the provision of information at the place where decisions and actions will be taken based on the information. *Support Congruence* relates to the design of reward systems, performance measurement systems, etc., and their alignment with the behaviors that are sought from people. For example, individual reward for individual effort, is not appropriate if team behavior is required. *Power and Authority* is concerned with responsibilities for tasks, and making available the resources that are needed to fulfill these responsibilities, which involves giving people the power and authority to secure these resources.

There is also another sub-set of principles that largely relate to the process by which technology is designed. These are: *The Compatibility Principle*; *The Incompletion Principle*; and *The Transitional Organization Principle*.

The *Compatibility Principle* states that the process by which technology is designed needs to be compatible with the objectives being pursued, implying that technologies designed without the involvement of users, would not be compatible with the aim of developing a participatory form of work organization where employees are involved in internal decision making. *Incompletion* addresses the fact that when workplace systems are designed, the design is in fact never finished. As soon implementation is completed, its consequences become more evident, possibly indicating the need for a redesign. The *Transitional Organization* principle addresses two quite distinct problems when creating new organizations: one is the design and start-up of new (greenfield) workplaces, the other relates to existing (brownfield) workplaces. The second is much more difficult than the first. In both situations the design team, and the processes it uses, are potentially a tool to support the start-up and any required transitions.

What remain from Cherns' set of 11 socio-technical design principles, is a sub-set that is significantly technology oriented, although the principles also have organizational implications. The principles in question are: *Minimum Critical Specification*; *Variance Control*; *Design and Human Values.*

The principle of *Minimum Critical Specification* states that only what is absolutely necessary should be specified, and no more than this, and that this applies to all aspects of the system: tasks, jobs, roles, etc. Whilst this is organizational in nature, it impacts technology as well. It implies that what has to be done needs to be defined, but how it should be done should be left open. In terms of features and functions of technology, the technology should not be over determined, but should leave room for different approaches. It implies a degree of flexibility and openness in the technologies. Turning now to *Variance Control*, this is a principle that, as its name suggests, is focused on handling variances, these being events that are unexpected or unprogrammed. Variances that cannot be eliminated should be controlled as near to the point of origin of the variance as possible. Some of these variances may be critical, in that they have an important affect on results. It is important to control variances at source, because not to do so often introduces time delays. Next on the list of principles is that of *Design and Human Values*. This is concerned with quality of working life. In the context of the working environment it manifests itself in issues such as stress, motivation, personal development, etc. This principle has both a social sub-system dimension and a technology sub-system dimension, in that both can be designed to reduce stress, and to enhance motivation and personal development.

The second approach mentioned as being of relevance to the Social Shaping of the Semantic Web, known as *interfacing in depth*, has its roots in technology design, specifically the design of computer-aided manufacturing systems.

This perspective on the *Social Shaping of Technology* rests on the observation (Kidd, 1992) of the importance of technology in influencing organizational choice and job design. There is a perspective (e.g. see Clegg, 1984) that suggests that technology is of secondary importance with respect to job design and organizational choice. However, as noted by Kidd (1992), technology is clearly not neutral and can close off options and choice in the design of organizations and jobs. Technology for example can be used to closely circumscribe working methods, to limit freedom of action and autonomy, and to determine the degree of control that users have over the work process.

This viewpoint, of technology shaping organizations, roles, and working methods, led to the notion of *interfacing in depth*. So, rather than just applying ergonomic and usability considerations to the design of human-computer interfaces, it was proposed that there is also a need to apply psychological and organizational science insights to the design of the technology behind the interface.

Kidd (1988) for example, describes a decision support system that was designed using this broader perspective. A key point about this decision support system is that the system characteristics were not achieved through the application of ergonomics or usability considerations to the design of the human-computer interface. Rather the characteristics arose from the technology behind the human-computer interface, where the technology refers to the algorithms, data models, architectures, and the dependency upon human judgment and skills that were built into the operational details of the software.

Kidd (1988) also points out that it is necessary to make a distinction between the surface characteristics of a system, as determined by the human-computer interface, and the deeper characteristics of a system, as determined by the actual technology. The surface characteristics are strongly related to ergonomics and usability, while the deeper characteristics relate more to the view of the user held by the designer, in that if values are driven by a desire to reduce user autonomy, this will be reflected in the details of the underlying technology. Likewise if values are such that autonomy is valued, then this will lead to a different type of underlying technology.

Consequently, good human-computer interface (surface) characteristics are necessary, but not sufficient. Attention must also be paid to the deep system characteristics, that is, the technology behind the human-computer interface. This is called *interfacing in depth*.

The relevance of both *sociotechnical design* and *interfacing in depth* to the *Social Shaping of the Semantic Web* has been addressed by Kidd (2008a). A key point in this consideration is the relevance of both approaches to non-workplace environments, for socially engendered ICTs, given that both the sociotechnical approach and *interfacing in depth* were developed in the context of workplace environments.

Kidd (2008a) specifically addresses the relevance of sociotechnical principles and *interfacing in depth* for the case of the Semantic Web, not just as a technology for the workplace, but in the context of the non-workplace user environment, for example in the home.

A key feature of any web technologies is that the outcome of the use of this type of technology is not known in advance. Consequently, to over determine how the technology is used, to over limit results based on semantics, could be incompatible with the purpose of the technology, as perceived by some people, and its value to users.

This implies that the sociotechnical variance control principle could potentially be very important in the design and development of the Semantic Web. One of the potential downsides of the Semantic Web is that it eliminates variances in web search results, thus destroying some of the value of the Web (the experience of discovering the unexpected). Consequently, enabling the user to decide how much variance to tolerate, in other words to place control of variances in the hands of users, could be an important attribute that needs to be designed into the Semantic Web, and for this reason therefore, variance control is potentially an important principle for the non-workplace environment. But it could also be an important principle in the workplace environment as well. The reason for this primarily lies in the competitive imperative for innovation, and in the need to be adaptive and responsive, especially in the face of structural changes in the business environment; changes that require agility, and corresponding organizational designs and operating principles that are open to bottom-up adaptation (Kidd, 2008b).

Control therefore is potentially important because not to have control over technology such as the Semantic Web, for users not to be able to decide which features of the technology should be employed, reduces the role of the Semantic Web to that of a vending machine for search results. This could be highly de-motivating to users of the Semantic Web.

This observation also arises from the *interfacing in depth* perspective. The whole philosophy of *interfacing in depth* is based on design of technologies where there is uncertainty and unpredictability in terms of outcomes. This approach provides a framework to counter the tendency to reduce human-computer encounters to circumstances where there is no uncertainty and unpredictability in outcomes. This theory is highly relevant to the Semantic Web, for this approach would seek to allow user autonomy and control to flourish, thus maintaining the potentially chaotic and serendipitous nature of the World Wide Web, but at the choice of the user.

Moving Towards the Social Shaping of the Semantic Web

Summarizing the central argument, the key issue is to shape the Semantic Web so that it does not reduce interactions with the Web to the circumstance where the Web becomes like a vending machine. But there is more involved here than a simple on-off switch that disables or enables, at will, the semantic features of the Web, although such as approach could be used. Ideally a circumstance should be created where the technology provides a more sophisticated approach. But the question remains how to do this? A key issue here relates to avoiding a circumstance where the Web is viewed in polar terms. The appropriate perspective therefore is not to see two competing possibility, two extremes, a case of the Web as semantic or the Web as non-semantic, but as a combination of both, as a continuum of infinite possibilities.

Such a perspective has been advanced before in connection with other technologies (Kidd, 1994, pages 301-303), but also more recently in relation to Ambient Intelligent Systems (Kidd, 2007a). The conceptual basis lies with *interfacing in depth* and variance control, and has been referred to as user defined human-computer relationships. This word *relationship* is important here as it implies more than just an interaction between person and machine. There has to be intelligence in this relationship, something that is often overlooked when the word intelligence is used in the context of computers. It is not, for example, very intelligent for a so-called *intelligent everyday artifact* to enforce a given way of working on users. An intelligent relationship with a semantically based World Wide Web would be built on control and understanding. Control comes from providing the technologies that will allow users to specify in some way, how semantic based searches operate, perhaps for example by including some form of *control knob* that would tone down the strength of the semantic dimension. But more than this, the Semantic Web needs to understand something of the context of the user.

This then touches upon a sensitive area, that of context awareness (Braun & Schmidt, 2006), which is a matter that arises in another area of World Wide Web development often referred to as *Web 2.0*. The sensitivity hinted at here relates to privacy, for to understand a user's context it is necessary to capture information, some of which may be of a personal nature, including patterns of usage and the like, much of which people may not want to have stored within a computer system. The information is also of the sort that commercial organizations, interested in marketing products and services, might be all too keen to lay their hands on.

However, putting aside for the moment these very serious issues, understanding the context under which users come to the Web, knowing something of their likes and dislikes, whether their are interests are broad or narrow, how much they value serendipity and how often they follow-up seemingly random and unrelated search results, could be a key factor in enabling the development of a more adaptive and responsive Semantic Web.

But this only defines the relationship. What about user motivation? Why should technology developers bother with such sophistication? This returns the discussion to the matter of paradigms and technologists' conceptions of the human dimension of the Semantic Web. Here, looking beyond utility, a factor that is such a dominant feature of the workplace, is critical. This involves addressing the non-utilitarian perspective, something that is perhaps an alien concept to the technologist. Put simply, not everything has to have utility.

Technologists need to understand that what makes people happy is not always something that is useful. Sometimes happiness comes from meaning, from emotional connection. This, it has been argued, is central to understanding why certain technologies are so successful, while others are less so (Lyngsø & Nielsen, 2007). For example, text messaging on mobile phones seems very much to be an example of a very useful tool, and it certainly has a very obvious utility. But text messaging is not just used for utilitarian purposes. Many young people use text messages to communicate with each other. But to adults the messages may seem to be pointless, like "where are you?" or "what are you doing?" or "I'm bored" and so forth. This is just chatter, which is meaningful to the younger generation, but not to adults. And the word *meaningful* is key here. It is the meaningfulness of the text messaging system that makes it so popular. And the same can be said for instant messaging, blogs, and social networking sites. They have very little in the way of utility. They are in fact just an extension of the face to face discussions that take place when people meet. But this point is important, because their motivation is not oriented to fulfilling a task, but to other more human inclinations, like for example, *having a good time*. These applications and many more, are examples of socially engendered ICT.

Socially engendered ICT points to a different type of driver for the development of the Semantic Web. The Semantic Web is not just a tool to undertake more efficient and effective searches of Web content, but can also be a means for people to *have a good time*. This is therefore links to the concept of Ludic Systems.

Ludic is something of an obscure word; it means playful (Huizinga, 1970), but in a very wide sense. Included are activities such as learning, exploration, etc. The Ludic perspective does not just characterized people by thinking or achievements, but also by their *ludic* engagement with the world: their curiosity, their love of diversion, their explorations, inventions and wonder. Play is therefore not just perceived as mindless entertainment, but an essential way of engaging with and learning about the world and the people in it (see Gaver (2008b) for an example).

Consequently, the Social Shaping of the Semantic Web needs to incorporate this perspective, which explicitly acknowledges that usefulness, as defined in the classic sense, is not the beginning and end of matters, and that, it is legitimate to design the Web taking into account that not everything has to have a particular purpose. Put another way, some artifacts can just simply be *curious things for curious people* (Gaver, 2008a). This could be of key importance in reshaping design paradigms, introducing a different dimension that explicitly recognizes that there is *life beyond mere utility*.

With this view in mind, Kidd (2008a) has proposed an additional sociotechnical design criteria to add to the 11 proposed by Cherns (1976,1987). This new criteria takes sociotechnical design out beyond the workplace environment, into the world of ubiquitous computing, of Ambient Intelligent systems, a world of the Web as used by a vast network of people seeking to *have a good time*, of a world of socially engendered ICT. The new principle embodies the mood of the age, as manifested in social networking Web sites, blogs, instant messaging, and so forth. The principle, referred to as the *Non-utility Principle*, is articulated as:

Non-utility Principle: *ICT in non-workplace contexts serve purposes beyond mere utility, and ICTs should therefore be designed to enable users to achieve emotional fulfillment through play, exploration, and several other dimensions, that are not traditionally associated with workplace environments.*

FUTURE TRENDS

Clearly during the early years of the 21st century there has been an emergence of, as well as a significant growth in, ICTs that are predominately focused on the world outside work. Many of these systems, while they also provide the workplace with useful tools that serve the utility oriented perspective of the working environment, were not conceived with this outcome in mind. It is more the case that they serve a purpose that is related to people as social creatures with a need to find meaning. Often these systems are used in what might be seen, when judged by the rational standards of work, as being nothing more than frivolous time wasting activities. But when looked at from a broader perspective, they seem to embody life, for life is made up of many activities such as enjoying oneself, socializing through small talk and casual chat, etc.

Further development and growth in these types of ICTs seems set to continue as social scientists and technologist begin to collaborate on the design and development of technologies that will make the experience of using these socially engendered systems, even better.

This collaboration between the social sciences and technologists is key to creating technologies that are better suited to the new circumstances of ICT and their use. With time, as technologists begin to realize that the value of technology does not just lie with utility, with making things more efficient, and so forth, and that it is quite legitimate to design technologies that will help people to find meaning through whatever activities (within reason) that they want to undertake, there should emerge a very different sort of technology to that which has already been developed.

What new delights lie ahead for the users of these systems is hard to foretell. What needs to be done to bring about these systems is however a little more predictable. Central will be the development of interdisciplinary design, and even the emergence of a new breed of technologist, with knowledge in social sciences as well as in technology subjects. Based upon this, the notion of a new breed of professional can be suggested, involving people who can operate in the spaces between the social sciences on one side, and engineering and technology on the other. Such people would be capable of taking into account both perspectives and would use their knowledge to design technologies more acceptable to society than those that might emerge from a more technology-oriented approach.

This in turn would lead to new research agenda, and in effect the implementation of *Social Shaping of Technology* in a world where technology is no longer perceived to lie outside of society, but to be an integral part of it. This development will in part be aided by research that is already underway looking at the development of complex systems science (European Commission, 2007) and its relevance and application in areas where ICT and society have already merged (social networking Web sites for example).

CONCLUSION

ICTs are beginning to develop along new paths, socially engendered and shaped to a significant extent by such concepts as instant messaging, chat rooms, social networking, and the like. These developments come from the world outside of work and are not based upon the notion of utility, but more on meaning, of doing things for fun, of explorations, etc. The Semantic Web on the other hand largely comes from business engendered thinking, from a world where the primary concerns are utility, effectiveness, efficiency, and usefulness.

These two worlds in many ways seem to clash, to be polar opposites. But this does not have to be so. The Semantic Web can be shaped in entirely new directions and does not have to become a tool for business, but could also be another means of having fun. To this end the paper has mapped out some preliminary possibilities, provided a conceptual basis for development, and highlighted a key guiding design principle. The challenge for the future is to take what is emerging from the domain of socially engendered ICT, and bring this to the area of business engendered ICT, to the benefit of both domains. For to do so would provide a means of preserving what is good about the Web, that is to say its unpredictability, providing a means by which meaning is found, while also delivering a Web that is also more useful for those with a more serious purpose. This new notion for the Semantic Web would provide a place for both work and play, adapting as required to the needs of users at specific moments in time.

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KEY TERMS AND DEFINITIONS

Ambient Intelligence: A human-centered vision of the information society where the emphasis is on greater user-friendliness, more efficient services support, user-empowerment, and support for human interactions with respect to intelligent everyday objects and other ICT systems.

Business Engendered ICT: Information and Communications Technology, the development and use of which is driven and shaped by the needs of business.

Interfacing in Depth: Shaping the characteristics of a technology by considering the details of the technologies that lie behind the human-computer interface, where technology refers to the algorithms, data models, architectures, and the dependency upon human judgment and skills that are built into the operational details of the software.

Ludic Systems: Ludic refers to the play element of culture. Ludic systems are based on a philosophy of understanding the world through play, of play being primary to and a necessary condition for the generation of culture. Such systems therefore do not necessarily fulfill any particular purpose in the sense that most technological systems usually exist to fulfil a need, or have some useful function, or are a utility.

Non-Utility Principle: ICT in non-workplace contexts serve purposes beyond mere utility, and ICTs should therefore be designed to enable users to achieve emotional fulfillment through play, exploration, and several other dimensions, that are not traditionally associated with workplace environments.

Social Shaping of Technology: The philosophy that technology is not neutral and is shaped by the dominant social, political and economic values of society. As a result therefore, changes in values lead to different technological outcomes, and as a result, social science considerations can be used to shape technologies.

Socially Engendered ICT: Information and Communications Technology, the development and use of which is driven and shaped by social interests.

This work was previously published in Handbook of Research on Social Dimensions of Semantic Technologies and Web Services, edited by M. M. Cruz-Cunha; E. F. Oliveira; A. J. Tavares; L. G. Ferreira, pp. 341-356, copyright 2009 by Information Science Reference (an imprint of IGI Global).

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